CANADIAN NORTHERN RAILWAY DEVELOPMENT

1913

Canadian Northern Railway, Construction, Betterments, Etc.

Canadian Northern Quebec Ry.—The Dominion Parliament has extended the time for the building of certain branch lines in Quebec.

Plans have been approved by the Board of Railway Commissioners for the erection of a new passenger and freight station at Maisonneuve, Montreal, to be situated on the south side of the track at the junction of Third and Fourth Avenues.

Land has been acquired in Hochelaga for the enlargement of the company's yards and the erection of new workshops. It was reported at the City Hall that the carrying out of the work would involve the closing of a number of streets. The matter is being looked into by the engineer and a committee of the council.

Canadian Northern Montreal Tunnel and Terminal Co.—It was reported by S. P. Brown, Chief Engineer in charge of the tunnel construction work, June 5, that 5,100 ft. of heading in solid rock had been cut in 31 days from the Dorchester St. end. The heading has now advanced 3,750 ft. west of Dorchester St., and very nearly equal progress has been made on the other heading. It is estimated that, if the same rate of progress is maintained the headings will be joined in September. About 3,600 ft. of the tunnel has been completed.

Canadian Northern Ontario Ry.—A proposition is reported to have been submitted suggesting that the C.N.O.R. join with the C.P.R. and the G.T.R. for the building of a joint four track line from a common point near Queen St. East at the Don River, Toronto, where a union station can be built, alongside the Don, to the union station tracks.

Plans have been filed showing the proposed entrance into Toronto from the west. They show a line four miles long, and include a tunnel of 2,360 ft. from east of St. Clarens Ave., just south of Davenport Road to Talbot St. The tracks will be depressed at the west end, and the Humber will be crossed by a high level bridge. We have been officially advised that it is expected to start construction of this bridge by the end of June. In connection with the entry of the line into Hamilton, the Mayor has been advised that the company is willing to enter into an arrangement with the other companies for a common right of way through the city, and the Mayor has arranged for conferences with a view of ascertaining whether such a plan would be feasible. It is reported that the project to build from Beamsville direct to the 198, 8 miles; Vegreville-Calgary line, 10 miles.

Work is being pushed on the Vonda-Melfort branch in Sask., and on the Vegreville-Calgary line, Alta., so as to have them both ready for traffic after the harvest.

Canadian Northern Pacific Ry.—A. R. Mann, of the Northern Construction Co., is reported to have stated in Vancouver, June 5, that grading will be finished to the Albreda Summit, 430 miles west of Edmonton, by the end of October, and that track will be laid over the whole of the line in British Columbia by Aug. 1, 1914.

Working eastward from Port Mann track has been laid to Boston Bar, 116 miles, and a train service was put on as far as Spuzzum, 115 miles, June 16. An 11 span viaduct, 1,000 ft. long, is being built at Anderson Creek, a few miles further east, and other bridge work is being completed to Kamloops, to which point the grading has been finished. It is expected to have the track laid to Kamloops by the end of the year.

Ties are being delivered for the Lulu Island branch, and it was expected to start track laying by the end of June. (June, pg. 277.)

Canadian Northern Railway Tunnel in Toronto.

The new line which the Canadian Northern Ontario Ry. has projected from Toronto to the Niagara frontier, will negotiate the escarpment near the northwest corner of Toronto by a tunnel 2,360 ft. long. The line, from the proposed union station at North Toronto, will parallel the C.P.R. North Toronto line for about 3 miles, branching off northwesterly, the original survey locating the line to the south of the shoulder of land which the revised line will pass under.

The east portal to the tunnel will be at the corner of Davenport Rd. and St. Clarens Ave., alongside the Canada Foundry Co.'s plant, the tunnel emerging at the west portal a short distance south of St. Clair Ave., just west of the G.T.R. Toronto-North Bay line, the greatest depth over the tunnel being 40 ft. From this point westerly to the outskirts of Toronto, the tracks will be depressed in a 15 to 20 ft. cut, all the streets crossing overhead. This tunnel and depressed tracks will mean a big saving in what would otherwise be heavy property damages, and at the same time will eliminate all grade crossings.

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Montreal-Ottawa-Port Arthur Line.—The agreement between the company and the North Bay Town Council respecting the location of the line through the town was approved June 11, and the Mayor authorized to sign it.

Canadian Northern Ry.—It was reported at Winnipeg, June 15, that about 200 miles of line, principally in Saskatchewan and Alberta, were ready to be handed over to the operating department.

Station construction work is being gone on with on the branch lines. A considerable number have recently been completed, a recent list shows those finished to be:—Delisle extension, west of McRory, 8 miles; Swift Current extension from Avonlea, 11 miles; Prince Albert-Battleford branch, 6 miles; Melfort-Humboldt branch, 2 miles; Saskatoon-Calgary line from Excel, mileage

277.)

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The tunnel will be double tracked, probably of the same form as that now being used in the tunnel the C.N.R. interests are building under Mount Royal at Montreal. This construction is the twin tunnel type of horseshoe construction, with a dividing wall between, it having the advantage of a saving in material and a self induced ventilation.

In the vicinity of the tunnel, there will be three railway crossings to be provided for, but by the use of the tunnel, none of them will be at grade. The G.T.R. Toronto-North Bay line will be passed under just before coming out at the west portal. This will also be the case with the crossing of the parallel lines of the G.T.R. old main line, and the C.P.R. Windsor line a short distance west of the west portal.

The C.P.R. has opened a city freight and passenger office at 404 Victoria Ave., Fort William, Ont., in which the staff of the District and City Passenger Agent and of the District Freight Agent are located.

JULY 1913

Dominion Subsidies in Aid of Canadian Northern Railway Lines.

The Dominion Parliament has voted the following subsidies in aid of the building of the Canadian Northern Ry., and its allied lines:—To the Canadian Northern Ontario Ry., for a line from Toronto to Ottawa, Ont., 250 miles, at the rate of $6,400 a mile; for a line from Ottawa to Port Arthur, Ont., 910 miles, $12,000 a mile. To the Canadian Northern Alberta Ry., for a line from Edmonton to the boundary between Alberta and British Columbia, near the Yellowhead Pass, 260 miles, $12,000 a mile. The lines are to be completed within three years from Aug. 1, 1913; running powers and other traffic facilities are to be given to other railways under conditions to be fixed by the Board of Railway Commissioners, but such orders may be varied or rescinded by the Governor in Council; transportation is to be furnished to the government for governmental purposes at reasonable rates, and in payment of these charges the government is to be credited by the company with a sum equal to 3% on the amount of subsidy received up to $6,400 a mile; that books showing the cost of construction and cost of operation shall be produced when desired; that $7,000,000 of the common stock of the C.N.R. shall be transferred to the Government, which may be disposed of at the discretion of Parliament, such stock to be held in trust by the Minister of Finance and Receiver General.

The Minister of Railways, in explaining the reason for the granting of this aid, said the total amount was:—Ottawa to Port Arthur, 910 miles, at $12,000 a mile, $10,920,000; Edmonton to Yellowhead Pass, 260 miles, at $12,000 a mile, $3,120,000; Toronto to Ottawa, 250 miles, at $6,400 a mile, $1,600,000, a total of $15,640,000. The cost of the Toronto-Ottawa line was estimated at $41,131 a mile, and the subsidy was at the regular rate. The average cost of construction of the Ottawa-Port Arthur line was $49,381 a mile. The Dominion Government had already voted a guarantee of bonds for $35,000 a mile, but the company had only been able to dispose of its bonds at 90¾, which produced $31,760,000. The average cost of the Edmonton-Yellowhead Pass line was estimated at $38,500 a mile, in aid of which the Government had already guaranteed bonds, varying from $13,000 to $35,000 a mile, which bonds had produced on an average $22,400 a mile. The cost of these two lines was estimated at

No land grant had been given direct to the company, but it had through the purchase of other lines acquired with them land grants for 4,000,000 acres, of which 1,225,600 acres applies on its main line.

The Minister of Finance gave an exhaustive analysis of the financing of the company, which showed that the Dominion Government had guaranteed bonds in respect of the building of 2,552 miles of line, of which $57,992,268 had been issued, realizing $52,823,428. On the company's affiliated lines are bonds guaranteed by the Dominion Government amounting to $37,216,664; Ontario, $7,860,000; British Columbia, $16,490,000; Manitoba, $349,000; and there had also been issued $32,808,283 of bonds which were not guaranteed. The total amount of bonds guaranteed for the C.N.R. and its affiliated companies by the various governments amounted to $120,120,461, and of bonds not guaranteed $145,379,151, making the total amount of securities outstanding $265,499,612. The bonds guaranteed by the governments altogether were as follows:—

Dominion of Canada	$58,043,250
Province of Manitoba	24,110,546
Province of Saskatchewan	8,030,000
Province of Alberta	5,586,665
Province of British Columbia	16,490,000
Province of Ontario	7,860,000

The mileages laid were:—Quebec to Montreal, 178; Hawkesbury to Ottawa, 57; Port Arthur to Edmonton, 1,265. There were under construction from Ottawa to Port Arthur 910 miles, from Edmonton to Yellowhead 260 miles, and from Yellowhead to Vancouver 525 miles; total, 1,695 miles. Contracts called for completion by the end of 1913, and by the summer of next year it was expected that the C.N.R. would be running across the continent.

The following figures were given, showing subsidies granted:—Ottawa to Hawkesbury, $367,000; Ottawa to Port Arthur, nothing; Stanley to Fort Frances, $1,355,000; Fort Frances to Rainy River, $179,000; Winnipeg to Summit, nothing; Montreal to Quebec, $1,927,000; Yellowhead to Vancouver, $6,180,000. The total of guarantees, Dominion and provincial, on the main line from Montreal to the Yellowhead Pass was $57,000,000, or about $20,000 a mile on the 2,700 miles.

Replying to questions in the House of Commons, June 2, the Minister of Railways said the maximum gradient against eastbound traffic between Port Arthur and Montreal, was 0.50%, or 26.4 ft. a mile, and that against westbound traffic on the same line 0.60%, or 31.68 ft. a mile; the

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Guarantee of bonds—	
Montreal to Port Arthur	$ 8,060,000
Grand View to Edmonton	8,060,000
Edmonton to Yellowhead Pass	6,720,000
	$50,655,000
Cash subsidies—	
Ottawa to Hawkesbury	$ 367,872
Stanley to Fort Frances	1,355,326
Fort Frances to Rainy River	179,200
Yellowhead Pass to Vancouver	6,180,000
Cash subsidy under proposed legislation	14,040,000
	$22,122,398

Province of Ontario

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On June 4, the Minister stated in reply to further questions that the mileage under construction to be controlled and operated by the C.N.R., and not included in the answer given June 2, was 3,143 miles; the total amount guaranteed by the Dominion Government in aid of the construction of such lines was $43,419,585, and the amount granted to date for these lines was $6,180,000; the amount guaranteed by other governments for these lines had not been ascertained by the Department.

It is said that the subsidies will be paid over, so far as constructed lines are concerned, on the completion of inspections which are now being made, and on the remaining mileages as the work progresses.

Six wheel trucks, rivetted wrought steel frames, M.C.B. standard axles, parts and pedestals, and 36 in. wrought steel wheels, have been advocated for exclusive use in steel passenger car truck design.

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Canadian Railway and Marine World.

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Canadian Northern Railway Mount Royal Tunnel:

By S. P. Brown, M. Am. Soc. C.E., Chief Engineer, Canadian Northern Montreal Tunnel and Terminal Co., Ltd.

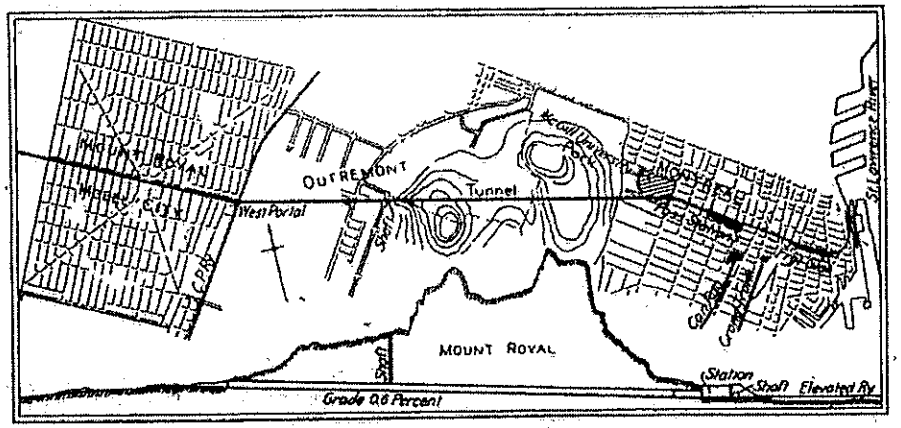
The C.N.R. is now operating about 5,000 miles of track in Manitoba, Saskatchewan and Alberta, besides its Eastern lines. It also has about 2,500 miles under construction that when completed in 1914 will make it a transcontinental system, with Vancouver, on the Pacific, and Montreal as its main eastern distributing point. When this work is finished it will be important to have proper terminal facilities already prepared in the main eastern point, and, with this in view, the Canadian Northern Montreal Tunnel & Terminal Co., Ltd., was incorporated to make the necessary developments in and about the city of Montreal.

Montreal has a population of about 600,000 and is the main eastern seaport during the busiest part of the year. The business and financial part of the city is largely concentrated in a narrow strip of land between the St. Lawrence River and Mount Royal, which is already so congested that the resident section is gradually spreading up and down the river and around the mountain into Westmount and Outremont. Mount Royal forms a very positive barrier between the people living back of the mountain and the business portion of the city.

General Features of Project.

The natural location of the business centre of Montreal, between Mount Royal and the river, made the problem of entry at first appear complicated. To enter from either end of this strip meant a detour that was undesirable and might bridge across the St. Lawrence River. Such an extension would also include in the commercial part of the town an elaborate freight distributing depot, a department to which the C.N.R. is giving most serious thought at present. In connection with this freight department, large sorting and transfer yards are being developed back of the mountain and east of the city, where most of its shunting and mechanical part of the freight transference will be accomplished.

Back of the mountain, in the broad, gently sloping country, including some of the most fertile farms in Eastern Canada, the C.N.R. saw an opportunity for the site of a new city. With this in view, the Canadian Northern Montreal Land Company, Ltd., was incorporated to purchase this farming country and develop it as part of the general scheme of financing.



Plan and Profile of Mount Royal Tunnel.

The New Model City.

The city of Mount Royal, or as it is locally termed, the "model city," is laid out on a rectangular plan, with four diagonal boulevards radiating from the railway station, which forms the centre of the tunnel will bring the Mount Royal station within a very few minutes of the main passenger terminal in the city proper and trolley cars will tie the street car lines of the "model city" with those of Outremont and Montreal. A small freight yard near the west portal of the tunnel will serve for the delivery of local freight and express and for the manipulation of multiple unit trains during the rush hours. The entire terminal scheme is to be utilitarian from the Back River to the waterfront. The idea is to produce structures and developments that will be attractive to the eye and so designed and disposed as to be self supporting in themselves without the assistance of the ordinary railroad traffic.

Tunnel History.

To the writer the most interesting part of the study of tunnels is its history. From the days of the cave man, through those of the Egyptians, Chaldeans, Romans and Europeans of modern times, the evolution has continued. The changes in the tunnel itself are small but the methods of excavation and construction have changed beyond recognition. The Lake Fucinus tunnel driven in the Abruzzi, during the reign of Claudius, was 6 ft. high, 10 ft. wide, and 3½ miles long. It took 11 years to build, and employed 30,000 men. To expedite this work some 40 shafts and inclines were sunk, some over 400 ft. deep.

As a comparison the present Mount Royal tunnel is practically the same length; the heading, however, is about 9 ft. high by 12 ft. wide, over 50% larger

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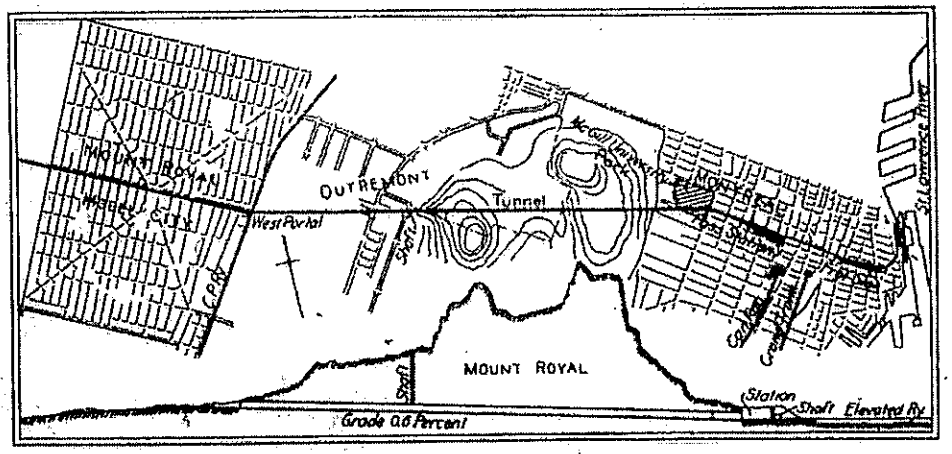

Plan and Profile of Mount Royal Tunnel.

General Features of Project.

The natural location of the business centre of Montreal, between Mount Royal and the river, made the problem of entry at first appear complicated. To enter from either end of this strip meant a detour that was undesirable, and might have resulted in two separate stations for the eastbound and westbound traffic. A study of the topography and economic distribution of the city and island showed that a tunnel was the logical, as well as the economical, method of entry. It was found that the railways coming from the west could be brought from a convenient site for yards, shops, etc., near the Back River to a junction point with the Quebec lines near the present Jacques Cartier Union Railway (G.T.R.) and thence at a very flat grade to a tunnel portal at its crossing with the C.P.R. belt line, about a mile from the Outremont yard. Thence the line will pass through a twin tunnel 3.25 miles long, down a 0.6% grade to a passenger terminal in the very centre of Montreal.

From the main passenger terminal the tracks may be extended across to the lower town on a viaduct at a level grade to connect with a viaduct along the harbor front, proposed by the Harbor Commissioners of Montreal, and a possible

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As a comparison the present Mount Royal tunnel is practically the same length; the heading, however, is about 9 ft. high by 12 ft. wide, over 50% larger than the Lake Fucinus tunnel. It has one intermediate shaft about 240 ft. deep and another about 50 ft. deep at Dorchester St., which is at present acting as the eastern portal. The first heading was started on July 8, 1912, and since that time the shafts have been sunk and over 2 miles of heading driven on the tunnel line, besides more than ¼ mile at the shafts and in the terminal sites. The reason of this great difference in speed is method and equipment.

In the Lake Fucinus tunnel they used crowbars, chisels, picks, shovels, and possibly drills and saws with cutting edges of corundum. Most of the progress, however, was made by "fire setting," i.e., by building fires against the face of the heading until the rock was highly heated and then dashing cold water or acid, such as vinegar, on it to break the ground. Condemned criminals and prisoners were used in this work, as the death rate was terrific.

Compare this with modern tunnel prac-

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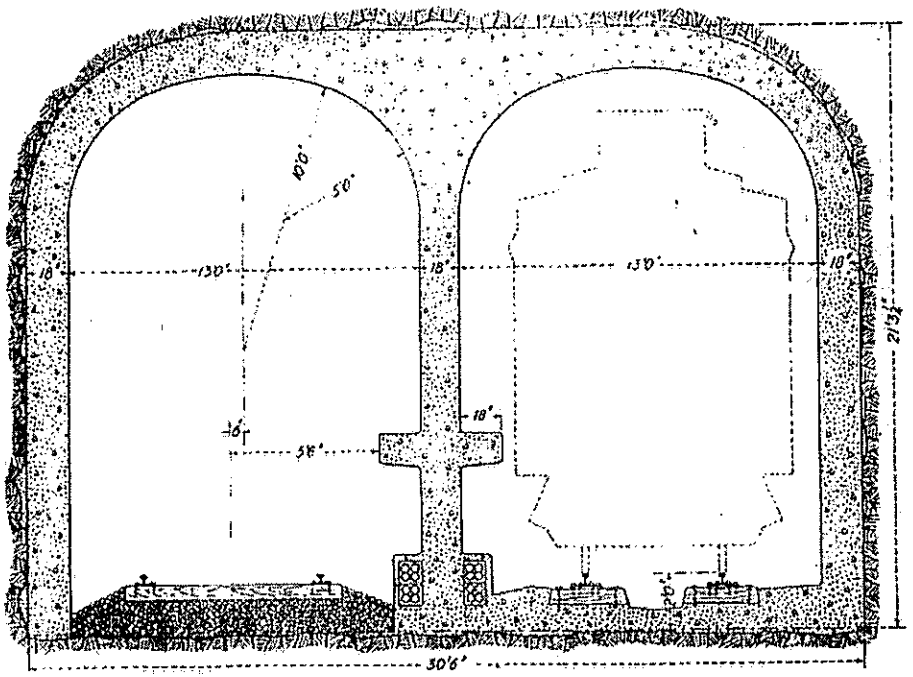
tice using electricity, compressed air and high explosives, which, combined with highly perfected machinery and carefully systematized forces, produce speed and economy that would have seemed incredible even a couple of generations ago, and one realizes how the usages have changed.

When the obstacles confronting those early tunnel diggers, however, are considered, we can but be filled with the sincerest admiration for the confidence, courage and perseverance that made the accomplishment of such great works possible. Their immature systems, methods and appliances required genius to produce success, and the stories of their early struggles form far more thrilling romances that one can find in the most visionary novel of today.

Mount Royal Geology.

Mount Royal is an intrusion of igneous rock forced upward through the original bed of Trenton limstone. There have evidently been several stages of eruption and the main volcanic intrusions, back of the mountain. It was, of course, known that the heart of the mountain was of hard, igneous essexite, as above described, which, with breccia, also showed outcroppings in a ridge near the western portal. While this lower ridge



Cross Section of Twin Tubes, Mount Royal Tunnel.

Tunnel Location.

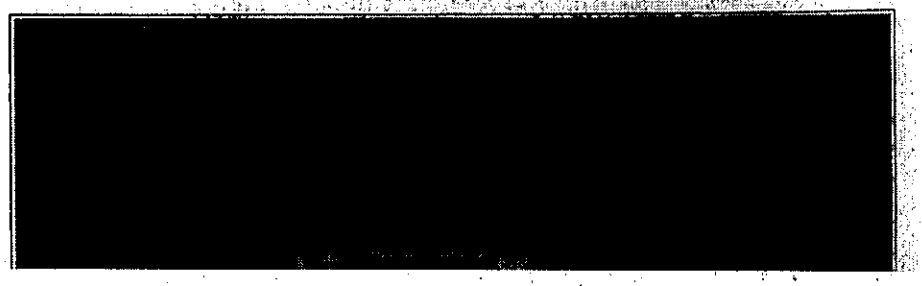
The location of the tunnel under Mount Royal was more or less established by the location of the passenger terminal in Montreal and the model city at the one possible between the two main objective points that could be devised to avoid surface obstructions and take advantage of the geological formation, as far as it is able to be anticipated. It is believed that while much of the breccia and part of the limestone will require masonry lining similar to that required in soft ground, much of the limestone, inclined as it is to the present tunnel line, will require only a centre wall for safe support; in the essexite no centre wall will be required except for ventilation and purposes of safety in case of derailment or accident. This gives, economically, an extremely good tunnel line, which, with the exception of one curve under the McGill University grounds, is all on a tangent and at only sufficient grade to insure proper drainage.

Tunnel Cross Section.

A twin tunnel cross section has been adopted for three main reasons—economy in excavation and construction, ease and economy in ventilation, and safety in case of accident or derailment. The outside wall clearance is coincident with the clearance for new structures in the New York Central terminal work in New York and in excess of the clearance of the Pennsylvania Lines East of Pittsburgh.

A high headroom, almost the same as that of the Detroit River tunnel, was adopted, on account of the probability of a high voltage overhead contact circuit. The flattened three centred arch was adopted to allow for the sway of the pantograph and on account of the stratification of the rock where much of the lining will occur.

The walkway is made narrow, so that people will be forced to pass along it in single file, thus avoiding the danger of crushing and panic. The normal clearance at the walkway edge is 2 in. greater



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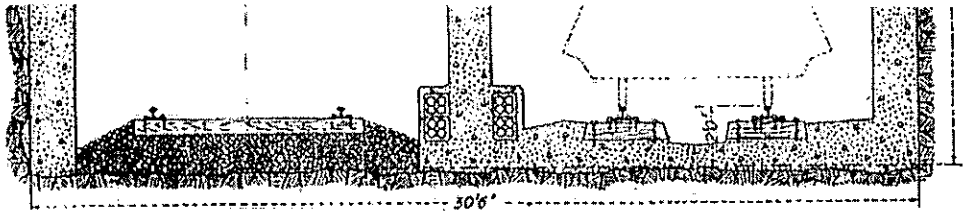


Cross Section of Twin Tubes, Mount Royal Tunnel.

and one realizes how the usages have changed.

When the obstacles confronting those early tunnel diggers, however, are considered, we can but be filled with the sincerest admiration for the confidence, courage and perseverance that made the accomplishment of such great works possible. Their immature systems, methods and appliances required genius to produce success, and the stories of their early struggles form far more thrilling romances that one can find in the most visionary novel of today.

Mount Royal Geology.

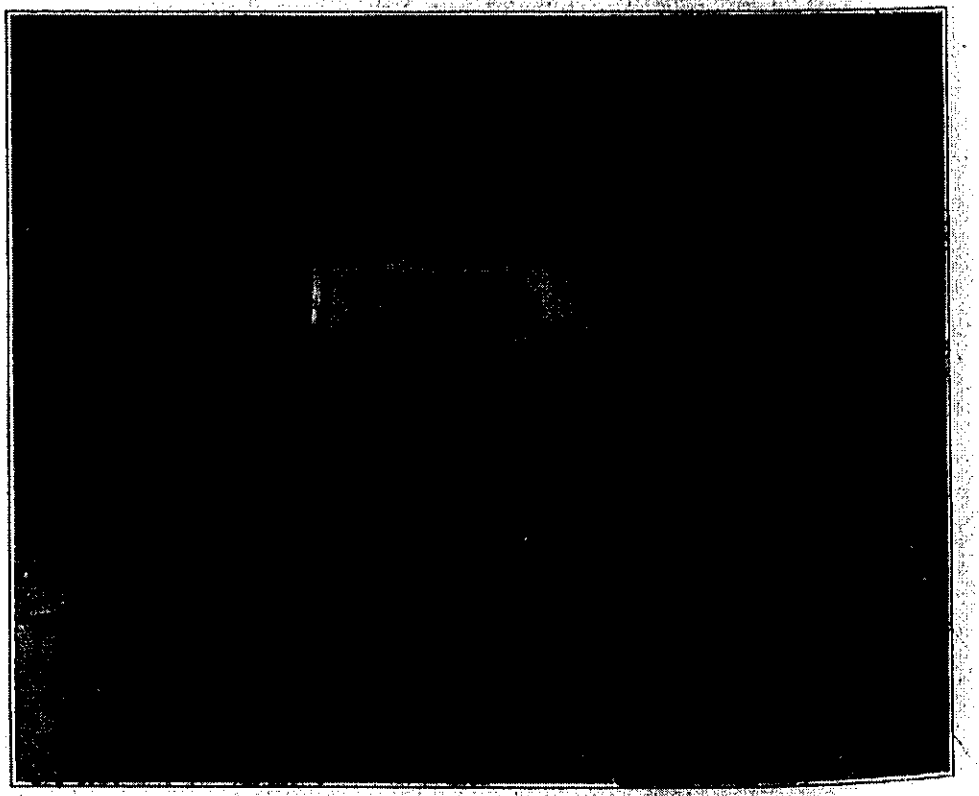
Mount Royal is an intrusion of igneous rock forced upward through the original bed of Trenton limstone. There have evidently been several stages of eruption or intrusion, as both the limestone and main igneous bodies are broken and cut by a multitude of dikes and sheets of different and varied character, and evidently of later origin.

The two principal rocks to be encountered on the present line are Trenton limestone, slightly tilted upward toward the mountain, and essexite, which is the main intrusion of igneous rock. The Trenton limestone, at a considerable depth, is quite hard and crystalline, and except where silicious or too much cut up by dikes is a very good tunneling rock. At the city end the limestone was very soft and rather blocky for the first 2,000 ft., with occasionally earth in the heading roof. As the cover increased the rock became harder and more cut by dikes. At present it is quite hard and becoming slightly crystalline, the dikes causing the only difficulty in the tunneling. The essexite is very hard, but aside from this as a good tunneling rock. The most difficult tunnel rock is a volcanic breccia, which when cut by dikes is so badly broken and blocky that it is extremely hard to drill, does not shoot well, and will require almost continuous masonry lining. This is especially common near the junction of the limestone back of the mountain. It was, of course, known that the heart of the mountain was of hard, igneous essexite, as above described, which, with breccia, also showed outcroppings in a ridge near the western portal. While this lower ridge of hard rock and breccia could not have been avoided without seriously affecting the layout of the model city, a portion of the hard rock in the centres of the mountain could have been avoided had it been considered expedient.

The line finally adopted is the shortest York and in excess of the clearance of the Pennsylvania Lines East of Pittsburgh.

A high headroom, almost the same as that of the Detroit River tunnel, was adopted, on account of the probability of a high voltage overhead contact circuit. The flattened three centred arch was adopted to allow for the sway of the pantograph and on account of the stratification of the rock where much of the lining will occur.

The walkway is made narrow, so that people will be forced to pass along it in single file, thus avoiding the danger of crushing and panic. The normal clearance at the walkway edge is 2 in. greater than that of the normal high passenger platform adopted in the terminal, which is somewhat greater than that allowed on the New York Central and Pennsylvania lines about New York. The walkway edge also coincides with clearance lines (outside of the platform) of the Penn-



Mount Royal Tunnel—Breakup, Showing Jumbo Timbers in Heading.

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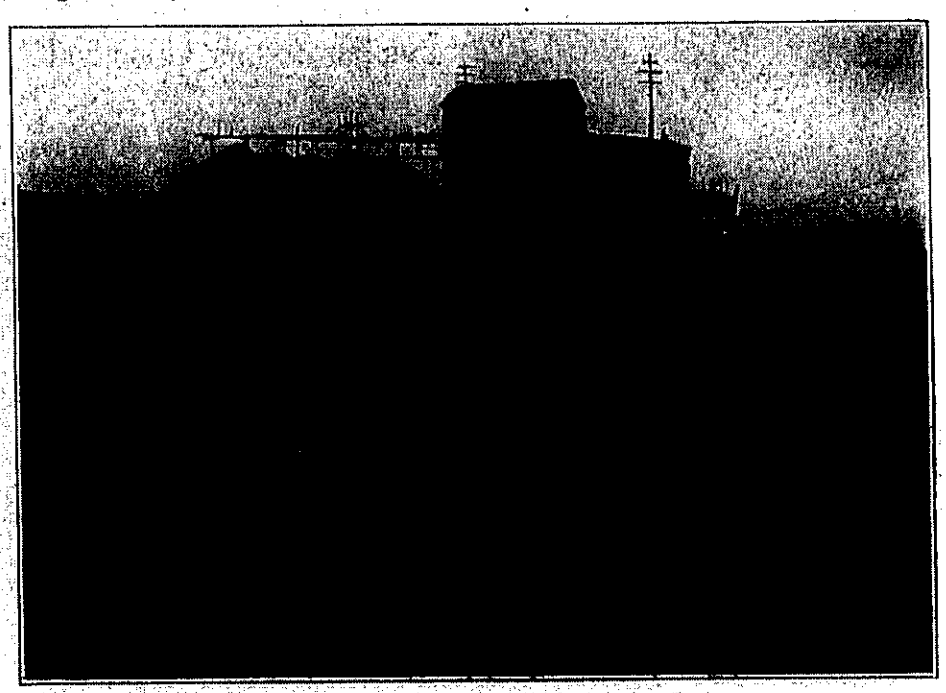
sylvania Lines East of Pittsburgh, including the through lines between New York and Pittsburgh. Underneath the walkway is a continuous refuge niche, except at splicing chambers, where trackmen may sit on the duct bench at the bottom of the dividing wall and be absolutely protected from passing trains.

Excavation.

The method of excavation adopted is perhaps more European than American, although a close analysis would show it to be the resultant of several systems. In modern tunnel practice, lines of demarcation and sectionalism that were quite distinct only a comparatively few years ago are gradually becoming lost, so that an engineer is apt to select a combination of several systems which he considers wisest for his ground and structure. The things that stand out most sharply in all tunnels where great progress has been made and which are principally European in origin are: First, the opening heading is always comparatively small and usually in the bottom of the section; second, a horizontal bar is used to support the drills instead of columns; and, third, short rounds are drilled and shots are fired often. Every little economy in time is practised, and all delays, no matter how trifling, are analyzed and corrected, when possible. Workmen are given a bonus for extra progress above the specified minimum, and machinery, such as drill carriages, is used where it is found advantageous.

European engineers, like our Western miners, like to get under the muck, so that much of it falls into the cars by gravity instead of having to be lifted in. Sometimes this is accomplished by stoping, and sometimes by driving a top heading directly above the bottom heading. The one important point is to rock, for by this method the heading can be driven on rapidly and the timbering work and full sized section developed with care and without hurry in many places simultaneously along the line.

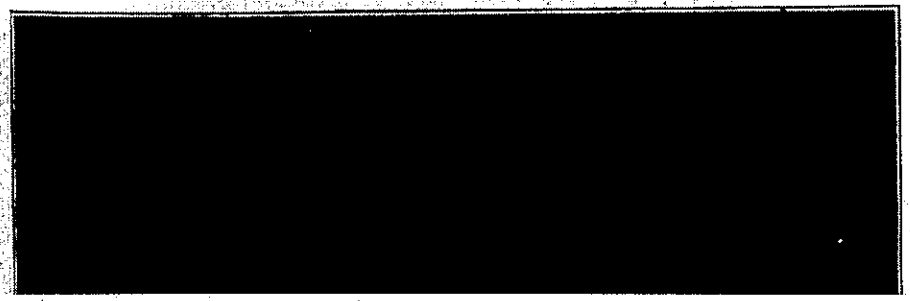
A great many mechanical drilling, excavating and mucking apparatus have been devised, and in some cases they were found to work advantageously, but where the space is confined and delays serious, the laborer, with his pick and shovel, is usually employed. One man



Mount Royal Tunnel—West Portal, Crushing Plant and Tipple.

centre heading with break ups at intervals where the full sized tunnel section is developed. The heading is driven by the horizontal bar method. In one heading, where very hard rock is encountered, requiring extra heavy drills, a drill carriage is used with a mechanical muck carrier for loading the cars. In this drill carriage the drill bar is supported on a beam which can be extended 20 ft. ahead of the carriage over the muck pile and has also a vertical and lateral movement to accommodate the heading.

On the city end outside conditions are very disadvantageous. The city of Montreal has never had any previous experience in underground excavation, so that blasting that would be hardly noticeable in New York, for instance, is considered quite serious. For this reason under the city proper, where the cover was light, no blasting was allowed between 11 p.m. and 7 a.m.; the holes in the heading were reduced to 36 and 42 in. in depth, including the cut, and the powder was reduced to a mere "trace."



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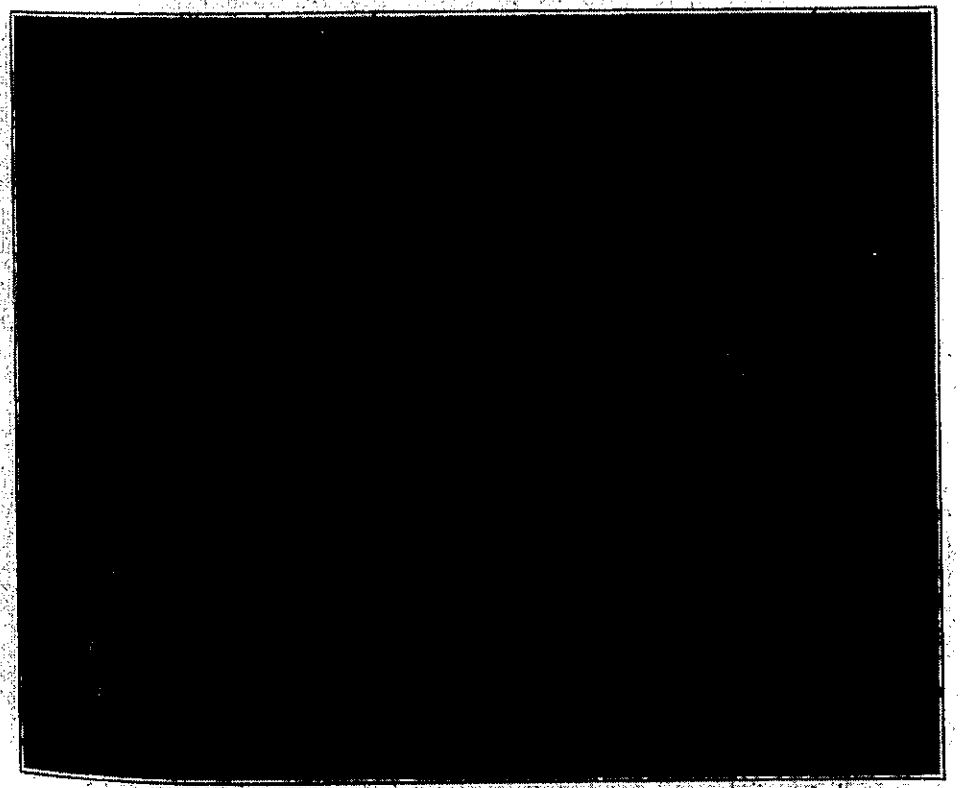
European engineers, like our Western miners, like to get under the muck, so that much of it falls into the cars by gravity instead of having to be lifted in. Sometimes this is accomplished by stoping, and sometimes by driving a top heading directly above the bottom heading. The one important point is to keep the bottom heading open for traffic at all times, so that the heading progress is never materially affected. The full size excavation can be carried on over jumbo timbers at as many places as necessary to keep up with the heading.

Mount Royal Tunnel—West Portal, Crushing Plant and Tipple.



Mount Royal Tunnel—Heading. Observe Drills on Horizontal Bar and Water Attachment to Drills.

A bottom heading in bad ground, if possible, is even more desirable than in cavating and mucking apparatus have been devised, and in some cases they were found to work advantageously, but where the space is confined and delays serious, the laborer, with his pick and shovel, is usually employed. One man can handle a good deal of muck in his shift, shoveling off slick sheets into low cars. At present muckers in the Mount Royal tunnel heading are handling 15 cu. yd. of muck per man per eight hour shift.

Bottom Heading Method.

The method of excavation adopted in the Mount Royal tunnel is a bottom riage is used with a mechanical muck carrier for loading the cars. In this drill carriage the drill bar is supported on a beam which can be extended 20 ft. ahead of the carriage over the muck pile and has also a vertical and lateral movement to accommodate the heading.

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The effect of all this on heading progress was not so serious as might have been expected. While the holes were short, the rounds were fired so often that an average progress of about 17 ft. a day was maintained. In approaching the mountain, where 5 ft. cut holes could be used, the average progress was about 20 ft. per day.

Record Tunnel Progress.

During the month of May, just ended at this writing, as the rock cover had very much increased, shooting was allowed at night, which very much improved the heading progress. In this way, a total of 810 ft. of 8 x 12 ft. heading were driven in the 31 working days immediately following May 1. This, the writer believes, is the best tunneling record yet made in a hard rock heading.

A greater record than the above was made in the Loetschberg tunnel in Switzerland, where 1,013 ft. of 6.5 x 10 ft. heading were driven in one month through soft triassic limestone. An excellent record was also made last year in Arizona, where 799 ft. of 8 x 8 ft. heading were driven in 31 working days through granite porphyry sufficiently hard to drill well and in general stand without timbering. Neither of these

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Canadian Northern Railway Construction, Betterments, Etc.

Quebec and Lake St. John Ry.—The old machine and other workshops at the rear of the Q. and L. St. J. Ry. station, St. Andrew St., Quebec, have been demolished, and the site is being laid out as additional yard room. The new tracks to be laid will give accommodation for 120 cars.

Canadian Northern Quebec Ry.—Press reports state that in connection with the rumored extension of the line easterly from Quebec to the Labrador coast, it is intended to build a line from Quebec to Sherbrooke, connecting with the line of the Boston and Maine Rd., which terminates there.

Canadian Northern Montreal Tunnel and Terminal Co.—Reviewing the work completed during the twelve months that have elapsed since the tunnel work was started, S. P. Brown is reported to have said, July 8:—"On July 8, 1912, the first shovelful of earth was removed, the work starting at the western portal. On July 31 the shaft at Maplewood avenue was commenced and driven downward for 240 ft. On Aug. 3 workmen commenced to dig the Dorchester St. shaft. Since then the western portal has been linked with the Maplewood avenue shaft and the tunnel driven further cityward until the men are working somewhere beneath the centre of the cemetery. A continuous boring, 7,350 ft. long, has been completed. From Dorchester St. also rapid progress has been made. A distance of 1,400 ft. has been completed in the terminal site between Cathcart and Latour streets. From Cathcart St. mountainward 3,700 ft. is the length of the hole to date, and the workmen are blasting almost directly under the high level reservoir. Nine feet by 12 are the dimensions of the excavation now being made, but in many places 'breakups' have been made. That is, the preliminary boring has been extended to its full height and width. 1,800 ft. have been completed in this manner and have attained the dimensions of the completed tunnel, 30 by 21½ ft. We expect to have the tunnel pierced from portal to portal by the middle of Jan., 1914, and by the end of Oct., 1914, the base will be extended to its full dimensions and the tunnel practically completed."

ed in the triangle made by the convergence of the two lines. The line is under construction from this point to the junction with the line running northerly from Toronto, but this section will not be completed until next year. Track has been laid for 150 miles westerly from near Sudbury, and for 127 miles easterly from Port Arthur, on the remaining section of the line, and gangs are laying steel to connect the two sections. These gangs are working easterly from the Port Arthur end, westerly from the Sudbury end, and in both directions from Obo, the point of junction with the Algoma Central and Hudson Bay Ry. A sub contract for tracklaying has been let to Robertson Bros. Seven ballast trains are being operated. It is expected to have the track laid and the ballasting completed so that the line may be put in operation in the fall. The buildings on the line are being erected by the Imperial Construction Co., Toronto, J. H. Montgomery, Manager. There will be divisional buildings at four points, together with 82 stations, and 82 tool houses.

Under the act passed last session of the Dominion Parliament the Government has entered into a contract with the Canadian Northern Ontario Ry., for the building of the line from Ottawa to Port Arthur, Ont., 910 miles.

Canadian Northern Ry.—In an interview at Toronto, July 8, Sir William Mackenzie is reported to have said that as soon as the Company's transcontinental line was put in operation, attention would be given to the building of a second track from Port Arthur to Winnipeg.

The St. Boniface, Man., City Council, July 14, approved plans for the erection of a new station on Des Meurons St., near Provencher Ave., to cost $35,000.

It is reported that about nine miles of grading is required to complete the branch line from Prince Albert to Battleford, Sask., which it is expected to finish this year.

Satisfactory progress is being made on the construction on the extension which will give a direct line from Saskatoon, Sask., to Calgary, Alta. Track has been laid to Anderson Creek, where an 11 span bridge, 1,000 ft. long, is being built.

end of June there was only a stretch of 80 miles, between the point reached by the Twohy gangs, and that reached from Tete Jaune by the gangs employed by Palmer Brothers and Hemming, the sub contractors working westerly.

Location plans for the branch line through the town of Vernon, have been approved by the British Columbia Government.

It was expected to have tracklaying completed on the Lulu Island branch, July 30, so as to have it in operation early in August.

The necessary bonds have been deposited with the City of Vancouver under the False Creek reclamation agreement; the Dominion Government has granted permission to fill in the centre of the creek, and final steps are being taken by the City Council to hand over the property to the Company. Speaking at a public meeting in Vancouver, recently, the Premier said he had been advised that the proceeds of the $10,000,000 of terminal bonds guaranteed by the B. C. Legislature, were available for the immediate starting of this work of reclamation.

Vancouver Island Lines.—The Premier in a recent speech at Vancouver, stated that he had been advised that the section of the line on Vancouver Island, extending from Victoria to Alberni, would be turned over to the operating department early in 1914.

Tenders are under consideration for the building of the following lines: From Victoria to Deadman's River, five miles; and from Regina Ave., Victoria, to Union Bay, Saanich peninsula, 15.85 miles. The work to be done includes clearing, grubbing, grading, bridges, trestles, culverts, masonry and fencing. (July, pg. 835.)

Dominion Railway Subsidy Agreements.

The Dominion Government has entered into agreements with the following companies, granting aid for the construction of lines, as mentioned:—

Canadian Northern Alberta Ry.—June 23—from Edmonton, Alta., to British Columbia boundary, at, or in, the Yellowhead Pass, 280 miles.

Canadian Northern Ontario Ry.—June 23—from Ottawa to Port Arthur, 910 miles; and from Toronto to Ottawa, 250 miles.

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Canadian Northern Ontario Ry.—The Dominion Government entered into a contract, June 13, with the C. N. O. R. for the building of a line from Toronto to Ottawa, 250 miles; under the terms of the act passed last session to aid in the construction of this and other lines. Work on this line is rapidly approaching completion.

The question of the proposed tunnel in North Toronto came before the Board of Railway Commissioners at Toronto, July 15. Considerable opposition was manifested, and the hearing was adjourned.

Montreal-Ottawa-Port Arthur Line.—Sir Donald Mann, Vice President, in an interview July 4, is reported to have said that the greater part of this line would be completed by the close of navigation. The section from Montreal to Hawkesbury is being finished up; the Hawkesbury-Ottawa section is in operation. A 15 stall locomotive house is to be erected at Rideau Jct., the point of junction of the Ottawa-Port Arthur line with the Ottawa-[illegible] divisional buildings at four points, together with 82 stations, and 82 tool houses.

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Tenders have been asked for the erection of a station at South Edmonton, to cost about $40,000. The yard accommodation at Edmonton is being added to; the new tracks will give space for 1,000 cars.

A contract has been entered into by the Dominion Government with the Canadian Northern Alberta Ry. for the building of the branch line from Edmonton to the boundary of British Columbia at Yellowhead Pass, 280 miles.

Canadian Northern Pacific Ry.—R. Twohy of Twohy Bros., sub contractors, is reported to have stated recently that he expects to have grading along the North Thompson River completed in October, to a connection with the construction proceeding westerly. The point where these sections are expected to join is at the Albreda summit, 40 miles

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Canadian Northern Ontario Ry.—June 23—from Ottawa to Port Arthur, 910 miles; and from Toronto to Ottawa, 250 miles.

Northern New Brunswick and Seaboard Ry.—July 5—from Drummond Mines, at Austin Brook, to Intercolonial Ry. where it intersects branch line from Bathurst station to Bathurst harbor, N.B., 16.9 miles.

Canadian Car Service Bureau.—At the annual meeting in Montreal, June 10, the following members were elected to the Executive Board:—Canadian Pacific Ry., Central Vermont Ry., Grand Trunk Ry., Quebec Central Ry., and Toronto, Hamilton and Buffalo Ry. The officers are J. E. Duval, Manager, Montreal; J. Reilly, Assistant Manager, Montreal, and W. J. Collins, Assistant Manager, Toronto.

The C.P.R. English Staff's Annual Sports were held at Acton, June 28, when the various events were keenly contested by members of the staffs of the various English offices. The challenge cup, presented by G. McL. Brown, European Manager, for the inter-office competition, was won from London by the Liverpool staff, and handed over to F.

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point of loading, also cost of force of men at loading points removing nails and fitting cars for grain.

Patents are being taken out by R. W. Burnett, General Master Car Builder, C.P.R., Montreal. The car illustrated was built by the Canadian Car and Foundry Co.

Canadian Northern Railway Pacific Type Locomotives.

The Canadian Northern Ry. recently had delivered four Pacific type locomotives of the J-1-a class, the first of this type ever used by this road. They were built by the Montreal Locomotive Works, and were mentioned in Canadian Railway and Marine World at the time the order was placed. For the most part, the design is standard, but as there are some features differing from usual practice, they are here outlined. The general dimensions are as follows:—

Cylinders	23 x 28 ins.
Driving wheels	69 ins. diam.
Boiler—	
Diameter	62 ins. front, 70 ins. back.
Pressure	170 lbs. per sq. in.
Firebox	64½ x 108 ins.
Tubes—	
Number	156 @ 2 ins.; 24 @ 5⅜ ins.
Length	20 ft.
Wheel base—	
Locomotive	33 ft. 7 ins.
Driving wheel	13 ft.
Locomotive and tender	65 ft. 8½ ins.
Weight—	
Locomotive in working order	216,000 lbs.
Tender in working order	142,000 lbs.
Locomotive and tender, total	358,000 lbs.
On leading truck	41,100 lbs.
On drivers	136,400 lbs.
On trailing truck	38,500 lbs.
Fuel	Bituminous coal.

tle being so designed as to permit of this without the removal of the stand pipe. The tubes are of seamless steel, and the staybolts are of staybolt iron. Four rows of Tate flexible expansion stays are used on the firebox. In the firebox, there is a brick arch, supported on studs from the sides of the firebox.

The front end arrangement of the locomotive is of the Master Mechanics' standard design, with double petticoat pipes. The superheater in this end is of the Schmidt fire tube type A, comprising 25 units running back through the 5⅜ in. flues.

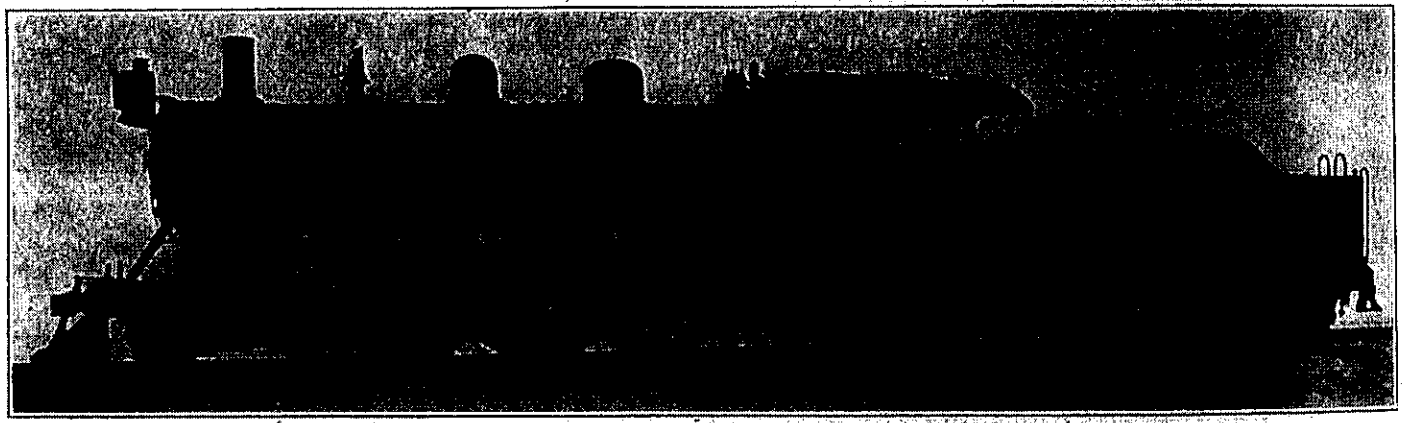
The cylinders are of the latest design, employing outside steam pipes running down from the superheater headers, a design that has met with general adoption within the last two years. Piston valves as is usual with superheated steam are employed. Over the valves is a by pass valve of what is generally termed the Pennsylvania type. It is claimed to be the best type in use owing to its positive action. Both the Baltimore and Ohio Rd., and the Pennsylvania Rd. use it as a standard. The cylinder cocks are of the double lift

The frames of the locomotive are cast Vanadium steel, to the front end of which is attached a cast steel bumper carrying a standard C.N.R. Sharon coupler. The pilot is of the C.N.R. standard, built up of oak, and fitted with an iron band shrunk on tightly.

The driving wheel centres are of cast steel, with bronze hub liners, and carrying supplementary counterbalance weights. The driving tires are of steel, 3½ ins. thick and 5½ ins. wide, and lipped on the outside to prevent their moving in. All six drivers are flanged. The axles are of hammered open hearth steel, with the main journals 9½ by 12 ins., and the others 9 by 12 ins. The driving boxes are of cast steel fitted with brasses, but with no babbitt in the bearings, and fitted with grease cellars. The springs of the spring system are of the Canadian Steel Foundries make.

The locomotive truck wheels are 33 ins. diameter, with cast steel spoke centres, with open hearth steel tires 3⅛ ins. thick by 5½ ins. wide, fitted with C.N.R. standard retaining rings rivetted in place. The axles are of hammered open-hearth steel, with journals 5½ by 12 ins. The trailing truck wheels are 45 ins. diameter, with 38 in. cast steel spoke pattern centres, and have iron tires 3½ ins. thick and 5½ ins. wide. The axles are of hammered open hearth steel with journals 8 by 14 ins.

The cab is of the C.N.R. standard type, which can be renewed in parts in a sim-



Canadian Northern Railway Pacific Type Locomotive, J-1-a Class.

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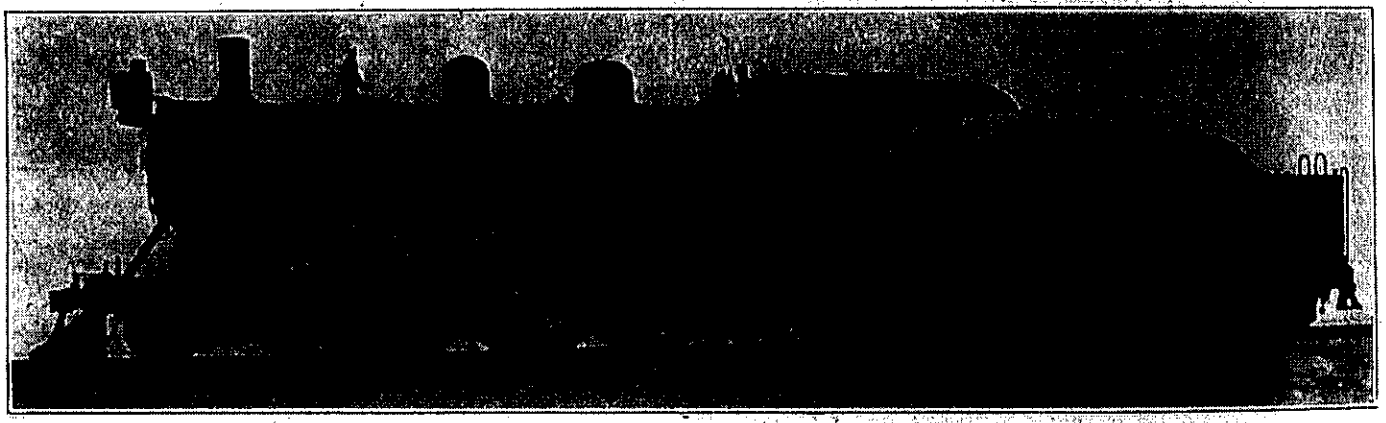
Tubes—	
Number	156 @ 2 ins.; 24 @ 5½ ins.
Length	20 ft.
Wheel base—	
Locomotive	33 ft. 7 ins.
Driving wheel	13 ft.
Locomotive and tender	65 ft. 8½ ins.
Weight—	
Locomotive in working order	216,000 lbs.
Tender in working order	142,000 lbs.
Locomotive and tender, total	358,000 lbs.
On leading truck	41,100 lbs.
On drivers	136,400 lbs.
On trailing truck	38,500 lbs.
Fuel	Bituminous coal.
Heating surface—	
Tubes	2,296 sq. ft.
Fire box	180 sq. ft.
Total	2,476 sq. ft.
Grate area	48.2 sq. ft.
Maximum tractive power	31,100 lbs.
Factor of adhesion	4.38
Tender capacity—	
Coal	12 tons.
Water	6,000 Imp. galls.



Canadian Northern Railway Pacific Type Locomotive, J-1-k Class.

The general arrangement presents nothing out of the ordinary, following pretty closely the lines of the Montreal Locomotive Works standard design in appearance. The principal point of variation in general design is in the arrangement of driving wheels. It will be noted that 69 in. wheels are called for, but the design has been worked out with the expectation of at some future date using 75 in. drivers, the wheel base being such as to permit of this rearrangement.

The boiler is of the extended wagon top design, possessing no features of consequence other than the manner of cross bracing of the steam space above the firebox by pin connected rods from side to side of the shell immediately over the fire sheet. This acts as a positive assurance against the boiler bulging outwards. The steam dome has a 20 in. opening in the top for entry in case of internal inspection, the throttle being a design that has met with general adoption within the last two years. Piston valves as is usual with superheated steam are employed. Over the valves is a by pass valve of what is generally termed the Pennsylvania type. It is claimed to be the best type in use owing to its positive action. Both the Baltimore and Ohio Rd., and the Pennsylvania Rd. use it as a standard. The cylinder cocks are of the double lift valve type. Instead of using a ball joint, with a ring at the mud ports in the bottom of the barrel, a 4 in. plug is used, and it is claimed that no trouble is experienced from leaking, and it is easier to remove and maintain. Both cylinders and valves are bushed. The piston valves are 14 ins. diameter.

The valve gear is of the Walschaert type, in one of the latest designs, comprising an outside slab frame for the outside link support, carried from the locomotive frame both front and rear. A light frame ladder is supplied on both sides of this supporting slab frame for internal inspection of the forward running gear and the oiling of the links. The valve stem is of the self centring type, supported directly from the valve chamber cover, and the front end of the piston rod is carried on a slipper in guides on the front end of the cylinder, both these features being recent practice.

The connecting and side rods are of open hearth steel, as are also the crank pins. The crank pin collars are secured by a lock nut and split pin through the crank pin, which is standard C.N.R. practice. All the grease cups are forged solid with the rods.

R. standard retaining rings rivetted in place. The axles are of hammered open-hearth steel, with journals 5½ by 12 ins. The trailing truck wheels are 45 ins. diameter, with 38 in. cast steel spoke pattern centres, and have iron tires 3½ ins. thick and 5½ ins. wide. The axles are of hammered open hearth steel with journals 8 by 14 ins.

The cab is of the C.N.R. standard type, which can be renewed in parts in a simple manner. The runboards are of diamond surface steel plate with an angle iron edge. The sanders are piped to the front of the main drivers. The headlight has an 18 in. round case Ross type reflector, and a Pyle type E generator supplied with steam through copper pipes run under the lagging. Auxiliary lighting is from C.N.R. standard oil lamps.

The ashpan arrangement is of the C. N.R. standard, which was described in these columns recently. The firedoors are of the Franklin automatic type. The lagging on the boiler is H. W. Johns-Manville fire felt, 2 ins. thick. The jacketing is of no. 22 planished steel. The bell ringer is of the Taylor and Arnold type. There are three 3 in. open pops. The boiler feed is from a no. 10 Ohio injector on the left side and a no. 11 on the right. The bearing metals throughout are the Canadian Bronze Co's make. The steam heating is on the Gold system, and all the metallic connections are through flexible hose. All boiler fittings are connected to the boiler with the C. N.R. standard 12 threads per inch. The air signals are on the Westinghouse schedule L, and the air brakes are all Westinghouse, with two 9½ in. pumps

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on the left side. A no. WM-2 and WD are applied to the locomotive truck and all the drivers, but with no braking on the trailing truck. All gauges have a double spring crank movement graduated to 300 lbs.

The tender tank and frame are of the C.N.R. standard construction described in these columns recently. The trucks are also of the standard C.N.R. equalized pedestal type, with cast steel bolsters and Wood's roller side bearings. The truck wheels have 33 in. diameter cast steel plate centres with tires, 2⅞ ins. thick and 5½ ins. wide. The axles are of open hearth hammered steel with 5½ by 10 in. journals.

We are indebted for the above information to A. L. Graburn, Mechanical Engineer, C.N.R.

August 1913

Canadian Railway and Marine World.

September, 1913.

The Canadian Northern Railway Montreal-Port Arthur Line.

By Henry K. Wicksteed, B.A.Sc., M. Can. Soc. C.E., Chief Engineer of Surveys, Mackenzie, Mann & Co., Limited, Toronto.

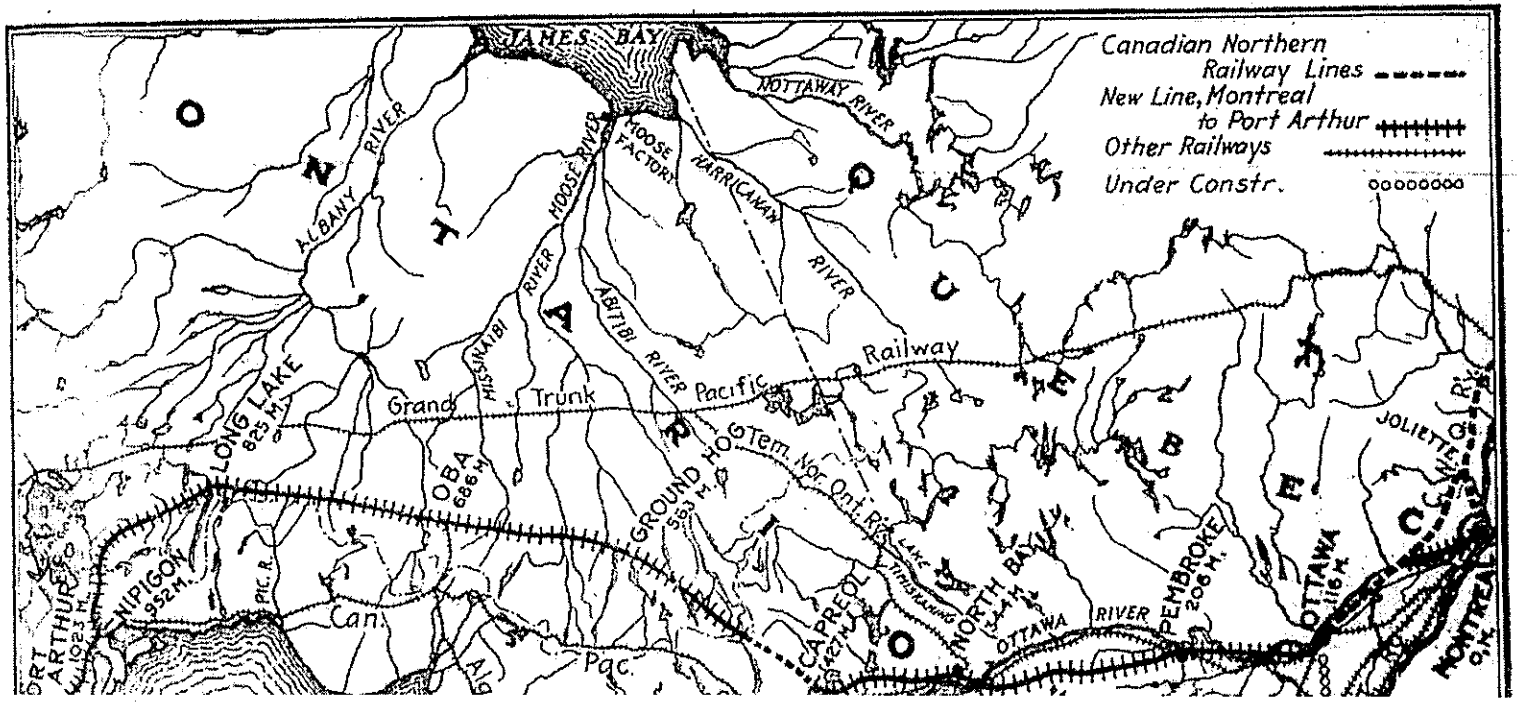
The Canadian Northern Ry. has been doing some rather remarkable work in filling in the last links of a transcontinental railway system. For over a year it has had under contract nearly 1,000 miles of main line between Montreal and Port Arthur, besides the completion of a branch of 250 miles between Toronto and Ottawa, and the construction of the Montreal tunnel and terminals, this last being the largest and boldest work of the kind which has ever been undertaken in Canada. These works are all on the east end of the railway system, between Ry. (now nearing completion) approaching it in the matter of ruling grades. The standard in this particular has been 0.6% against the westbound traffic and 0.4% in the opposite direction. One grade of 10 miles in length is 0.5% (compensated for curvature) against eastbound traffic, but with this single exception the standard has never been exceeded in the whole distance of 1,000 miles, and not even reached except for very short distances.

Owing to the extremely rocky and broken character of much of the country consideration (and at several points a governing one) in working out the location.

It will be of interest now to describe the line somewhat in detail.

Montreal to Lake Nipissing.

The Canadian Northern Quebec Ry., an allied corporation, has a terminal in the east end of Montreal and runs thence northeasterly parallel to the St. Lawrence to Quebec and a number of other important points in the province. About 1½ miles from this terminal, is located a sorting yard and a spur connecting



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heated, and the food was the best which could be obtained. A special mail carrier was attached to each division and made regular trips (by canoe in summer and on snowshoes in winter) over the 75 to 150 mile gap which separated the parties from the C.P.R. Fresh meat was often obtainable and fish almost always, except in midwinter.

One remarkable exception to the general standard of comfort was on an expedition organized by the western divisional engineer through an exceptionally inaccessible belt of country, which it was urgently desired to finish before the spring breakup. Mr. Rose discarded all his white staff except those absolutely necessary for the instrumental work and retained 17 Indians of the country. Tents were abandoned in favor of enough canvas to cover the wigwam. Heating and cooking were done on an open fire in the centre. All the camp impedimenta and provisions were carried on the backs of the men at one trip. It is sufficient to say that in spite of temperatures lower than 50° below zero, the party emerged from the woods three months later in the best of health and spirits and with the work satisfactorily finished.

In one respect the survey parties in this north land had a great advantage over the Antarctic explorers about which so much has been heard lately. Fuel and shelter from the wind were always within reach. On the other hand the light fleecy snow of the north land is incomparably more difficult to travel on than the wind swept wastes of the South Pole. And one is led to wonder whether the British sailor is after all the right man to carry through successfully such expeditions as that of Capt. Scott, and whether the north country Indian or Esquimaux, under competent leadership, is not the proper person.

The half breed runner has been known to make 100 miles in 24 hours on snowshoes. The writer had made 70 miles, and 40 to 50 miles was an ordinary day's work a generation ago. But these men were brought up to it from childhood. No man, however strong, could hope to keep pace with them unless after years of practice. They travelled with the birch bark canoe of the native Indian, a wonderful construction built entirely of the products of the local forest, but extremely delicate and unfit for use by any but practised white men.

Next came the basswood or cedar canoe, built roughly on the Indian models. It was much stronger and more speedy, but also heavier, and weight is a very serious matter on the portages. A still later arrival, and one coming into general use, is the canvas canoe. I believe this came originally from Maine, and it is now brought to considerable perfection. The construction, except for the canvas skin, is very like that of the Indian; but the white man's tools and metal fastenings give him a great advantage over the native, and wonderful as the Indian's work is, considering his facilities, the civilized product is better. The canoes for the C.N.R. surveys were built by the Chestnut Co., in Fredericton, N.B., but its models were rejected in favor of that of the aboriginal craft, and both models and construction were a decided advance on anything previously used.

Tents were also experimented with, and a number of different styles were tried. Here again lightness was essential. The final evolution was a roof of best 8 oz. duck, with back, front and walls of light drill. Shelter being almost always available and windage unimportant, the walls were made unusually high (5 to 6 ft.), adding much to available room inside.

Bedding for summer consisted of the inevitable woolen blankets, but in winter the extremely low temperatures render these insufficient for the ordinary man, even when made into a sleeping bag. The rabbit skin blanket is the most perfect substitute which the red man or anyone else had evolved up to a few years ago, but latterly the eiderdown quilt has superseded everything else. This, made into a sleeping bag, with a protective covering of duck, has been a very satisfactory solution of the bedding question. A well fed man can sleep comfortably in a snowbank in one of these bags with the thermometer at 80° below zero.

Outfit is probably the snowshoe, and it has been one of the hardest to get of serviceable make. The snowshoe the Indian makes for himself is good, but those he makes to sell are the reverse, and those sold by the dealers in civilization are almost useless. The Fredericton firm has taken up this branch of manufacture of late, and is supplying a very good article.

Cooking outfits have also been the subject of much study and experiment. For light flying expeditions, the open fire is all sufficient, but for a large party requiring a variety of food it is difficult in these days to find a cook who is willing to operate on one. In stormy weather his job is not an enviable one, the baking of bread especially being very difficult. Further, the open fire necessitates a very large quantity of dry wood, which is only obtainable anywhere by virtue of much chopping and hauling and sometimes not at all. In any case it takes a helper's whole time to keep the cook supplied. Sheet steel cook stoves have been brought to a fair state of efficiency, but they are still cumbersome and heavy.

Instruments.

The surveying instruments would seem to be the most important of all, but as a matter of fact they caused little worry and few accidents occurred. American patterns were used almost exclusively, and the simplest and lightest were preferred. One of the worst faults with the smaller instruments was the small diameter of the milled head of the leveling and clamp screws, necessitating the removal of the mitten for every adjustment. Stadia wires or a gradienter attachment for the measurement of distances were essential, in fact much of the exploratory work was carried on by micrometer work. A vertical arc on the other hand was worse than useless, merely so much more weight to be carried.

The dumpy level was the favorite on account of the greater need for ample light than for great magnifying power. For one reason or another long sights in thick woods are seldom possible in any case, and in midwinter in these latitudes the day is only eight hours long

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and it is important to use the last vestige of daylight. A pole rod, self reading, with figures painted on the wood was used almost invariably. The telescope rods were apt to play tricks, slipping down unnoticed at times and refusing to extend when required.

Repairs were difficult to make, and as a matter of fact this question of repairs with the elementary tools which could be carried (the axe, spokeshave, auger and awl) was one that entered into consideration with almost every article of the equipment.—Engineering News.

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Canadian Northern Ontario Railway Supply Car.

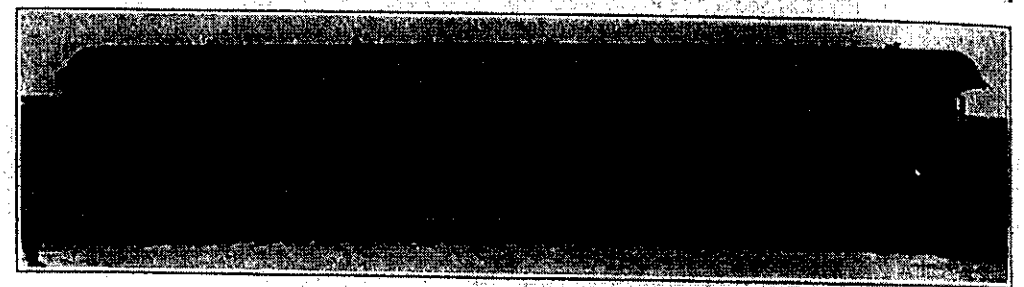
Early this year, the C.N.O.R. placed in service a new supply car, which is illustrated herewith. The car is an old Pullman sleeping car, rebuilt under the direction of A. L. Graburn, Mechanical Engineer, to designs evolved in conjunction with L. C. Thomson, Storekeeper, embodying a number of new features that have appeared desirable to the latter through his long familiarity with store cars, both on the C.N.R. and the C.P.R.

The fact that the car is a piece of passenger equipment, discarded, not on account of being unserviceable, but rather from the fact that for present day equipment it was a little antiquated, made a splendid base on which to construct the store car. While but little of the old body remains, the underframing, car framing, and trucks have been utilized, the whole making for a very solid car. The trucks are six wheel, with 36 in. steel wheels; the underframing is of steel I beams throughout; and it is provided with standard draft rigging. The air and signal arrangement is that of a standard passenger car.

The car was of the old open vestibule type. One of these vestibules, on the store end, has been removed. The overall dimensions of the car body are 66 ft. 2 ins. long, by 9½ ft. wide. As refinished, the window arrangement of the former sleeper has been rearranged with a few higher windows along both sides. The finish of the car corresponds to the C.N.R. standard.

The open vestibule end is the living and business end of the car. To the right on entering from that end is a double berth section for the attendant in charge. Opposite this section, in the corresponding length of the car—6¼ ft. —are three sections, two of which are shelf lockers, with a heater room alongside, containing a Baker heater with its auxiliary apparatus.

Beyond this section of the car is a room 10 ft. 2½ ins. long, designed for the on each side of a central aisle. These sections are of different shapes and sizes, to accommodate to the best advantage the full range of stores carried. The first section at entering on the right is a set of four vertical compartments above and below, opening into the centre aisle by sliding doors. Across from this section is a double section of tiers of drawers, entered both from the office and a cross aisle. The other store sections take different shape, all opening from the cross aisles with the exception of the end section on the left, which has sliding doors from the centre aisle. The two sections opening on the centre aisle was



Supply Car, Canadian Northern Ontario Railway.

necessitated by the lack of space in the narrow cross aisles.

Beyond these storage sections, the balance of the car is a long open room, except for the lavatory on the left, and a tier of special lockers beyond the latter, for the storage of inflammable material, such as matches, fusees, etc. This section is kept under lock and key, and the interior, both walls and door, is lined with galvanized iron to minimize the fire danger. This is an idea embodied by Mr. Thomson as the result of an experience encountered some years ago in the handling of inflammable stores. The tightness of these compartments makes the possibility of fire very small.

This large room, 30 ft. 10 ins. long, contains three oil tanks, two small 280 the stations, nobody but the attendant being allowed in the car, he thereby having a closer check on all the stores. The practice in service is to have the stores for delivery at a certain station made up on the run and piled opposite the delivery door ready for serving out without delay. For safety, there is a 1 in. grab iron across the door opening above the door.

The large oil tank room is also the store room for bulk stores, such as tie plugs, which can be heaped in the open spaces at the end of the room or opposite the small tanks.

The lighting is from six pairs of oil lamps suspended from the roof, spaced at even intervals down the centre of the car. There is also a side bracket lamp over the attendant's desk. Fire protection is provided for by a chemical fire extinguisher above the desk, and four pails of sand on a ledge over the door leading into the oil room.

The factor of operating the car is well looked after in the design. All the oil tanks have connections on the under side of the car through which they are filled, removing that dirty operation from the body of the car. Any oil that does slop out inside the car is drained off as noted. All supplies are loaded into the car at the loading depot through the side doors and distributed to their several locations for redistribution along the line without having occasion to go into the living section of the car at all. The whole arrangement is a considerable improve-

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The open vestibule end is the living and business end of the car. To the right on entering from that end is a double berth section for the attendant in charge. Opposite this section, in the corresponding length of the car—6¼ ft. —are three sections, two of which are shelf lockers, with a heater room alongside, containing a Baker heater with its auxiliary apparatus.

Beyond this section of the car is a room 10 ft. 2½ ins. long, designed for the attendant's general living quarters, the portion on the right forming the kitchen, and the opposite side the office. In the kitchen portion, at the entry end, is a double locker, cupboards above and refrigerator below, the front of the cupboard forming a kitchen ledge and sink. In front of this is a garbage chute to the outside of the car. The opposite end of the kitchen section contains a small kitchen range, insulated on the two wall sides and floor. The office half of the room contains at the entry end a small desk attached to the wall, with revolving desk chair in front. Over the desk are tiers of pigeon holes for the stores bills, etc. To the rear of the desk, along the side of the car, is a table 4 ft. long, used principally in wrapping up parcels for delivery at the different stations.

Beyond this double utility room, in the centre of the car, is an 18 ft. 10½ in. section containing three storage sections necessitated by the lack of space in the narrow cross aisles.

Beyond these storage sections, the balance of the car is a long open room, except for the lavatory on the left, and a tier of special lockers beyond the latter, for the storage of inflammable material, such as matches, fusees, etc. This section is kept under lock and key, and the interior, both walls and door, is lined with galvanized iron to minimize the fire danger. This is an idea embodied by Mr. Thomson as the result of an experience encountered some years ago in the handling of inflammable stores. The tightness of these compartments makes the possibility of fire very small.

This large room, 30 ft. 10 ins. long, contains three oil tanks, two small 280 gal. tanks for journal and signal oils, and the third at the very end of the room of 800 gal. capacity, for headlight oil. All these tanks are equipped with Bowser measuring and drawing apparatus. This whole room, with the exception of the strip across between the two 4 ft. sliding doors near the end of the larger tank, is laid with slatting. Under this, on the underflooring, is a surface of galvanized iron, draining to 1½ in. drain holes at each end of the room, through which all the wasted oil is drawn off from the floor of the room. This idea of slatting on the floor and surfacing underneath is one of the most valuable features of the car.

The side doors are very similar to those found in baggage cars, sliding on wheels into protected door pockets. Across between the doors, the surface is of 2 in. close flooring. All the stores are given out through these side doors at over the attendant's desk. Fire protection is provided for by a chemical fire extinguisher above the desk, and four pails of sand on a ledge over the door leading into the oil room.

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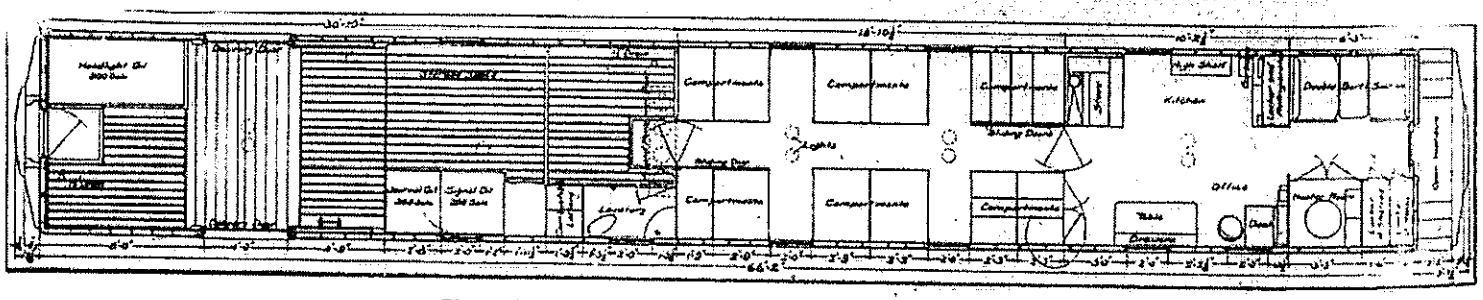

Plan of Supply Car, Canadian Northern Ontario Railway.

The Reid Newfoundland Co.'s employes held their first annual outing at Octagon, Aug. 23.

During June there were 14 fatal and 10 non fatal accidents on railway construction in the Dominion. Thirteen of the deaths were due to premature explosions, and one to a derailment.

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work of the greatest authorities on railway economics have been found antiquated when compared with the progress of recent events. There is also a decided lack of harmony between different depart-

unit for minimum cost of operation.

But to return to the question of the value of lower ruling grades. It should not be necessary at present to make a strong plea for their use wherever they

ceiving attention from the principal transportation companies, such as greater facilities for a more speedy and continuous flow of traffic in both directions along the main arteries, with corresponding

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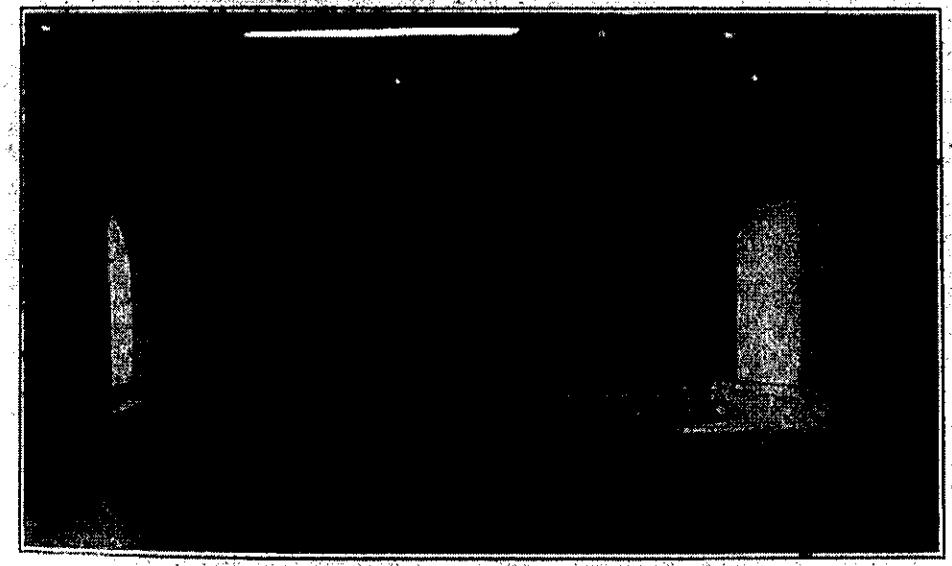
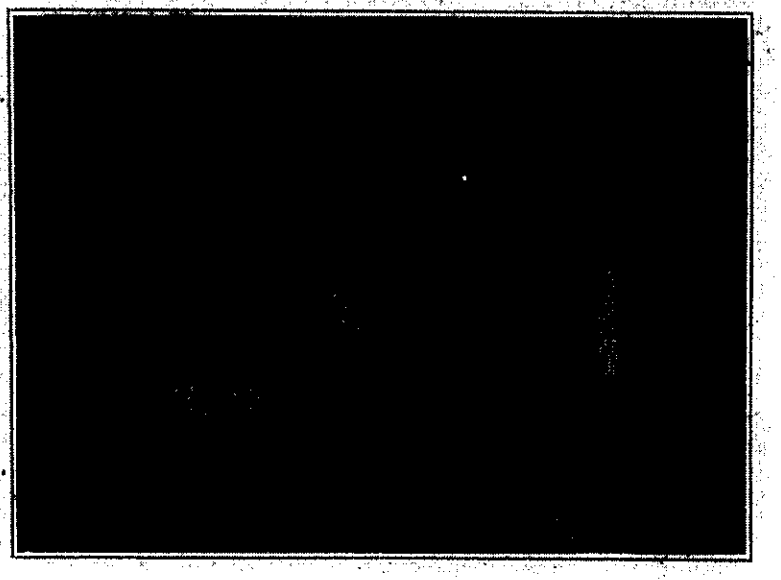


Supply Car Interior, looking from Oil Room towards Vestibule End.



Oil Room of Supply Car.

Payment of pension allowances for year	169,329.16
Balance in cash and investments	$681,596.60

Number on Pension Roll at June 30.

Under 60 years of age	73
Between 60 and 70 years of age	294
Over 70 years of age	238
Total	605

Grand Trunk Railway Betterments, Construction, Etc.

Bonded Freight Shed in Montreal.—The company is building a freight shed, 1,200 by 60 ft., for bonded freight at Point St. Charles, Montreal.

At one end will be the office, 60 by 60 ft., giving accommodation for the general, cartage and Customs staff, etc., on two floors, with basement below, in which will be the heating plant, storage room for records and a waiting room for shed laborers.

The building will have concrete foundation up to the floor line of shed with brick walls above, faced with red pressed brick facing. There will be a flat roof, covered with felt and gravel and supported on columns and beams. The office portion will be of fireproof construction.

The shed will have continuous doors along the track side, with glazed steel sashes above, whilst on the other side there will be doors every 15 ft.

At intervals through the building will be travelling cranes, which will be capable of handling a load of 6 tons straight from the cars to the teams on the opposite side of building. Scales for the weighing of freight will also be provided.

A driveway 30 ft. wide will be provided on Wellington St., which will be paved with scoria paving blocks, provision being made at intervals for driveways across the sidewalk.

Track Elevation in Montreal.—The order for the elevation of the G.T.R. tracks in Montreal is reported to have been prepared for issue by the Board of Railway Commissioners. The estimated cost of the work is over $8,000,000, and it may amount to as much as $10,000,000. The only question said to be undecided is the proportion of the cost to be paid by the city. The actual cost of the track elevation is a little over $5,000,000, towards which the city is authorized to contribute $2,500,000, but the company asks for an additional $500,000. The remaining part of the estimated cost of the work is made up of the alteration of terminal facilities to suit the track elevation, and for the building of a new passenger station to replace the present Bonaventure one.

Stratford Station, Yards, Etc.—A start was made Aug. 8, on the deflection of the

Canadian Northern Railway Construction, Betterments, Etc.

The question of the Atlantic Coast terminals of the C. N. R. is being discussed in the press at considerable length. On the one hand the probability of the granting of running rights over the Intercolonial Ry. to St. John and Halifax is given credence, while on the other Boston, Mass., and Portland, Me., are advocated. Sir Donald Mann, Vice President, is reported to have stated, Aug. 12, that the company did not contemplate making Portland its Atlantic terminal. The newspaper reports made a terminal at Boston a part of the Portland terminal The whole question is, however, being given consideration, but there is nothing definite in view at present.

Sir Donald Mann returned east, Aug. 5, from a trip of inspection over the lines under construction in Western Canada. In an interview he stated that the line from Port Arthur easterly giving connection with Montreal and Quebec, via. Toronto, would be opened for traffic by December. On the Canadian Northern Pacific Ry. there were only 80 miles of grading uncompleted, and this line would be finished through from Edmonton to Vancouver by the fall of 1914. The terminals at Port Mann, Vancouver and Victoria were being rapidly pushed forward.

Montreal-Ottawa-Port Arthur Line.—The sections of this line which are being completed for opening this year, are those between Montreal and Hawkesbury, there connecting with the line now in operation into Ottawa, and the line west of Sudbury to Port Arthur. On this latter section a train service is being operated to Ruel, and track has been laid for a considerable mileage beyond. At Obo, some track has been laid easterly, and about 25 miles westerly. About 150 miles of track have been laid easterly from Port Arthur. With the exception of the bridges across the Nepigon River and at the end of Kapuskasing Lake, all the steel bridges on the line have been completed.

The section of the line which will be brought to completion by the end of 1914, or early in 1915, extends from Ottawa to the junction with the Toronto-Sudbury line at Capreol. Construction is being proceeded with. The questions at issue between the company and the North Bay Town Council, are still unsettled, but an early arrangement is hoped for. It is stated that a possible solution for some of the points will be an agreement with the Temiskaming and Northern Ontario Ry. for the use of that railway's station and terminal facilities.

Canadian Northern Ry.—Track is reported to have the steel laid and the ballasting done by Oct. 1. The grading was done by the Western Canada Construction Co.

A plan and book of reference, giving details of route, etc., of the C.N.R. Alaska branch, as located through tps. 25-26, ranges 20-23, west of the third meridian, Saskatchewan, has been deposited in the Land Titles office at Moose Jaw, Sask.

The company's line will enter Moose Jaw, north of the C.P.R. tracks, and will cross the Cousin's siding by an overhead trestle 35 ft. high, according to plans laid before the City Council, which have been approved.

Hugh Sutherland, Executive Agent, C.N.R., Winnipeg, recently stated that the C.N.R and the G.T. Pacific Ry. were planning to erect union stations in every city in Western Canada where the two lines came together.

Every effort is being made to complete the line into Calgary and to have it in operation this fall. It was expected to have the line finished for opening Sept. 1, but there had been considerable delay in the delivery of the steel for the bridges, which had held up construction considerably.

A contract is reported to have been let to John McLeod and Son, Winnipeg, for the erection of a station for the C. N. Western Ry. at Edmonton, at an estimated cost of $40,000.

Canadian Northern Pacific Ry.—Track laying is reported to be in progress westerly in the vicinity of Yellow Head Pass, and grading is in progress right up to the Albreda Summit, to which point the construction is in charge of Mackenzie-Mann and Co.'s Winnipeg staff. The construction from Port Mann to the Albreda Summit is in charge of the Vancouver office. Track has been completed to mileage 86 north of Kamloops, while considerable progress has been made with the work beyond that point.

The Lulu Island branch has been completed and was reported ready for official inspection Aug. 4.

Construction was started Aug. 11 on the first part of the terminal buildings at Port Mann. This will consist of a 15-stall locomotive house, a repair house 140 by 312 ft., and a turntable. The foundation work, which is being done by the Northern Construction Co., necessitates the driving of 2,800 piles. The buildings will be put up by the Imperial Construction Co.

Sir Donald Mann stated on the occasion of his visit to Vancouver, July 26, that a start would be made right away on the filling in and other work on the

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Canadian Northern Ry.—Track is reported to have been laid on what is known as the Fort Rouge cut off at Winnipeg, and it is expected to have it in operation early in September. This cutoff will enable grain trains from the West to go through to the C. N. R. yards at St. Boniface, and to the G. T. Pacific Ry. yards at Transcona, without passing through the Fort Garry terminals. This will relieve the terminals of a large amount of shunting, and consequent delaying of traffic.

The Board of Railway Commissioners has authorized the opening for traffic of the diversion of the Coste Point branch from sec. 21, tp. 11, range 2, east of the first principal meridian.

The extension of the branch now terminating at Bienfait to Estevan, Sask., 9 miles, has been graded, and it is expected the line into Calgary and to have it in operation this fall. It was expected to have the line finished for opening Sept. 1, but there had been considerable delay in the delivery of the steel for the bridges, which had held up construction considerably.

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Sir Donald Mann stated on the occasion of his visit to Vancouver, July 26, that a start would be made right away on the filling in and other work on the False Creek terminal site, Vancouver.

Vancouver Island Lines.—In connection with the building of the branch line along the Saanich Peninsula—which is referred to locally as the Patricia branch—notice has been given of the deposit with the Minister of Public Works at Ottawa, of the plans for the trestle bridge and embankment across the Selkirk water to carry the line from the Songhees Reserve to the Selkirk Bridge on the Gorge Road, and also the plans for the railway ferry terminal at the Patricia Bay terminal.

The plans for laying out the Songhees Reserve for terminal purposes have been prepared, and J. Montgomery, of the Imperial Construction Co., was in Victoria, Aug. 10, arranging for the starting of construction. (Aug., pg. 380.)

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wharves for ocean and coastwise steamers.

It is also reported that the company is negotiating for the purchase from the Government of the Squamish Indian Reserve at the mouth of the Squamish River, near Newport, which has an area of 1,175 acres, of which the company propose to use 675 for yards and terminal purposes.

Construction is reported to be well advanced along the line from near North Vancouver to Newport, and from the end of the old Howe Sound and Northern Ry., to beyond Lillooet. F. C. Gamble, of the Provincial Government Railway Department, returned to Vancouver, recently from an inspection of the Anderson Lake-Quesnel section of the route. On this section the maximum gradient will be 1% owing to difficulties of construction. The line is being located southerly from Fort George, to a junction with the surveys working northerly.

The Premier, Sir Richard McBride, in a recent speech said that at a future date the question of extending the P. G. E. Ry. into the Yukon Basin, would be taken into consideration by the Provincial Government. (Aug., pg. 376.)

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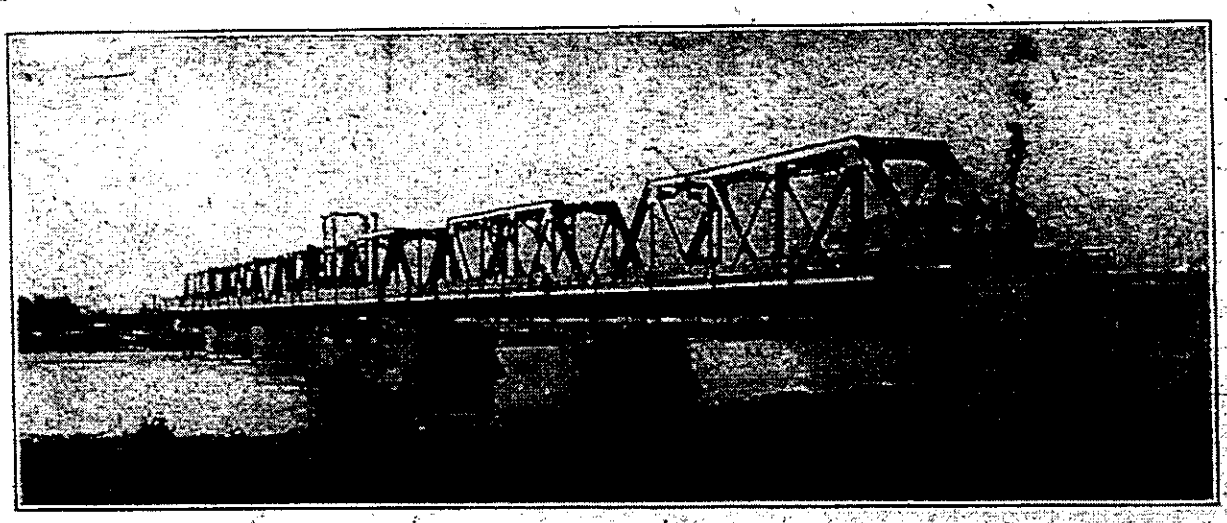
The Hudson Bay Railway Bridge at Pas, Man.

Bridge at Pas.—The illustration on this page shows the bridge which has been built over the Saskatchewan River, at Pas, Man., to connect the line which the Government is building from that point to Hudson Bay, with the Canadian Northern Ry. branch line running southwesterly from Pas. The total cubic yards of concrete in piers and abutments is about 7,000. As much as 24 ft. of water was encountered at some of the piers at low water, and 42 ft. at high water, the current being about 4 miles an hour. The bottom was hardpan, covered with small boulders, necessitating the use of steel sheet piling. About 1,000,000 lbs. of the Lackawanna type was used. The piers rest upon the natural bottom at an average of about 8 ft. below the water. This portion of the work was done by Mackenzie, Mann & Co., Ltd. The superstructure is a rivetted truss designed as "class heavy" of the Department of Railways and Canals, with a highway 12 ft. clear bracketed to each side; the total weight being a little over 2,700,000 lbs. There are four fixed spans of 147 ft. each and a swing span of 262 ft., 850 ft. over all. The width of the piers for the fixed spans is **9 ft. 10 ins.**, and length 34 ft. 4 ins., these dimensions being over the coping. The diameter of the pivot pier is 26 ft. The swing span superstructure was fabricated and erected by the Canada Foundry Co.



The Hudson Bay Railway Bridge at Pas, Man.

G.T.R. Branch St. John's Ambulance Association.—The following have been

Resuscitation From Apparent Death From Electric Shock.

The Board of Railway Commissioners has issued the following circular: "Attention is directed to circular 37 issued by the Board May 3, 1909, regarding rules for resuscitation from apparent death from electric shock. These rules have recently been revised under the auspices of the National Electric Light Association, T. C. Martin, Secretary, 33 West 39th St., New York. The Board deems it advisable that you should secure copies of them, and have them posted in conspicuous places in every department, so that the knowledge therein contained shall be spread amongst all officials and employees of your institution.

"Attention is also directed to the advisability of warning employes about the absolute necessity of keeping away from all electric light or power lines. On Feb. 28, 1913, near Ingersoll, Ont., one railway man was killed by coming in contact with an electric power line through the medium of a tape line which he was using to measure the clearance between the rails and the wires. He and his companions had acquired the bad habit of throwing a string over the power wires in order to determine the distance between the wires and rails. On the occasion in question, as there was no string at hand, these men used a cloth tape line and, unknown to them, a light copper mesh, which was woven within the tape line, conveyed current from the power line through one of the men to the ground

October 1913

Canadian Northern Railway Construction, Betterments, Etc.

Canadian Northern Ontario Ry.—We are officially advised that on Sept. 9, there still remained about four miles of track to lay, and about 60% of the ballasting to be done on the uncompleted portion of the line between Toronto and Ottawa. The erection of station buildings, roundhouses, etc., has been completed. Owing to the uncertainty of the amount of train filling to be done on several sections, we are informed, it is not possible to fix a date for the completion and opening of the line for traffic.

Sir Donald Mann, Vice President, made a trip of inspection over the line from the Ottawa end to Chaffey's Locks, on the Rideau River, Sept. 11. With the exception of about four miles between Chaffey's Locks and Sydenham, on which trouble is being given by some sink holes, the line is completed. Press reports state that the work of filling these is expected to be completed to permit of the operation of trains through from Toronto to Ottawa, by Oct. 15, but Sir Donald Mann, in an interview Sept. 18, is reported as stating that "six months' deferment of the opening of the line to passengers will allow the tracks to settle down."

Montreal-Ottawa-Port Arthur Line.—We were officially advised Sept. 9, that the portion of work on this line at that date was:—Grading, 60% completed; tracklaying, 42% completed; ballasting, 20% completed; erection of buildings, etc., 5% completed. The work on the line will be continued until completion, as everything is in such a shape that work may be continued regardless of the season. These figures refer to the progress of work on the whole of the line between Montreal and Port Arthur, but they do not indicate the state of completion on various sections. The line between Montreal Island and Hawkesbury is practically finished but for the completion of the bridges at the Montreal end; the section between Hawkesbury and Ottawa is in operation, and the mileage between Ottawa and Rideau Junction, the point where the line to Toronto separates, is also completed, but has not yet been opened for traffic. Between Rideau Jct. and Capreol, Ont., the line is under construction, and we were advised Sept. 17, of the following state of construction on this section: Grading from Ottawa to Pembroke, 56% completed; grading from Pembroke to North Bay, 45% completed; grading from North Bay to Capreol, 86% completed. Track has been laid from Capreol, mileage 313 from Ottawa, easterly for 44 miles to mileage 269, from just west of North Bay, mileage 231, for 19 miles to mileage 250, and from just east of North Bay at mileage 227 to mileage 186, in all 104 miles. Track has also been

for the operation of trains from Fort William. The new track begins at the diamond, and skirts the present C.N.R. yards to the station. Heretofore the trains ran over the freight train track.

The Board of Railway Commissioners has authorized the operation of traffic over the connection between the C.N.R. and National Transcontinental Railway at St. Boniface, Man.

The Winnipeg North Eastern Ry. has deposited with the Minister of Public Works at Ottawa plans of the proposed railway bridge over the Red River, from the foot of Clare Ave., Winnipeg, to south of Harrowby Ave., St. Boniface.

Ballasting is being pushed ahead on the Totogan branch, with a view of bringing it up to a higher standard. The branch is being extended and press reports state that some additional track will be laid before the end of the year.

The Board of Railway Commissioners has approved of location of the extension of the Grosse Isle Branch, which now extends to Inwood, Man., from mileage 74.47 to 80.88.

A start has been made at Yorkton, press reports state, on a line from that point to Wroxton, Sask.

The Board of Railway Commissioners has approved of location plans for the extension of the Alsask Branch from mileage 105.42 to 148.54.

It was reported to the Calgary, Alta., City Council, Sept. 12, that the line from Vegreville would be completed into Calgary within 30 days. The steel has been laid to Drumheller, to which place the line is in operation from Vegreville, but the bridges over the Bow and the Elbow rivers have not been completed. These bridges, however, are at Calgary, and all that is delaying the completion of the line is the ballasting. The gravel for this purpose has to be hauled over 130 miles.

Canadian Northern Pacific Ry.—Track has been laid easterly from Port Mann, B.C., 122 miles, a little beyond North Bend. A large steel bridge is under construction at this point over Stroma Creek, which is expected to be completed early in October. Grading is practically completed to Lytton, and work is well forward as far as Kamloops, where a big bridge is being built across the Thompson River, which will take some time to complete. Grading is well advanced north and east of Kamloops, to within about 28 miles of the work in progress from the Yellowhead Pass. Ballasting is being pushed close behind the tracklaying gangs.

Work on the proposed electric line from Kamloops to Vernon is reported to be under way, after having been suspended for some

Sept. 9, that they would be sent to Toronto shortly for approval.

Vancouver Island Lines.—The contracts for the construction of the line from the Songhees Reserve at Victoria, to Patricia Bay, in the Saanich Peninsula, are reported to have been let to J. Macdonald and the Littleton-Bruce-Elsbach Co. D. D. Lewis, District Engineer, Victoria, is reported as saying, Aug. 30, that the work to be done covers the building of a line from Patricia Bay to the point at which the line to Alberni starts, mileage 4.7 from Victoria, and a line from that point into the Songhees Reserve. The engineering staff then had everything ready to go ahead as soon as the contractors arrived. The work will be rushed ahead as fast as possible.

Grading on the main line from Sooke Lake to mileage 100 is expected to be completed by Nov. 30, and good progress has been made up to mileage 140. The steel superstructure of the bridges over the Cowichan and the Koksilah Rivers is being put up. (Sept., pg. 427.)

Canadian Pacific Railway Company's Annual Report.

In publishing this report in our last issue some errors unfortunately occurred in showing the liabilities in the condensed balance sheet on page 425. The copy was put in the printers' hands correctly and was also put in type correctly, but in putting the type into the form some lines were transposed. The grand total of the liabilities was unaffected, but the totals of the amount due on mortgage bonds, $13,157,520.00, and of the current liabilities, $30,511,302.78, were transposed, and the amounts of the Algoma Branch first mortgage bonds, and current liabilities were repeated, the former incorrectly. The correct arrangement of figures is as follows,—

LIABILITIES

Capital stock		[illegible]
Payments on subscription to new issue capital stock (60,000,000.00 at 175)		[illegible]
4% preference stock		[illegible]
4% consolidated debenture stock		[illegible]
Mortgage bonds:		
First Mortgage, 6%	34,998,633.38	
Less amount redeemed and cancelled	21,841,113.38	
		13,157,520.00
Algoma Branch, 1st mortgage		3,650,000.00
Current liabilities:		
Audited vouchers	14,785,322.[illegible]	
Pay rolls	6,549,901.[illegible]	
Miscellaneous accounts payable	9,176,078.[illegible]	
		30,511,302.78
Interest on funded debt and rental of leased lines:		
Coupons due July 1, 1913, and including coupons overdue not presented	1,208,016.[illegible]	
Accrued fixed charges	183,795.[illegible]	
		1,391,811.[illegible]
		850,000.00
Equipment obligations		[illegible]

given by some sink holes, the line is completed. Press reports state that the work of filling these is expected to be completed to permit of the operation of trains through from Toronto to Ottawa, by Oct. 15, but Sir Donald Mann, in an interview Sept. 18, is reported as stating that "six months' deferment of the opening of the line to passengers will allow the tracks to settle down."

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Work on the proposed electric line from Kamloops to Vernon is reported to be under way, after having been suspended for some time.

The trestle work in connection with the Lulu Island Branch has been finished and the line is now ready for operation.

Sir William Mackenzie, President, in an interview Sept. 5, is reported as stating that a large portion of the proceeds of the loans recently placed in London, Eng., will be used for western development. The plans include the shops at Port Mann, terminals at Vancouver, Victoria and New Westminster, and the provision of an entrance into Vancouver by a tunnel. These several projects will be gone on with at once, but the company's entrance into Vancouver does not depend upon the building of the tunnel, an arrangement having been made by which the C.N. Ry. will use the Great Northern Ry. lines for the present.

Plans for the reclamation of the False Creek flats are being prepared, and T. G. Holt, Executive Agent, Vancouver, stated

October 1913

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October 1913

ciation First Aid Work by

Demonstration of First Aid Work Before the Duke of Connaught by C.N.R. St. Andrew's Ambulance Association.

tions of the Western and Eastern Lines met last fall, the team from the Western Lines being declared the winners. The C.N.R. Fort Rouge section challenged this winning team, and in the demonstration which followed, proved capable of defeating the champions of the C.P.R. system.

Blende River Viaduct, Canadian Northern Ontario Railway.

The Blende River viaduct, at mileage 24 east of Port Arthur, on the C.N.O.R., recently completed, is the largest of the many steel structures on that line. Although the stream crossed is but a rivulet, the wide and deep valley necessitated a structure of some magnitude to conform to the location and grade adopted, the alternative being a more circuitous route, which would have increased the length of line several miles.

The structure is 2,300 ft. long, the maximum height above water level being 130 ft. It comprises 14 spans of 75 ft., 15 towers of 45 ft., with six 60 ft. spans and four 40 ft. towers at the ends. The foundations of the two abutments and end pedestals are on rock; the remaining pedestals are built upon pile foundations.

The structure is designed to Dominion Government Specification, 1908, Class heavy loading—that is, a capacity to safely carry two 180 ton locomotives, coupled together, easterly, in position Dec. 28, 1912.

The concrete substructure was built by J. A. Whalen, subcontractors Kennedy Construction Co., the total yardage being about 3,600 cu. yds. About 2,000 piles were used in the foundations. The steel superstructure was built by the Canadian Bridge Co., Walkerville. The weight of steel is about 5,000,000 lbs. The total cost was nearly $350,000.

The viaduct was designed under the supervision of W. P. Chapman, Bridge Engineer, Mackenzie, Mann and Co., Ltd.

Blende River Viaduct, Canadian Northern Ontario Railway.

Telephone Train Dispatching on the Intercolonial Ry.—F. P. Gutelius, General Manager, Canadian Government Railways, is reported to have stated recently, that a telephone dispatching system will be installed almost immediately on the St. John-Moncton section of the Intercolonial Ry., and that tenders have been asked for the necessary equipment. It is said that at the same time the automatic block signalling system will be installed.

Railway Lands Patented.—Letters patent were issued, during August, in respect of railway lands in Manitoba, Saskatchewan, Alberta and British Columbia, as follows:—

	Acres.
Canadian Northern Ry.	5.14
Grand Trunk Pacific Ry.	141.26
Qu'Appelle, Long Lake and Saskatchewan Rd. and Steamboat Co.	2,232.00
Total	2,378.40

October 1913

Electrification of the Mount Royal Tunnel, Canadian Northern Railway.

Work on this tunnel is progressing so rapidly that a contract has been let by the Canadian Northern Montreal Tunnel and Terminal Co. for the equipment for the electrification of the tunnel and approaches through the suburban district back of Montreal. The electric service will extend from the Montreal station through the tunnel to yards which will be built near the Riviere des Prairies, at the back of Montreal Island, where the trains will be changed from electric to steam traction, or vice versa. In addition to the operation of through trains through this district with electric locomotives, there are to be multiple unit trains for handling suburban traffic from Montreal to the new model city at the back of the mountain, which will be largely dependent on this service for rapid communication with the city. There will be storage yards in Mount Royal and freight yards at Cartierville at Riviere des Prairies.

The 2,400 volt d.c. system has been definitely decided on, and the order which has been placed with the Canadian General Electric Co., calls for 7 electric locomotives, 8 multiple unit motor cars, and complete substation apparatus to serve the electrified zone comprising 10 miles of double track. The locomotives will weigh 80 tons each, with all the weight on the drivers. They will be equipped with two four wheel trucks, articulated together, with four motors geared to the drivers through twin gears. The motors will be of the commutating pole type, wound for 1,200 volts and insulated for 2,400 volts, operating two in permanent series. The control will be multiple unit, series parallel, the current for the contractors being furnished by a motor generator set. The motors for the multiple unit four motor car equipments will be rated at 125 h.p., 1,200 volts each, and the control will be in general similar to that of the locomotives. The locomotive cabs will be divided into a main compartment for the control apparatus and two end compartments for the operator, these two being exactly alike, so that locomotives can be operated from either end. An overhead catenary trolley system, supported by steel bridges, will be used, the current being collected by a pantograph.

The substation is to be located at the west portal of the tunnel, where 3 phase, 60 cycle power at 11,000 volts will be delivered from outside sources, and converted to d.c. in motor generator sets. The motor generator set will consist of two d.c. generators on the same shaft and driven by a synchronous motor, and will be rated 1,500 k.w. at 2,400 volts, with a 5 minute overload capacity of 200%. The generators will be of the commutating pole type, each wound for 1,200 volts and insulated for 2,400 volts, in permanent series. The synchronous motor will be 2,100 k.w. at 11,000 volts. The station is to be designed for an ultimate capacity of 4,500 k.w., or three sets, only two of which it is intended to instal at present.

Railway Rolling Stock Notes.

The G.T.R. has received six Mikado type locomotives, 62 ins. wheel, nos. 544 to 549, from Baldwin Locomotive Works.

The Canadian Northern Ry. has ordered three snow ploughs (mentioned in our last issue), and 5 electrically lighted first class cars, from Canadian Car and Foundry Co.

The Pacific Great Eastern Ry., 404 Welton Building, Vancouver, B.C., advises us that it is about to purchase its rolling stock for the ensuing year, which will include several locomotives and about 200 freight cars.

The Dominion Coal Co. has ordered one consolidation locomotive from the Montreal Locomotive Works. The cylinders will be 21 by 26 ins., driving wheels 50 ins. diar., and the approximate total weight in working order, 179,000 lbs.

The Intercolonial Ry., between Sept. 18 and Oct. 15, received one box car, 60,000 lbs. capacity, from its Moncton Shops; 52 platform cars, 80,000 lbs. capacity, from Canadian Car and Foundry Co., and 147 box cars, 60,000 lbs. capacity, from Nova Scotia Car Works.

It was announced, Oct. 1, that 20, or about a half, of the locomotives which the C.P.R. is using between North Bend and Vancouver, B.C., have been remodelled so as to

November 1913

Nipigon Sub. Div.	Scadla	Pays Plat	15.0	7.0
	Gravel	Dubuc	51.0	5.0
Broadview Sub. Div.	Kamsay	Virden	29.0	43.5
Moose Jaw Sub. Div.	Indian Head	Regina	43.0	16.0
	Regina	Parqua	34.8	34.8
Swift Current Sub. Div.	Caron	Swift Current	64.5	64.3
Cascade Sub. Div.	Ruby Creek	Westminster Jct.	64.4	64.4
			449.9	451.9

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Work on this tunnel is progressing so rapidly that a contract has been let by the Canadian Northern Montreal Tunnel and Terminal Co. for the equipment for the electrification of the tunnel and approaches through the suburban district back of Montreal. The electric service will extend from the Montreal station through the tunnel to yards which will be built near the Riviere des Prairies, at the back of Montreal Island, where the trains will be changed from electric to steam traction, or vice versa. In addition to the operation of through trains through this district with electric locomotives, there are to be multiple unit trains for handling suburban traffic from Montreal to the new model city at the back of the mountain, which will be largely dependent on this service for rapid communication with the city. There will be storage yards in Mount Royal and freight yards at Cartierville at Riviere des Prairies.

The 2,400 volt d.c. system has been definitely decided on, and the order which has been placed with the Canadian General Electric Co., calls for 7 electric locomotives, 8 multiple unit motor cars, and complete substation apparatus to serve the electrified zone comprising 18 miles of double track. The locomotives will weigh 80 tons each, with all the weight on the drivers. They will be equipped with two four wheel trucks, articulated together, with four motors geared to the drivers through twin gears. The motors will be of the commutating pole type, wound for 1,200 volts and insulated for 2,400 volts, operating two in permanent series. The control will be multiple unit, series parallel, the current for the contactors being furnished by a motor generator set. The motors for the multiple unit four motor car equipments will be rated at 125 h.p., 1,200 volts each, and the control will be in general similar to that of the locomotives. The locomotive cabs will be divided into a main compartment for the control apparatus and two end compartments for the operator, these two being exactly alike, so that locomotives can be operated from either end. An overhead catenary trolley system, supported by steel bridges, will be used, the current being collected by a pantograph.

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It was announced, Oct. 1, that 20, or about a half, of the locomotives which the C.P.R. is using between North Bend and Vancouver, B.C., have been remodelled so as to [illegible] additions to rolling stock:—4 second class cars and 40 stock cars, from Crossen Car Co.; 52 box cars, from Nova Scotia Car Works; 90 box cars and 35 flat cars, from National Steel Car Co.; 2 combination cars, from Preston Car and Coach Co.; [illegible] sleeping cars, from Barney and Smith Co.; [illegible] consolidation locomotives, from Canadian Allis-Chalmers, Ltd.

The C.P.R., between Sept. 14 and Oct. 14, received the following additions to rolling stock:—127 wooden box cars, 25 steel frame box cars, 10 vans, 2 stores supply cars and 4 class V3 locomotives, from its Angus Shops; 540 steel frame box cars, 4 first class cars and 4 tourist cars, from Canadian Car and Foundry Co.; [illegible] class P1 locomotives, from Montreal Locomotive Works; 5 class D10 locomotives, from Canadian Locomotive Co.; 2 Jordan ballast spreaders, from F. H. Hopkins and Co., and 550 steel frame box cars, from Barney and Smith Co.

The gas electric car which, as announced in a recent issue, is being operated by the Victoria and Sidney Ry., on Vancouver Island, is stated to be giving complete satisfaction. The average daily mileage is given as 110 miles, and on two days in each week, a 30 ton trailer is hauled. The body of the car is mainly of steel. The motive power equipment consists of a [illegible] cylinder, 4-cycle gasoline engine with integral air pumps directly connected with the lighting generator, one [illegible] cycle main engine with low tension magneto and air starters, and two [illegible] volt, series, commutating pole traction motors mounted directly on the axles of forward truck with nose suspension; auxiliary lighting generator is of bipolar compound wound type and connected to the auxiliary engine. Following are the chief dimensions:—

Weight, total	[illegible]
Length, passenger compartment	[illegible]
Length, baggage compartment	[illegible]
Length, car	[illegible]
Centres, centre to centre trucks	[illegible]
Wheel base, truck	[illegible]
Wheel base, total	[illegible]

The Busiest Railway Terminal.—Although the Grand Central station, New York, is the largest, it is not the busiest terminal in America. Statistics for the year ended June 30 show the total number of passengers in and out of the Grand Central station was [illegible] 403,295, whereas for the same year the total for the South station at Boston was [illegible] 507. Of this total, 23,117,333 represented passengers of the New York, New Haven and Hartford Rd. lines, and [illegible] were passengers on the Boston and Albany.

Authorized by the Postmaster General for Canada, for transmission as second class matter, July 4, 1912. Entered as second class matter, July 24, 1913, at the Postoffice at Buffalo, N.Y., under the Act of Congress of March 3, 1879.

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NOTICE TO ADVERTISERS.

ADVERTISING RATES furnished on application.

ADVERTISING COPY must reach the publisher by the 10th of the month preceding the date of issue.

TORONTO, CANADA, NOVEMBER, 1913.

PRINCIPAL CONTENTS.

[illegible] vice. As the line is nearing completion, interest in the vast undeveloped country through which it runs, particularly in British Columbia, is increasing, and there is every prospect that the rapid settlement of the country will take place as soon as adequate transportation facilities are provided.

"Good progress is reported on the company's chain of hotels being built across the continent as an adjunct to its transportation business. It is expected that the Fort Garry hotel at Winnipeg will be completed, ready for opening, the end of November. The construction of the Qu'Appelle hotel, which was recently commenced in Regina, Sask., at a cost of $1,000,000, is making good progress. The Macdonald hotel, under construction at Edmonton, Alta., occupies one of the finest situations in the city, overlooking the Saskatchewan River and surrounding country for many miles. It is expected that it will be completed so that it may be opened within the next twelve months. Other hotels, of the most modern architecture and equipment, are projected for attractive resorts along the line in the Rocky Mountains, and the excavation for a large hotel at the terminal at Prince Rupert was also recently commenced.

"Traffic along the line is being carried in ever increasing volume each year, and there is every prospect that the prime object for which this vast undertaking is being executed will not be lacking at any period in the company's future history."

The directors for the current year are:—E. J. Chamberlin, President; W. Wainwright, M. M. Reynolds, Vice Presidents; A. W. Smithers, Sir Henry M. Jackson, J. A. Clutton Brock, Lord Welby, H. G. Kelley, W. H. Biggar, E. B. Greenshields, R. Dandurand, W. M. Macpherson, Hon. G. A. Cox, E. R. Wood, and J. R. Booth. The officers were re-elected.

Canadian Pacific Railway Electrification in British Columbia.

Sir Thos. G. Shaughnessy visited his birthplace, Milwaukee, Wis., on his way to Winnipeg recently, and one of the enterprising individuals who provide the daily press with fairy stories telegraphed a report which was published with big headlines, stating that Sir Thomas had announced that the company's experiments with electrification in British Columbia were only preliminary to the electrification of the entire system, should the experiment prove successful. Of course, the report telegraphed was an absolute invention by the press correspondent, and was not taken seriously by [illegible]

The 23rd annual convention was held at Montreal, Oct. 21-23, this being the second time the convention has taken place in Canada, the last time being at Quebec, ten years ago. The members were welcomed by the President, A. E. Killam, formerly Inspector of Bridges and Buildings, Intercolonial Ry., and W. McNab, Principal Assistant Engineer, G.T.R., and about 100 new members, chiefly Canadians, were elected. A number of reports were received and discussed, the one dealing with the association's finances, being especially satisfactory. The entertainments included a drive round Mount Royal, a trip to the Lachine Rapids, inspection of the two bridges crossing the St. Lawrence, and a visit to Ottawa by special train provided by the C.P.R.

Railway Route Maps Approved.

The Minister of Railways has approved railway route maps as follows:—

Alberta Central Ry.—Oct. 16.—Revision of line from Tp. 26, r. 22, w. 3 m., to Tp. 27, r. 25, w. 3 m., about 14 miles;

Canadian Northern Quebec Ry.—Oct. 10.—From St. Michel to Bout de l'Isle, about 5.25 miles;

Canadian Northern Ry.—Oct. 10.—Revision of line between Sturgis and Hudson Bay Jct., Man., 17.71 miles;

Canadian Pacific Ry.—Oct. 10.—Revision of Swift Current Northwesterly line near Empress, Sask., 23.2 miles;

Montreal and Southern Counties Ry.—Oct. 10.—From St. Cesaire to Granby, Que., about 14.5 miles.

Canadian Northern Ry. Organization.—Charles Hine, who recently resigned his position at Tucson, Arizona, as Vice President and General Manager of the Southern Pacific Rd. of Mexico, and of the Arizona Eastern Rd., two subsidiaries of the Southern Pacific Co., to take up expert railway work along organization and efficiency lines, with headquarters in New York, N.Y., has been retained by the Canadian Northern Ry. executive for a limited period to go over its system and make suggestions in regard to organization, etc. He has already been over the eastern lines and will now go over the western ones.

There are five possible methods for the abatement of smoke from locomotives: 1. The use of comparatively smokeless coals; 2. The use of air jets; 3. The use of mechanical stokers; 4. The instruction of the men operating the locomotives and the supervision of their work; and 5. The elimination of the steam locomotive.

Electric Locomotives for Mount Royal Tunnel, Canadian Northern Railway.

Some general information in regard to the principal electrification features of the Mount Royal Tunnel, Montreal, supplied by W. C. Lancaster, Electrical and Mechanical Engineer, Canadian Northern Montreal Tunnel and Terminal Co., was published in Canadian Railway and Marine World for November. The following fuller details in regard to the electric locomotives, six of which have been ordered, has since been received. As before stated they will be designed for an operating potential of 2,400 volts direct current, with vertical trolley construction. Two of them, operated and controlled as a single unit, will have ample capacity and suitable speed requirements for handling the heavy transcontinental pas-

Electric Locomotive of Similar Type to those ordered for Mount Royal Tunnel.

senger trains—1,180 tons trailing load—within the Montreal terminal zone. A single locomotive will successfully handle the freight trains—1,000 tons trailing—and the local passenger service—550 tons trailing.

The general type of locomotives to be used is that known as the box cab articulated running gear. The estimated weight of the complete locomotive is 83 tons. The locomotive will have four axles, with all of the weight of the locomotive upon the eight driving wheels, thus securing the maximum adhesive weight on drivers. The running gear will consist of two four wheel trucks, articulated together by a heavy hinge. The equalization of the trucks will be accomplished by a heavy locomotive type semi elliptic leaf spring, over each journal box, connected through spring hangers to the frame and to the equalizer bars. Practically a three point suspension the effect of severe shocks.

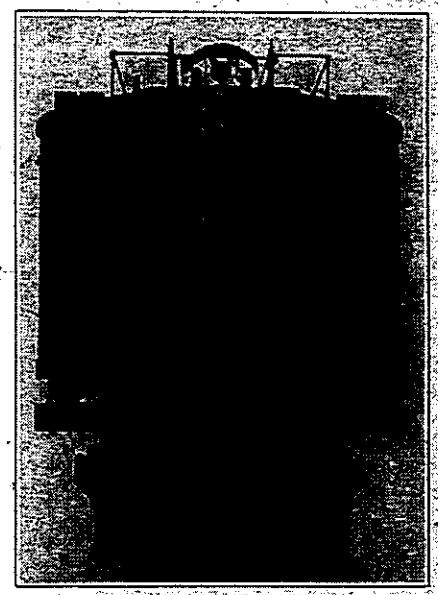
Both the box cab and platform will be built of plates, sheets, angles and heavy channels, and will be thoroughly reinforced throughout. The box cab will be divided into three compartments; the apparatus compartment in the centre and the two operators' compartments at the ends. Each operator's compartment will have a full complement of apparatus, consisting of controller, control switches, meter, air brake control apparatus, air gauges, pantagraph control and heaters, thus providing the locomotive with a complete double end control. All apparatus subject to 2,400 volt potential will be located in the centre apparatus compartment and screened to protect against accidental contact. The location and general arrangement of this apparatus will be such as to provide easy access from all sides for inspection, cleaning and repairs.

The Sprague-General Electric type M multiple unit double end control equipment is proposed for the locomotives, all the control points being proportioned and adjusted so as to secure a smooth and even acceleration, at all times, corresponding to a current consumption near the slipping point of the wheels. The transition between series and series-parallel will be effected by a special electro pneumatically operated changeover switch and the motor fields will always be on the ground side of the armature.

A motor generator set will supply 125 volt energy for the operation of the control and a 2,400 volt air compressor of 100 2,400 volts, so that two may be connected permanently in series and operated on a 2,400 volt circuit. These motors will be geared to the axles through twin gears, there being one pinion on each end of the armature shafts. These motors are especially designed for locomotive service and will be provided with forced ventilation by a blower located in the apparatus compartment. The locomotives will be geared for a free running speed on tangent, level track of approximately 45 miles an hour, and will be operated as two speed machines with ten points in series and nine points series parallel.

The air brake equipment will be the straight air and automatic type, so as to combine the desirable features for train operation through an equalizing reservoir and the independent operation of the brakes upon the locomotive. Provision will be made for the multiple operation of the compressors upon all locomotives when operating in multiple, so as to distribute the duty upon all the compressors in the train.

The motors will be operated in series and series-parallel by the Sprague-General Electric type M two speed control. The external regulating resistance will be divided into two parts, each part being directly connected to a pair of motors permanently connected in series. The two pairs of motors, with their resistances, will all be connected in series on the first point of the control, the resistance being varied through the first nine points on the controller and finally short circuited on the tenth, or running point. The two pairs of motors will then be similarly operated in series parallel and all resistances cut out on the last or full speed running point.



End View Electric Locomotive.

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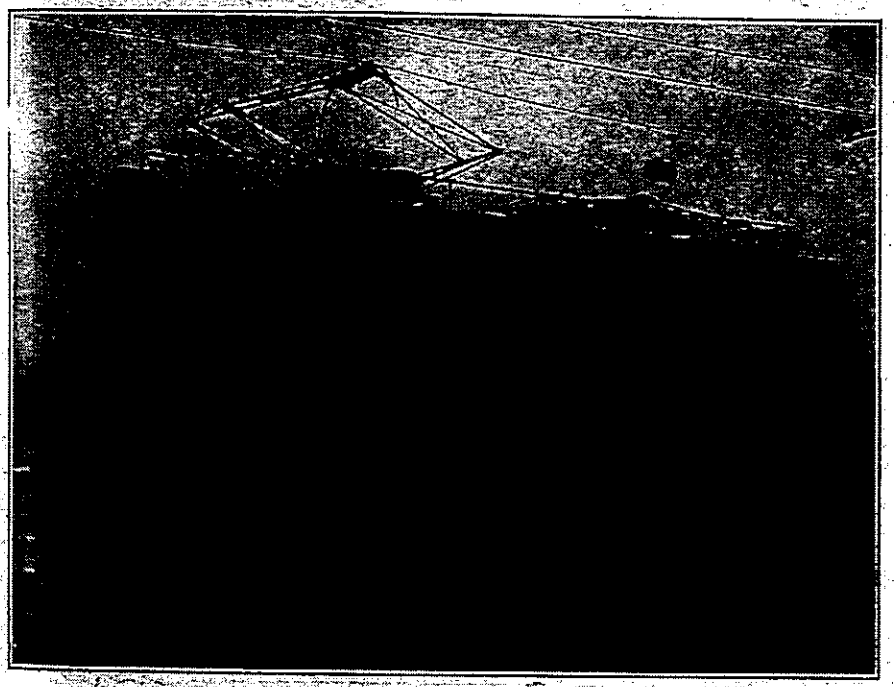

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A motor generator set will supply 125 volt energy for the operation of the control and a 2,400 volt air compressor of 100 cubic feet free air piston displacement will be provided as part of the air brake equipment. Two air operated roller pantagraphs and a properly insulated bus line will be located upon the roof. The bus line will supply power to two or more units from the pantagraphs of any of these units.

The motor equipment will consist of four G.E.C. 229 commutating pole type motors wound for 1,200 volts and insulated for

of approximately 45 miles an hour, and will be operated as two speed machines with ten points in series and nine points series parallel.

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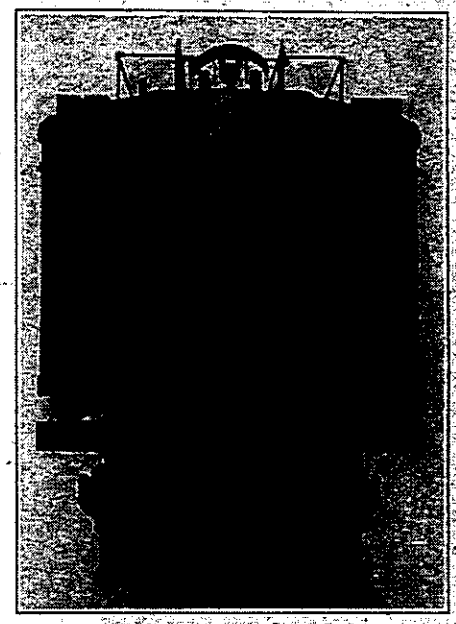

End View Electric Locomotive.

last or full speed running point.

A special electro pneumatically operated changeover switch will be used, to make the transition between series and series parallel so that there will be no appreciable reduction in tractive effort during the change. A smooth transition between all points, both rheostatic and transitional, will insure motor operation close to the slipping point of the wheels and a steady, gradual acceleration at all times.

The motors will have sufficient capacity to slip the wheels, the slipping point serving as a current limit to prevent overload-

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ing. Either pair of motors may be cut out, in case of emergency, by means of a special handle on the changeover switch.

The master controllers will receive their energising current at a potential of 125 volts from the motor generator set and provide for operating the contactors so that they will close the motor circuits under different combinations and regulate the external motor resistances to give 10 points series and 9 points parallel. The controller will be of the non automatic type and will have two handles; one regulating the applied voltage at the motors and the other for controlling the direction of rotation of the motors. Each of the above handles will control a single cylinder.

The overhead trolleys will be of the pantagraph type, mounted on insulated bases and pneumatically operated. A hand pump will be provided for raising the trolley in case a locomotive has been standing some time and has no air supply.

Provision will be made for automatically opening the control circuit and cutting off all power from the locomotive, in case the locomotive driver overruns a signal set against him. At the same time a special valve will be opened which will set the emergency air brake.

Following are the approximate general dimensions of the locomotives: Length inside of knuckles, 37 ft. 4 in.; length over cab, 31 ft.; height over cab, 12 ft. 10 ins.; height with trolley down, 15½ ft.; width over all, 10 ft.; total wheelbase, 26 ft.; rigid wheelbase, 8 ft. 8 ins.; track gauge, 4 ft 8½ ins.; minimum radius of curvature, 150 ft.

The locomotives, as well as the rest of the electrical equipment, have been ordered from the Canadian General Electric Co.

The illustrations on this page are of a locomotive built for the Butte, Anaconda and Pacific Ry., and we are advised that the ones for the Mount Royal Tunnel will be precisely similar.

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Canadian Northern Montreal Tunnel and Terminal Co.—It is expected that the boring of the Mount Royal tunnel will be completed Dec. 15. A contract for the electrification of the tunnel and the connecting lines has been let to the Canadian General Electric Co.

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Press reports state that considerable progress has been made with relaying track on the Duluth, Rainy Lake and Winnipeg Ry. from Virgina, Minn., to Rainy Lake, opposite Fort Frances, Ont., with 80 lb. steel.

company's legal department, and J. A. Foley, of the engineering staff, were in Medicine Hat, recently, completing the agreement with the city council. This is one of the lines, for the building of which the Alberta Legislature has guaranteed the company's bonds. The Vegreville-Calgary line, which has been in operation as far as Drumheller, is reported completed and ready for traffic as soon as the official inspections have been made.

The Board of Railway Commissioners has authorized the opening for traffic of the extension of the line from Macrorie to Tichfield, Sask., six miles, and of the branch from between those two points to Elrose, 50 miles.

Press reports state that track laying has been completed on the short line from Blaine Lake to Denholm, Sask., which will permit of the operating of traffic by a shorter route than at present from Prince Albert to Edmonton.

The Board of Railway Commissioners has approved of revised location of the line from Maryfield, Sask., westerly, from mileage 194.82 to 224.58. This line is projected to extend to Lethbridge, thence northerly to Calgary, Alta. Press reports from Lethbridge state that grading is in progress on the section of the line from Calgary southerly to Barons, at which point the line will part, one branch going to Macleod, and the other to Lethbridge.

The Alberta Legislature has increased the guarantee of bonds granted in 1909 for the building of certain branch lines from $13,000 to $15,000 a mile.

The Alberta Legislature has authorized the government to guarantee bonds of the Canadian Northern Western Ry. for $25,000 a mile, for a line from the point where the line crosses the Calgary and Edmonton Ry. near Blackfolds, for not exceeding 115 miles, on cancellation and delivering up of bonds of the same amount now outstanding.

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Montreal-Ottawa-Port Arthur Line.—Grading is reported completed from the western portal of the Montreal tunnel to the Back River, and it was reported, Nov. 20, that track laying was to be gone on with at once, in order that the steel may be transported for the bridges at that point. There are two channels of the Back River which are to be crossed, then the line crosses Isle Jesus, and then over another bridge to the mainland. The substructure for two of these bridges has been completed, and the last pier for the third one is being erected. On the mainland the grading and bridge work is completed as far as Carlton, at which point a large bridge is to be built over the Ottawa River to Portage du Fort. The substructure for this bridge is completed, and the superstructure will be put in place during the winter.

Canadian Northern Ontario Ry.—The line from Toronto to Ottawa, which has recently been completed, is 240 miles long. A freight service has been put in operation, but it is not intended to operate a passenger service until next summer. The company is now able to give connection through the C.N. Quebec Ry. at Hawkesbury, Ont., with Montreal, Quebec and Lake St. John.

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Work was begun, Nov. 8, on a new station at the corner of Provencher Ave. and Rue des Menrous, St. Boniface, Man. The building is to be of concrete and brick. Benoit and Co., St. Boniface, have the contract.

Notice has been given by the company that it intends to apply for an order to permit of the construction of a double track line along the route of the projected Fort Rouge cutoff at Winnipeg. The residents along the route held a meeting at South Fort Rouge, Nov. 12, to consider the question of applying to the Board of Railway Commissioners for an order directing that the cutoff be operated by electricity.

The line into Moose Jaw, Sask., has been completed, and a train service was put in operation from Rodville, Nov. 4. A temporary station has been opened on Home St., and it is reported that negotiations are in progress with the G.T. Pacific Ry. for the erection of a union station.

Track has been laid as far as Brieux, Sask., on the extension of the line from Melfort to Humboldt. It is expected that the line will be completed into Humboldt by the fall of 1914. Press reports state that on the completion of the extension additional terminal facilities will be laid out at Humboldt.

A through connection has been established between Saskatoon and Calgary, over the line which was opened for traffic, Nov. 9. The line had previously been opened for traffic to Alsask, but on Nov. 9 it was opened to Hanna, 93 miles, and subsequently to Munson, the junction with the Vegreville-Calgary line, 40 miles further. It is proposed to build a branch line from Hanna to Medicine Hat, and press reports state that a contract will be let for its construction during the winter. G. R. Clark, of the [illegible] from between those two points to [illegible] miles.

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Construction is being proceeded with on the branch line into the Brazeau River country. Owing to the large number of trestles to be erected it is not expected that track will be laid as far as the coal fields until Dec. 30.

The Board of Railway Commissioners has authorized the opening for freight traffic of the line from St. Albert, Alta., westerly, for 22 miles.

It was expected that track laying would be completed in Alberta, on the main line to Vancouver, by Nov. 20. West of the provincial boundary the line is known as the C.N. Pacific Ry., but the construction to the Alberta summit is being carried on under the supervision of the company's staff working westerly. Eighty miles of grading have been completed beyond the summit, and it is expected that track will be laid on this mileage by the end of the year. Beyond this point to the Alberta summit, grading and bridge work is reported to be well advanced.

Canadian Northern Pacific Ry.—A regular train service has been inaugurated between Port Mann and Hope, B.C., passengers and freight being carried. The bridge over the Stoyama Creek, opposite North Bend, is reported completed. The structure is 750 ft. long and consists of seven spans, on steel towers, built on concrete pedestals. Five small steel bridges have been completed over gullies as far as Nine Mile Creek, mileage 128.5 from Port Mann, to which track has now been laid. At this point a 300 ft. viaduct resting on three steel towers will be built, the material for which is being delivered. Grading has been practically completed to Kamloops, and track laying is being pushed ahead as fast as possible. At Kamloops, a branch line is projected to Vernon. The location for this line, we are officially advised, has been com-

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pleted, and everything is ready for construction, but tenders have not yet been invited. Grading has been completed to about 108 miles westerly from Kamloops, and 26 miles of track has been laid.

Vancouver Island Lines.—The Premier of British Columbia is reported to have stated, Nov. 10, that track had been laid for the greater part of the 140 miles from Victoria to Port Alberni, and the line would be completed by the end of next summer.

Plans for the bridge across the Selkirk water, connecting the terminals on the Songhees Reserve to the gully under the gorge bridge, have been filed. They show a bridge of the bascule type, at a height of 23 ft. above extreme low water. There will be two openings in the bridge, 60 ft. and 26 ft., respectively, to permit of the passage of small vessels.

Survey parties are reported to be in the field in the districts north of Alberni Canal, and also north of North Sound, locating a line from Port Alberni to the extreme north of the island. (Oct., pg. 478.)

Grading and Track Laying in 1913.—We have been favored with the following official particulars of grading and track laying done in Manitoba, Saskatchewan and Alberta. The figures for grading are up to Sept. 30, and for tracklaying up to Oct. 31. A great deal of the track laid this year is on grading done in 1912. The figures represent miles:—

Delisle Jct., westerly, graded this year, 13.80; track laid on 1912 grade, 31.48.

Delisle, southerly, track laid on 1912 grade, 5.61.

Bienfait-Estevan, graded this year, 8.10.

Blackfalls, westerly, graded this year, 24.70; track laid on 1912 grade, 32.55.

Camrose, southeast, graded this year, 44.60.

Edmonton to Yellowhead, main line, graded this year, 33.40; track laid on 1912 grade 111.51, on 1913 grade 13.40, total 124.91.

Deerfield Spur, track laid on 1912 grade, 12.50.

Canora, north, graded this year, 1.90.

Greenway extension, graded this year, 2.94, track laid on 1912 grade 12.25, on 1913 grade 3.08, total 15.33.

Grosse Isle, northierly, graded this year, 13.40; track laid on 1912 grade, 7.62.

Moose Jaw, southerly, track laid on 1912 grade, 1.

Oakland, northerly, track laid on 1912 grade, 11.48.

Onaway, northwest, graded this year, 6; track laid on 1912 grade, 30.40.

Prince Albert-Battleford, graded this year, 1.15; track laid on 1912 grade, 46.

Avonlea, westerly, graded this year, 7.15; track laid on 1912 grade, 48.70, on 1913 grade, 7.15, total, 55.85.

Saskatoon-Calgary, track laid on 1912 grade, 25.92.

Vegreville-Calgary, track laid on 1912 grade, 12.64.

Vonda, north, graded this year, 8.20.

Winnipeg-Fort Alexander, graded this year, 7.40.

Wroxton-Yorkton, graded this year, 2.

The total grading done this year to Sept 30 was 174.74; track laid on 1912 grade, 389.66; on 1913 grade, 23.63; total track laid to Oct. 30, 413.29.

Railway Mechanical Conventions.—The Master Car Builders Association and the

December 1913

pleted, and everything is ready for construction. No tenders have yet been invited. When the line is completed to about 100 miles westerly from Kamloops, and 85 miles of track has been laid.

Vancouver Island Lines.—The Premier of British Columbia is reported to have stated, Nov. 19, that track had been laid for the greater part of the 140 miles from Victoria to Port Alberni, and the line would be completed by the end of next summer.

Plans for the bridge across the Selkirk water, connecting the terminals on the Songhees Reserve to the gully under the gorge bridge, have been filed. They show a bridge of the bascule type, at a height of 23 ft. above extreme low water. There will be two openings in the bridge, 60 ft. and 25 ft., respectively, to permit of the passage of small vessels.

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Canadian Northern Railway Construction, Betterments, Etc.

James Bay and Eastern Ry.—The first section of this railway is under construction from Roberval, Que., the northerly terminus of the Quebec and Lake St. John Ry., 90 miles northerly. We are officially advised that grading upon this is well advanced. J. P. Mullarkey, Montreal, is the contractor, and A. F. Stewart, Chief Engineer of Construction, Mackenzie, Mann & Co., Ltd., is in charge of the work.

Canadian Northern Quebec Ry.—The extensions and branch lines located, but not yet finally passed for construction, are:—Huberdeau, Argenteuil county, Que., to St. Remi, 11 miles, and from Rawdon to St. Donat, 49 miles. These lines are projected for the purpose of opening up new territory lying between the old Great Northern Ry. and the old Montford Colonization Ry., both of which are now part of the C.N.Q.R. Another charter also amalgamated with the C.N.Q.R. is the Quebec, New Brunswick and Nova Scotia Ry., under which it is proposed to build a line from Quebec Bridge to Woodstock, N.B.

Canadian Northern Montreal Tunnel and Terminal Co.—The headings of the tunnel being driven under Mount Royal to give the C.N.R. an entrance into Montreal were joined on Dec. 10. The heading is 8 by 12 ft., and the work of enlargement to 22 by 30 ft. is being gone on with.

Plans have been filed in Montreal showing a revision of the location of the line to connect the tunnel with the St. Lawrence water front. These have been approved by the Board of Railway Commissioners.

The Central Ontario Ry. is asking the Dominion Parliament for an extension of time within which to complete the line from its present northerly terminus to a junction with the C.P.R. at some point between Sudbury Jct. and Callander station, Ont.

Canadian Northern Ontario Ry.—A mixed freight and passenger service has been put in operation on the Ottawa-Sydenham section of the Ottawa-Toronto line which has recently been completed. A regular freight and passenger service has been operated for some time between Toronto and Sydenham, and these services will be run through to Ottawa early in the spring.

The Board of Railway Commissioners has authorized the opening for traffic of the branch from Oshawa station to the [illegible] yard south of William St., 2.75 miles, and the building of a transfer track between the C.N.O.R. Oshawa spur and the Oshawa Ry.

Montreal-Ottawa-Port Arthur Line.—Track was laid during 1913 on 136 miles of this line, distributed as follows:—Between Montreal and Hawkesbury, Ont., 18 miles; between Ottawa and Capreol, Ont., [illegible] miles; between [illegible] and Port Arthur, [illegible] miles. The line is being built under special guarantees by the Dominion Government, under the charter of the Canadian Northern Ontario Ry. Ballasting and other work are reported well forward from [illegible] west. [illegible] is also reported to be completed up to [illegible] from Port Arthur, and [illegible] [illegible]

[illegible] of the statutes of 1909, and in chap. 8 of the statutes of 1912. Sec. 6 of the present act authorizes the Government to guarantee the bonds for any surplus mileage on the lines mentioned in the original acts over the mileage specifically guaranteed at $13,000 a mile, or in the event of there being a shortage of mileage the Government may authorize the application of the surplus of guaranteed bonds to be used in respect to the construction of other lines to be built.

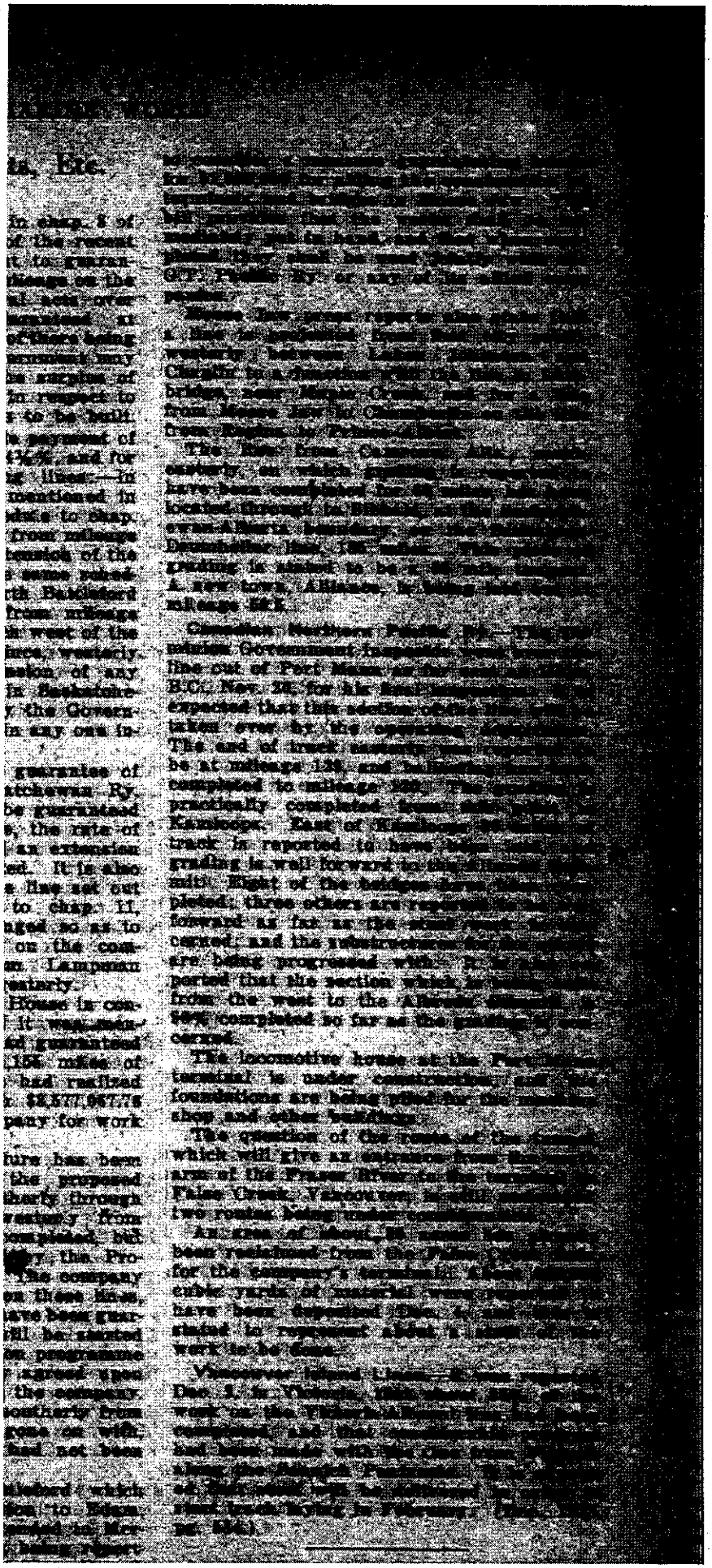
A second act provides for the payment of interest on these securities at [illegible] and for the building of the following lines:—In further extension of the line mentioned in par. 1, second part of the schedule to chap. 5, statutes of 1908-09, westerly from mileage 215 for 50 miles; in further extension of the line mentioned in par. 2 of the same schedule from mileage 50 from North Battleford northwesterly for 25 miles; from mileage 100, on the Thunder Hill branch west of the eastern boundary of the Province, westerly for 40 miles, and any extension of any lines authorized to be built in Saskatchewan, as may be designated by the Government, not to exceed 40 miles in any one instance.

A third act deals with the guarantee of the bonds of the C.N. Saskatchewan Ry. The amount of the bonds to be guaranteed is increased to $15,000 a mile, the rate of interest is fixed at 4½%, and an extension of time for construction granted. It is also provided that the route of the line set out in par. 5 of the schedule to chap. 11, statutes of 1912, may be changed so as to be routed from Handsworth on the company's authorized line from Lampman northerly, westerly or northwesterly.

In a statement made to the House in connection with these measures it was mentioned that the Government had guaranteed bonds for the building of 1,[illegible] miles of line. The sale of the bonds had realized so far $[illegible], of which $[illegible] had been released to the company for work done.

The Saskatchewan Legislature has been informed that surveys for the proposed branches from Lampman northerly through the territory lying north westerly from Moose Mountain have been completed, but have not yet been approved by the Provincial Minister of Railways. The company has agreed that construction on these lines, the bonds for building which have been guaranteed by the Legislature, will be started early in 1914. The construction programme for 1914 had not been finally agreed upon between the Government and the company. The extension of the branch northerly from [illegible] would probably be gone on with, but the final location plans had not been approved.

The line from North Battleford which has [illegible] [illegible]



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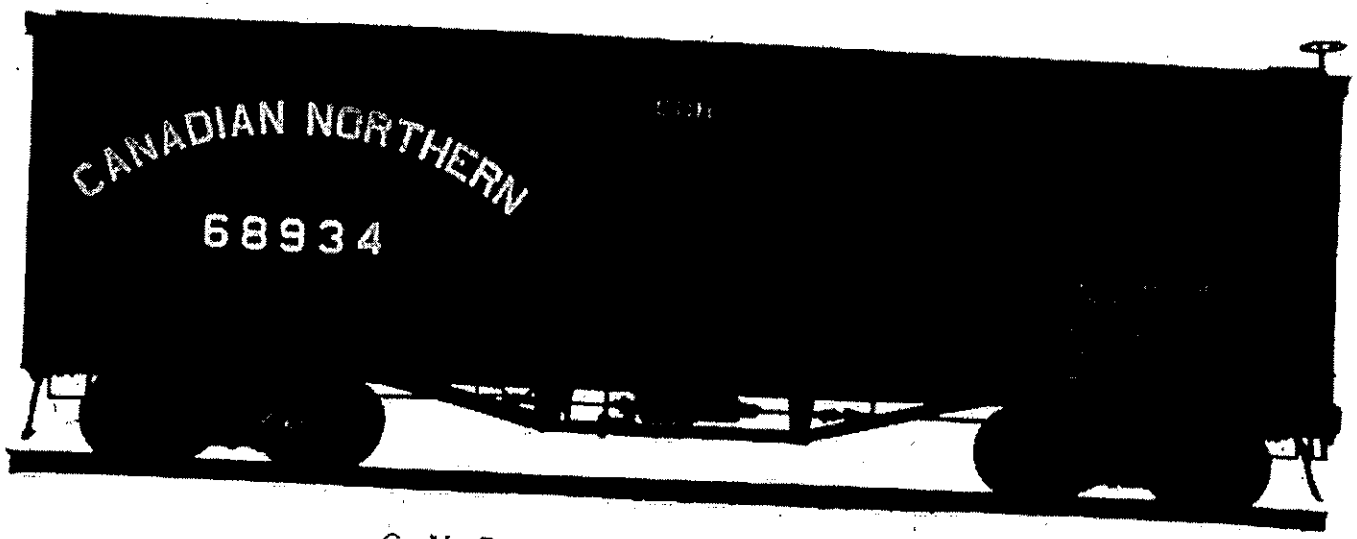

C. N. R. 30 Ton All Wood Box Car


CANADIAN NORTHERN
16234
REFRIGERATOR

Canadian Northern Railway Construction, Betterments, Etc.

Mount Royal Tunnel and Terminal Co.—Supplemental letters patent were granted to the Canadian Northern Montreal Tunnel and Terminal Co., Jan. 10, changing the name of the company to the Mount Royal Tunnel and Terminal Co.

The Quebec Court of Appeal, Jan. 11, decided that the owners of property under which the tunnel is being constructed may bring actions for damages to property other than those which are taken cognizance of by the arbitrators dealing with the question of price. The original action was brought by the owner of a property at the corner of Bellingham and Maplewood Avenues, the sum claimed being $9,000. The company claimed that the whole amount of the damage should be estimated by the arbitrators. This exception was dismissed in the lower court, and the judgment is now upheld on appeal.

The Board of Railway Commissioners has reserved judgment on the application of the company to expropriate the whole of the Rainville property, including a small strip not included in the original application. The company subsequently took only an easement for the tunnel, but the owner claimed damages to the property. The company said the property might be useful for station purposes in the future.

Canadian Northern Ontario Ry.—A through fast freight service was inaugurated between Toronto, Ottawa, Montreal and Quebec, Jan. 8, over the Toronto-Ottawa line, the last section of which was recently completed; thence over the old Great Northern Ry. and the old Chateauguay and Northern Ry. into Montreal, and over the old Great Northern Ry. to Quebec. A regular train service is operated from Toronto to Sydenham, Ont., and a limited service from Sydenham into Ottawa.

A bylaw will shortly be submitted to the ratepayers of St. Catharines, Ont., providing for a bonus of $100,000 to aid in building the company's Toronto-Niagara line through that city. The agreement provides for the completion of the line from Hamilton to St. Catharines within three years, and its completion from Toronto to Niagara in five years.

Montreal-Ottawa-Port Arthur Line.—Track laying has been completed easterly from Capreol to North Bay, Ont., and construction trains are being operated over it. Track has also been laid to between 50 and 60 miles east of North Bay. Out of Ottawa, track is laid nearly to Pembroke.

The last spike on the section of this line terminating in Port Arthur, Ont., was driven near Little White Otter River, 254 miles east of Port Arthur, Jan. 1, by Sir William Mackenzie, who, accompanied by an official party, left Toronto by a special train and travelled over the line via Parry Sound to Capreol, which is the point at which the Montreal-Ottawa-Port Arthur line connects with the line from Toronto; thence to Ruel, where present permanent operation ceases, and then over the newly completed line to the point where the track laying was completed on New Year's morning. The journey was then resumed and the special ran on to Port Arthur, which was reached at midnight. The party was entertained at dinner immediately afterwards, and speeches were delivered by the Mayor of Port Arthur, Sir William Mackenzie, President; Sir Donald Mann, Vice President; D. B. Hanna, Third Vice President, and others.

The building of this section of the line was entrusted to Foley, Welch and Stewart and the Northern Construction Co., in 1911, under the terms of a special agreement with the Dominion Government. Actual construction work started early in 1912. The line has a gradient of 0.4%, with an almost perfect alignment, the final location being made over a period of four years by H. K. Wicksteed, Chief Engineer of Surveys.

Work has been suspended on the line for the winter, but it is expected that ballasting gangs will be put on in the spring in order to get the line in running condition by the fall. One lift of ballast has already been put on. Station buildings have been completed to mileage 183 out of Port Arthur.

Canadian Northern Ry.—The Board of Railway Commissioners has authorized the opening for traffic of the revised line across Rainy Lake, Ont., mileage 224.3 to 226.4.

The Lieut.-Governor of Manitoba, in his speech at the opening of the Provincial Legislature, referring to the building of the railway to Hudson Bay by the Dominion Government said:—"It is the fixed policy of my Government to extend the Oak Point line northward to intersect the same in such time as will guarantee our ability to take advantage, when the main line of the railway is ready for operation, of this through route to the markets of the world for the products of the farms of Manitoba. My Government believe that the opening of such a through route will prove of great benefit to the agriculturists of this Province." This line is being built by the C.N.R. and is in operation from Winnipeg to Gypsumville, 162 miles.

The Board of Railway Commissioners has authorized the opening for traffic of the extension of the Oakland Branch from mileage 24, for a further distance of 12 miles.

The C.N.R. is carrying on its construction work in Manitoba, Saskatchewan and Alberta, not only under its own charter, but also under the charters of the Canadian Northern Saskatchewan Ry., the Canadian Northern Western Ry., and the Canadian Northern Alberta Ry. The construction work done under the charters of these companies for 1913 is as follows:—

Grading was done on 23 lines and track laying on 19 lines. The main line out of Edmonton is being built under the Canadian Northern Alberta Ry. charter, and on this 34.28 miles of grading were done, and 143.36 miles of track laid to the provincial boundary. A 5 mile spur, known as Huffs spur, was also laid.

The work done on the various branch lines, arranged according to provinces, is as follows:—

	Grading. Miles.	Track laid. Miles.
C.N. Ry.	107.37	271.72
C.N. Sask. Ry.	4.00	—
C.N. Western Ry.	87.54	74.53
C.N. Alberta Ry.	34.28	148.31
Total	733.19	494.56
	Miles graded.	Miles track laid.
Manitoba—		
Winnipeg cut off	3.98	3.34
Winnipeg & Northern Ry.	7.45	—
Deerfield (Oak Point line)	12.50	12.50
Greenway extension	2.94	15.33
Oakland extension	—	11.69
Grosse Isle extension	14.28	22.80
	41.15	65.66
Saskatchewan—		
Bienfait to Estevan	8.20	—
Canora northerly	1.90	—
Goose Lake branch	—	25.78
Jackfish line	—	17.10
Macrorie east	2.26	8.59
Macrorie west	34.83	31.57
Moose Jaw line	0.30	1.85
Prince Albert-Battleford line	1.15	51.05
Swift Current line	7.10	55.85
Vonda, northerly	8.20	—
Wroxton, westerly	4.00	—
	67.94	192.69
Alberta—		
Vegreville-Calgary line	0.23	13.20
Calgary, southerly	1.60	—
Strathcona-Camrose	0.45	0.17
Brazeau line	36.77	42.60
Camrose south east	33.43	—
Peace River line	6.50	30.65
Strathcona-Calgary line	0.30	1.28
Red Deer spur	0.52	—
Main line	34.28	148.31
	124.10	236.21
Total for three provinces	213.19	494.56

The three measures with respect to the guaranteeing of the company's bond issues by the Province of Saskatchewan mentioned in our last issue, have received final assent. The question of the construction programme for the year, under these acts, is now under consideration by the government.

Canadian Northern Pacific Ry.—The C.N. Ry. construction department at Winnipeg is supervising the Canadian Northern Pacific Ry. construction from the Alberta-British Columbia boundary to the Albreda Summit.

During 1913 grading was completed for 67.8 miles westerly from the provincial boundary, and 6.07 miles of track laid.

The remainder of the line in British Columbia is being built under the Vancouver construction department, T. H. White being Chief Engineer. Track was laid from Sumas to Hope, 41.75 miles, in 1912, and during 1913 an additional 206 miles of track was laid. Of this 12 miles was on the branch from New Westminster to Steveston, leaving 194 miles of track laid on the main line. Track has been laid from Hope to Cisco, 62 miles, and nine miles between the steel bridges under construction between Cisco and Kamloops; for 123 miles from Kamloops to Cottonwood. The distance from Cisco to Kamloops is 103 miles, and from Cottonwood to Yellowhead Pass is 134 miles. The company has under survey a line from Kamloops to Kelowna and Shuswap Falls, 141 miles, and a line from Westminster bridge to Lulu Island bridge, five miles.

Considerable progress is being made with the construction of the terminals at Port Mann. It is expected that the locomotive house will be completed early in February.

Sir Donald Mann, Vice President, arrived in Vancouver, Jan. 5, when he is reported to have said that the company's line would enter Vancouver by a tunnel three miles long, the exact location of which had not been settled. (Jan., pg. 29.)

Dominion Railway Subsidy Agreements.

The Dominion Government has entered into agreements under the act granting aid in the construction of railways, for the following lines:—

Canadian Pacific Ry., Jan. 8, for railway bridge over the Saskatchewan River, at Outlook, Sask. This bridge has been built and opened for traffic. It was fully described and illustrated in Canadian Railway and Marine World, June, 1913.

Kettle Valley Ry., Dec. 16, 1913, for a line from Merritt to Penticton wharf, B.C., 145 miles, and for a line from a point on the line between Merritt and Penticton wharf, about 25 miles south of Merritt, to a point on the Fraser River, near Hope station, B.C., 55 miles.

Kootenay Central Ry., Dec. 15, 1913, for a line from Golden, via Windermere and Fort Steele, B.C., to a point on the British Columbia Southern Ry., at or near Jukeson, 175 miles.

Locomotive Design.—The present tendency is to use larger cylinders, maintaining former steam pressures. The first step in this direction was to use larger cylinders with decreased steam pressure, but it has since been found advisable to maintain the pressure as before.

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said the property might be useful for station purposes in the future.

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C.N. Western Ry.	87.54	74.53
C.N. Alberta Ry.	34.28	148.31
Total	233.19	494.56
	Miles graded.	Miles track laid.
Manitoba—		
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Winnipeg & Northern Ry.	7.45	—
Deerfield (Oak Point line)	12.50	12.50
Greenway extension	2.94	15.33
Oakland extension	—	11.69
Grosse Isle extension	14.28	22.80
	41.15	65.66
Saskatchewan—		
Bienfait to Estevan	8.20	—
Canora northerly	1.90	—
Goose Lake branch	—	25.78
Jackfish line	—	17.10
Macrorie east	2.26	8.59
Macrorie west	34.83	31.57
Moose Jaw line	0.30	1.85
Prince Albert-Battleford line	1.15	51.95
Swift Current line	7.10	55.85
Vonda, northerly	8.20	—
Wroxton, westerly	4.00	—
	67.94	192.69
Alberta—		
Vegreville-Calgary line	0.23	13.20

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Canadian Northern Railway Construction, Betterments, Etc.

Canadian Northern Montreal Tunnel and Terminal Co.—It is expected that the boring of the Mount Royal tunnel will be completed Dec. 15. A contract for the electrification of the tunnel and the connecting lines has been let to the Canadian General Electric Co.

Press reports state that plans for the station on Dorchester St. are being prepared by Warren and Wetmore, New York.

J. P. Mullarkey, who is building a section of the line westerly from Rideau Jct., is reported to have stated, Nov. 17, that he expected to have his contract completed by the end of 1914. The Board of Railway Commissioners has authorized the making of a connection with the C.P.R. at Pembroke, Ont., in order to get in construction material. Tracklaying is being gone on with easterly from Pembroke, and it is expected to lay 35 miles this year. Sir Donald Mann, in an interview Nov. 10, is reported to have stated there were about 60 miles of track to be laid to complete the line from Port Arthur to Ruel, 545 miles. It is expected to have this laid by the end of the year.

Montreal-Ottawa-Port Arthur Line.—Grading is reported completed from the western portal of the Montreal tunnel to the Back River, and it was reported, Nov. 20, that track laying was to be gone on with at once, in order that the steel may be transported for the bridges at that point. There are two channels of the Back River which are to be crossed, then the line crosses Isle Jesus, and then over another bridge to the mainland. The substructure for two of these bridges has been completed, and the last pier for the third one is being erected. On the mainland the grading and bridge work is completed as far as Carlton, at which point a large bridge is to be built over the Ottawa River to Portage du Fort. The substructure for this bridge is completed, and the superstructure will be put in place during the winter.

Canadian Northern Ontario Ry.—The line from Toronto to Ottawa, which has recently been completed, is 240 miles long. A freight service has been put in operation, but it is not intended to operate a passenger service until next summer. The company is now able to give connection through the C.N. Quebec Ry. at Hawkesbury, Ont., with Montreal, Quebec and Lake St. John.

The Board of Railway Commissioners has approved of revised location through York Tp. and part of the city of Toronto, mileage [illegible] to York, Yonge St.

Canadian Northern Ry.—In connection with press reports to the effect that the company proposed to erect a car repairing plant at Port Arthur, Ont., at a cost of $30,000, we are officially advised that it is not contemplated to do so.

It was reported in Port Arthur, Nov. 10, that the company has for some time past had some gangs of men at work on the section of the old Port Arthur and Duluth Ry., from Stanley to the International boundary. A large number of new ties are said to have been put in; a lot of additional ballast distributed, and several new station buildings erected.

Press reports state that considerable progress has been made with relaying track on the Duluth, Rainy Lake and Winnipeg Ry. from Virgina, Minn., to Rainy Lake, opposite Fort Frances, Ont., with 80 lb. steel.

Work was begun, Nov. 8, on a new station at the corner of Provencher Ave. and Rue des Menrous, St. Boniface, Man. The building is to be of concrete and brick. Benoit and Co., St. Boniface, have the contract.

Notice has been given by the company that it intends to apply for an order to permit of the construction of a double track line along the route of the projected Fort Rouge cutoff at Winnipeg. The residents along the route held a meeting at South Fort Rouge, Nov. 12, to consider the question of applying to the Board of Railway Commissioners for an order directing that the cutoff be operated by electricity.

The line into Moose Jaw, Sask., has been completed, and a train service was put in operation from Rodville, Nov. 4. A temporary station has been opened on Home St., and it is reported that negotiations are in progress with the G.T. Pacific Ry. for the erection of a union station.

Track has been laid as far as Brieux, Sask., on the extension of the line from Melfort to Humboldt. It is expected that the line will be completed into Humboldt by the fall of 1914. Press reports state that on the completion of the extension additional terminal facilities will be laid out at Humboldt.

A through connection has been established between Saskatoon and Calgary, over the line which was opened for traffic, Nov. 9. The line had previously been opened for traffic to Alsask, but on Nov. 9 it was opened to Hanna, 93 miles, and subsequently to Munson, the junction with the Vegreville-Calgary line, 40 miles further. It is proposed to build a branch line from Hanna to Medicine Hat, and press reports state that a contract will be let for its construction during the winter. C. R. Clark, of the

December 1913

Canadian Northern Railway Construction, [illegible]

James Bay and Hudson Ry.—The first section of this railway is under construction from [illegible], Que., the northerly terminus of the Quebec and Lake St. John Ry., 50 miles northerly. We are officially advised that grading upon this is well advanced. J. P. Mullarkey, Montreal, is the contractor, and A. F. Stewart, Chief Engineer of Construction, Mackenzie, Mann & Co., Ltd., is in charge of the work.

Canadian Northern Quebec Ry.—The extensions and branch lines located, but not yet finally passed for construction, are:— [illegible] Argenteuil county, Que., to St. [illegible], 11 miles, and from Rawdon to St. Donat, 40 miles. These lines are projected for the purpose of opening up new territory lying between the old Great Northern Ry. and the old Montfort Colonization Ry., both of which are now part of the C.N.Q.R. Another charter also amalgamated with the C.N.Q.R. is the Quebec, New Brunswick and Nova Scotia Ry., under which it is proposed to build a line from Quebec Bridge to Woodstock, N.B.

Canadian Northern Montreal Tunnel and Terminal Co.—The headings of the tunnel being driven under Mount Royal to give the C.N.R. an entrance into Montreal were joined on Dec. 16. The heading is [illegible] by 12 ft., and the work of enlargement to [illegible] by 30 ft. is being gone on with.

Plans have been filed in Montreal showing a revision of the location of the line to connect the tunnel with the St. Lawrence water front. These have been approved by the Board of Railway Commissioners.

The Central Ontario Ry. is asking the Dominion Parliament for an extension of time within which to complete the line from its present northerly terminus to a junction with the C.P.R. at some point between Sudbury Jct. and Callander station, Ont.

Canadian Northern Ontario Ry.—A mixed freight and passenger service has been put in operation on the Ottawa-Sydenham section of the Ottawa-Toronto line which has recently been completed. A regular freight and passenger service has been operated for some time between Toronto and [illegible], and these services will be run through to Ottawa early in the spring.

The Board of Railway Commissioners has authorized the opening for traffic of the branch from Oshawa Station to [illegible] south of [illegible] St., 2.75 miles, and the building of a [illegible] track between the C.N.O.R. Oshawa spur and the G.T.R. [illegible]

[illegible]

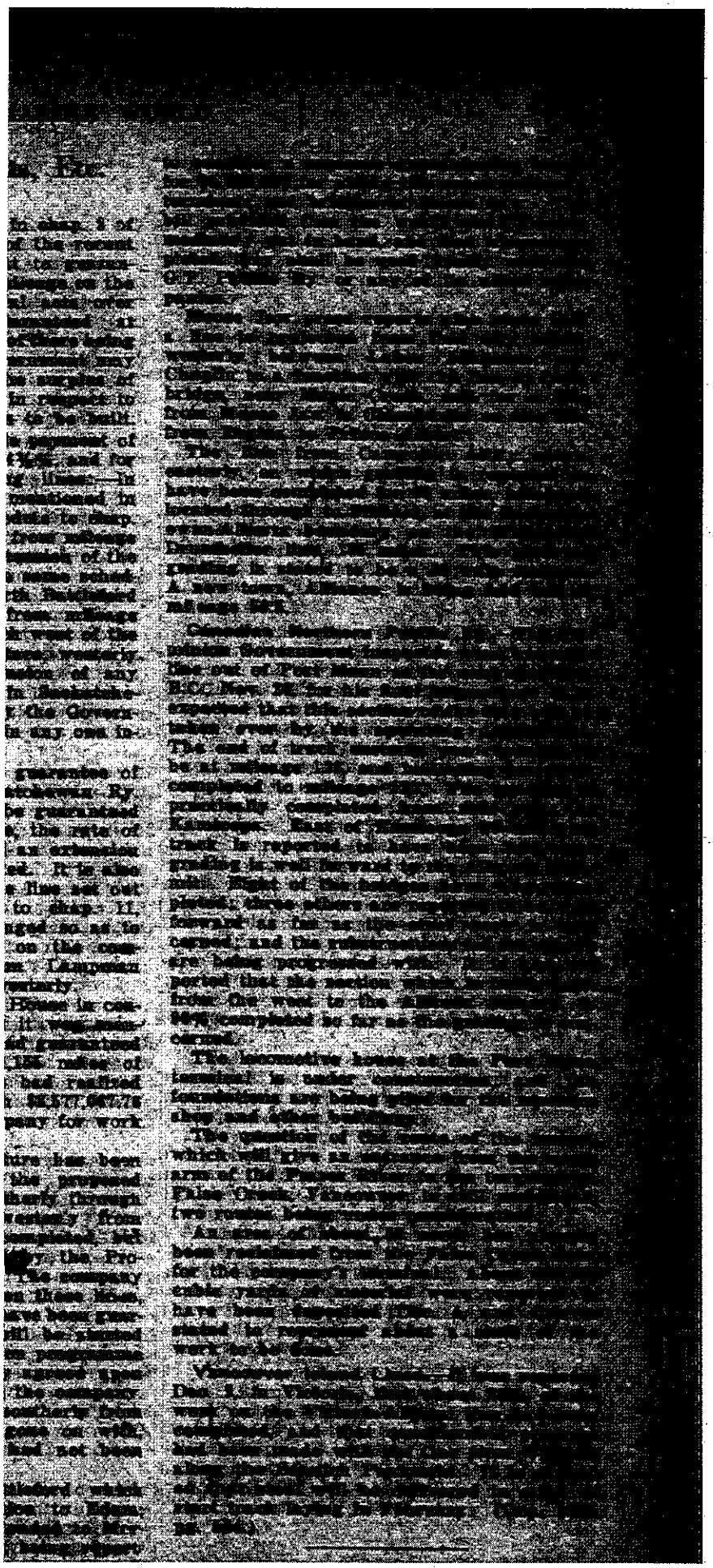
[illegible]

A third act deals with the guarantee of the bonds of the C.N. Saskatchewan Ry. The amount of the bonds to be guaranteed is increased to $[illegible] a mile, the rate of interest is fixed at [illegible], and an extension of time for construction granted. It is also provided that the route of the line set out in par. 5 of the schedule to chap. 11, statutes of 1911, may be changed so as to be routed from [illegible] on the company's authorized line from [illegible] northerly, westerly or northwesterly.

In a statement made in the House in connection with these measures, it was mentioned that the Government had guaranteed bonds for the building of [illegible] miles of line. The sale of the bonds had realized so far $[illegible], of which $[illegible] had been released to the company for work done.

The Saskatchewan Legislature has been informed [illegible]

January 1914



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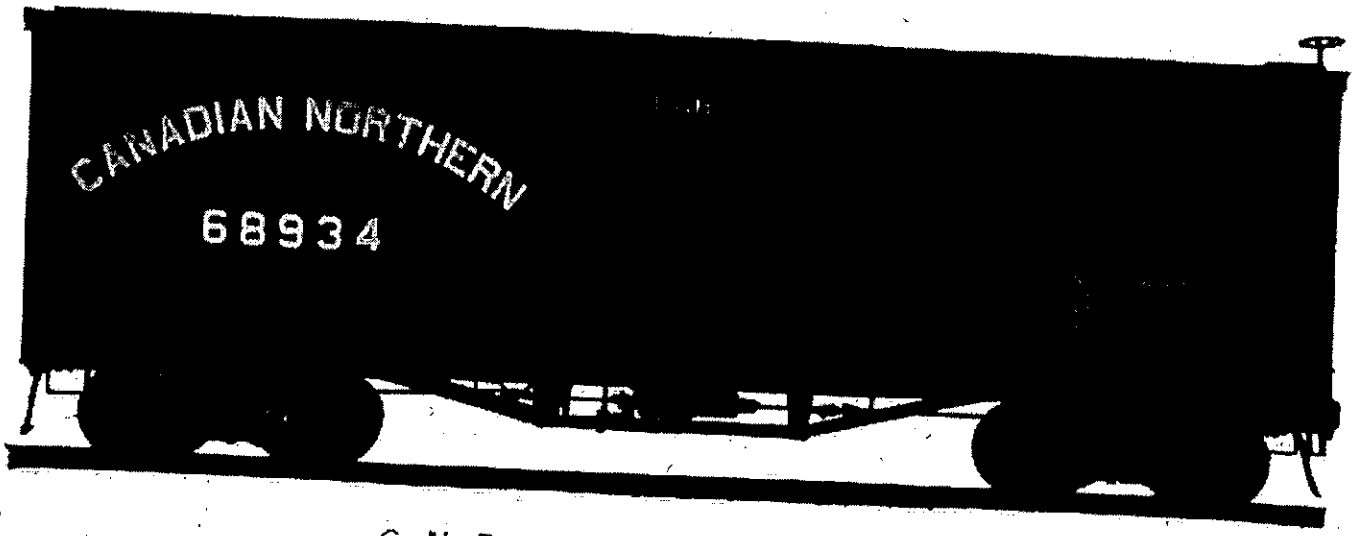

C. N. R. 30 Ton All Wood Box Car

Canadian Northern Railway Construction, Betterments, Etc.

Mount Royal Tunnel and Terminal Co.—Supplemental letters patent were granted to the Canadian Northern Montreal Tunnel and Terminal Co., Jan. 10, changing the name of the company to the Mount Royal Tunnel and Terminal Co.

The Quebec Court of Appeal, Jan. 11, decided that the owners of property under which the tunnel is being constructed may bring actions for damages to property other than those which are taken cognizance of by the arbitrators dealing with the question of price. The original action was brought by the owner of a property at the corner of Bellingham and Maplewood Avenues, the sum claimed being $9,000. The company claimed that the whole amount of the damage should be estimated by the arbitrators. This exception was dismissed in the lower court, and the judgment is now upheld on appeal.

The Board of Railway Commissioners has reserved judgment on the application of the company to expropriate the whole of the Rainville property, including a small strip not included in the original application. The company subsequently took only an easement for the tunnel, but the owner claimed damages to the property. The company said the property might be useful for station purposes in the future.

Canadian Northern Ontario Ry.—A through fast freight service was inaugurated between Toronto, Ottawa, Montreal and Quebec, Jan. 8, over the Toronto-Ottawa line, the last section of which was recently completed; thence over the old Great Northern Ry. and the old Chateauguay and Northern Ry. into Montreal, and over the old Great Northern Ry. to Quebec. A regular train service is operated from Toronto to Sydenham, Ont., and a limited service from Sydenham into Ottawa.

A bylaw will shortly be submitted to the ratepayers of St. Catharines, Ont., providing for a bonus of $100,000 to aid in building the company's Toronto-Niagara line through that city. The agreement provides for the completion of the line from Hamilton to St. Catharines within three years, and its completion from Toronto to Niagara in five years.

Montreal-Ottawa-Port Arthur Line.—Track laying has been completed easterly from Capreol to North Bay, Ont., and construction trains are being operated over it. Track has also been laid to between 50 and 60 miles east of North Bay. Out of Ottawa, track is laid nearly to Pembroke.

The last spike on the section of this line terminating in Port Arthur, Ont., was driven near Little White Otter River, 254 miles east of Port Arthur, Jan. 1, by Sir William Mackenzie, who, accompanied by an official party, left Toronto by a special train and travelled over the line via Parry Sound to Capreol, which is the point at which the Montreal-Ottawa-Port Arthur line connects with the line from Toronto; thence to Ruel, where present permanent operation ceases, and then over the newly completed line to the point where the track laying was completed on New Year's morning. The journey was then resumed and the special ran on to Port Arthur, which was reached at midnight. The party was entertained at dinner immediately afterwards, and speeches were delivered by the Mayor of Port Arthur, Sir William Mackenzie, President; Sir Donald Mann, Vice President; D. B. Hanna, Third Vice President, and others.

The building of this section of the line was entrusted to Foley, Welch and Stewart and the Northern Construction Co., in 1911, under the terms of a special agreement with the Dominion Government. Actual construction work started early in 1912. The line has a gradient of 0.4%, with an almost perfect alignment, the final location being made over a period of four years by H. K. Wicksteed, Chief Engineer of Surveys.

Work has been suspended on the line for the winter, but it is expected that ballasting gangs will be put on in the spring in order to get the line in running condition by the fall. One lift of ballast has already been put on. Station buildings have been completed to mileage 183 out of Port Arthur.

Canadian Northern Ry.—The Board of Railway Commissioners has authorized the opening for traffic of the revised line across Rainy Lake, Ont., mileage 224.3 to 226.4.

The Lieut.-Governor of Manitoba, in his speech at the opening of the Provincial Legislature, referring to the building of the railway to Hudson Bay by the Dominion Government said:—"It is the fixed policy of my Government to extend the Oak Point line northward to intersect the same in such time as will guarantee our ability to take advantage, when the main line of the railway is ready for operation, of this through route to the markets of the world for the products of the farms of Manitoba. My Government believe that the opening of such a through route will prove of great benefit to the agriculturists of this Province." This line is being built by the C.N.R. and is in operation from Winnipeg to Gypsumville, 162 miles.

The Board of Railway Commissioners has authorized the opening for traffic of the extension of the Oakland Branch from mileaged 24, for a further distance of 12 miles.

The C.N.R. is carrying on its construction work in Manitoba, Saskatchewan and Alberta, not only under its own charter, but also under the charters of the Canadian Northern Saskatchewan Ry., the Canadian Northern Western Ry., and the Canadian Northern Alberta Ry. The construction work done under the charters of these companies for 1913 is as follows:—

Grading was done on 23 lines and track laying on 19 lines. The main line out of Edmonton is being built under the Canadian Northern Alberta Ry. charter, and on this 24.23 miles of grading were done, and 143.36 miles of track laid to the provincial boundary. A 5 mile spur, known as Huffs spur, was also laid.

The work done on the various branch lines, arranged according to provinces, is as follows:—

	Grading. Miles.	Track laid. Miles.
C.N. Ry.	107.37	271.72
C.N. Sask. Ry.	4.00	—
C.N. Western Ry.	87.54	74.53
C.N. Alberta Ry.	34.28	148.31
Total	233.19	494.56
	Miles graded.	Miles track laid.
Manitoba—		
Winnipeg cut off	3.98	3.34
Winnipeg & Northern Ry.	7.45	—
Deerfield (Oak Point line)	12.50	12.50
Greenway extension	2.94	15.33
Oakland extension	—	11.69
Grosse Isle extension	14.28	22.80
	41.15	65.66
Saskatchewan—		
Bienfait to Estevan	8.20	—
Canora northerly	1.00	—
Goose Lake branch	—	25.78
Jackfish line	—	17.10
Macrorie, east	2.26	8.59
Macrorie west	34.83	31.57
Moose Jaw line	0.30	1.85
Prince Albert-Battleford line	1.15	52.05
Swift Current line	7.10	55.85
Vonda, northerly	8.20	—
Wroxton, westerly	4.00	—
	67.94	192.69
Alberta—		
Vegreville-Calgary line	0.53	13.20
Calgary, southerly	1.60	—
Strathcona-Camrose	0.45	0.17
Brazeau line	36.77	42.60
Camrose south east	53.45	—
Peace River line	6.50	30.65
Strathcona-Calgary line	0.30	1.28
Red Deer spur	0.52	—
Main line	34.28	148.31
	134.10	236.21
Total for three provinces	243.19	494.56

The three measures with respect to the guaranteeing of the company's bond issues by the Province of Saskatchewan mentioned in our last issue, have received final assent. The question of the construction programme for the year, under these acts, is now under consideration by the government.

Canadian Northern Pacific Ry.—The C.N. Ry. construction department at Winnipeg is supervising the Canadian Northern Pacific Ry. construction from the Alberta-British Columbia boundary to the Albreda Summit.

During 1913 grading was completed for 67.8 miles westerly from the provincial boundary, and 6.07 miles of track laid.

The remainder of the line in British Columbia is being built under the Vancouver construction department, T. H. White being Chief Engineer. Track was laid from Sumas to Hope, 41.75 miles, in 1912, and during 1913 an additional 206 miles of track was laid. Of this 12 miles was on the branch from New Westminster to Steveston, leaving 194 miles of track laid on the main line. Track has been laid from Hope to Cisco, 62 miles, and nine miles between the steel bridges under construction between Cisco and Kamloops; for 123 miles from Kamloops to Cottonwood. The distance from Cisco to Kamloops is 108 miles, and from Cottonwood to Yellowhead Pass is 134 miles. The company has under survey a line from Kamloops to Kelowna and Shuswap Falls, 141 miles, and a line from Westminster bridge to Lulu Island bridge, five miles.

Considerable progress is being made with the construction of the terminals at Port Mann. It is expected that the locomotive house will be completed early in February.

Sir Donald Mann, Vice President, arrived in Vancouver, Jan. 5, when he is reported to have said that the company's line would enter Vancouver by a tunnel three miles long, the exact location of which had not been settled. (Jan., pg. 29.)

Dominion Railway Subsidy Agreements.

The Dominion Government has entered into agreements under the act granting aid in the construction of railways, for the following lines:—

Canadian Pacific Ry., Jan. 8, for railway bridge over the Saskatchewan River, at Outlook, Sask. This bridge has been built and opened for traffic. It was fully described and illustrated in Canadian Railway and Marine World, June, 1913.

Kettle Valley Ry., Dec. 16, 1913, for a line from Merritt to Penticton wharf, B.C., 148 miles, and for a line from a point on the line between Merritt and Penticton wharf, about 25 miles south of Merritt, to a point on the Fraser River, near Hope station, B.C., 55 miles.

Kootenay Central Ry., Dec. 15, 1913, for a line from Golden, via Windermere and Fort Steele, B.C., to a point on the British Columbia Southern Ry., at or near Jukeson, 175 miles.

Locomotive Design.—The present tendency is to use larger cylinders, maintaining former steam pressures. The first step in this direction was to use larger cylinders with decreased steam pressure, but it has since been found advisable to maintain the pressure as before.

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Vonda, northerly	8.20	—
Wroxton, westerly	4.00	—
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Alberta—		
Vegreville-Calgary line	0.23	13.20

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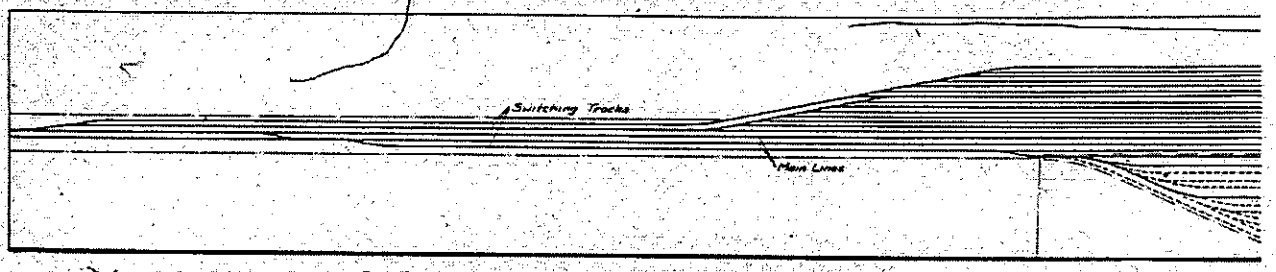
Canadian Northern Railway Terminals at Port Mann.

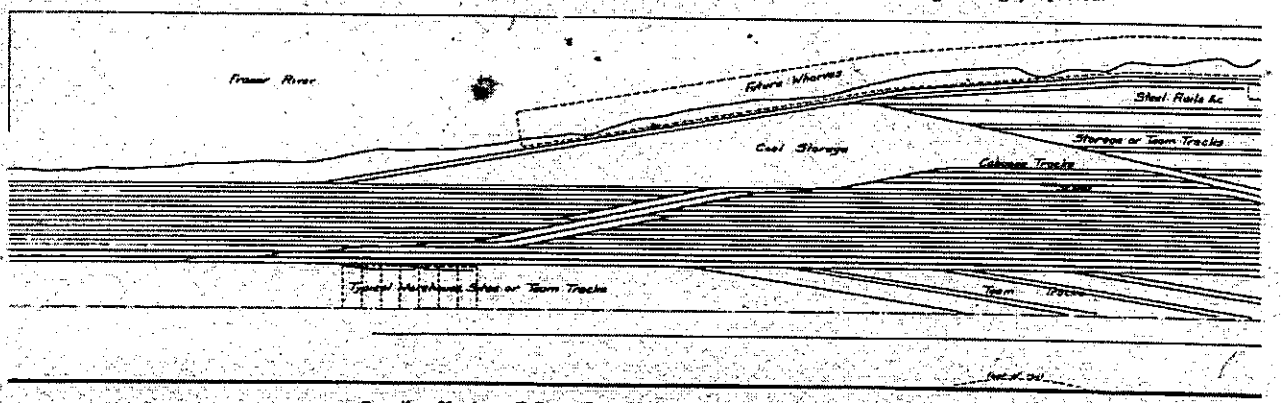
The Canadian Northern Ry. for one of its Pacific Coast terminals of its transcontinental line now nearing completion, has opened up a tract of land on the Fraser River, about 12 miles from Vancouver, where it is constructing extensive terminal facilities. The site has been named Port Mann, after Sir Donald D. Mann, Vice President. As a part of the general scheme, and as a means of financing the work, the property back from the river, along which the railway facilities will be situated, was secured by the railway as a townsite, was subdivided,



Canadian Northern Railway Port Mann Terminal Layout (Section 1).

and has been on the market for some time. The town layout is of considerable extent, and it is anticipated that with the extensive railway and shipping facilities which will be provided it will become a point of considerable importance.

The Fraser River is navigable up to this point for large, ocean going vessels, and in consequence, it is expected to become a place of importance for the transhipment of freight for the Orient; a possible traffic in the transhipment of grain, etc., by way of the Panama Canal, is another phase of future development. Considering all these viewpoints, the prospect of the place developing seemed so imminent to the railway management, that a well developed



Canadian Northern Railway Port Mann Terminal Layout (Section 2).

scheme for extensive facilities has been undertaken, as shown in the accompanying plans.

The yard accommodation will consist of three yards of equal size, each containing 14 body tracks, 2,300 ft. long in the clear, giving a capacity in each of 1,000 cars, or a total capacity of 3,000 cars. These yards are on the north side of the double track main line, along the river bank. To each end of each yard, there will be two ladder tracks, each of these serving 7 tracks. To the intermediate body tracks, there will be cross overs from the main line. From the west, the westerly ladder tracks will be approached by two 1,600 ft. switching tracks, over which the made up trains may be taken from or into the yards. On the north of the east end of the easterly yard, there will be three caboose tracks, between which and the yard, will be a scale track. To the north of this, a large coal storage space has been reserved.

The centre of the projected town will be Bon Accord Square, Centre St. leading directly from the river into it. Stub tracks leading from ladder tracks east and west of this street, will form an extensive system of storage and team tracks; there will be 14 of these to the west, and 7 to the east of the street, the latter being the entry thoroughfare to the teamways. Along the south side of the yards, there will be a service track, from which stub team tracks will branch off, terminating at Railway St., 8 tracks to the west and 4 to the east of Centre St. Immediately to the west of Centre St. there will be 4 local freight tracks, with a freight shed, 40 by 200 ft., abutting on the street. Provision has been made for the extension of this shed to double its original size. The southerly two tracks of the team track layout will be spanned by a transfer crane, with a team scale in the roadway nearby.

Ample accomodation is being made for future warehouses on sites 50 by 100 ft., both to the east and to the west of Centre St. The station will adjoin Centre St. At the foot of Centre St., there has been built a 1,000 by 102 ft. wharf, with freight storage shed adjacent. The extension of the wharf to four times its present capacity is contemplated as traffic increases, and the freight storage shed can be increased to three times its present capacity. The water along the frontage is being deepened so that the largest vessels may dock there, and with the double track that has been laid along the rear of the wharf, will make a convenient transhipment arrangement.

A very complete shop layout for the handling of rolling stock repairs on all the company's Pacific Coast lines, has also been planned, only a small portion of which will be completed at present. Provision has been made for the addition of all the buildings required in a complete shop layout, some of which will be built in sections, and extended as required.

The general shop scheme consists of a central midway served by a 60 ft. transfer crane, at right angles to the main line tracks. The locomotive shop will be, to the east of the midway, and will ultimately be 150 by 600 ft., with 24 locomotive pits. The initial section now being built, is 250 ft. long, containing 10 pits. This shop will be served by an 80 ft. transfer table along the east side, extending the full length of the shop. Only the portion corresponding to the part of the shop now being completed, is being built at present. On the east side of the transfer table, there will be a corresponding number of storage tracks, served by the transfer table. The locomotive shop, like all the buildings of the plant, will be of concrete construction, divided into two longitudinal bays by a central row of cast iron columns.—It will contain two 10-ton travelling cranes, and a 200 ton electric jack for wheeling locomotives. This building will be the only part of the shop layout to be completed at present, all the other buildings being projected.

All the remaining buildings of the plant will be situated to the west of the midway. Abutting the midway will be the pattern shop, 50 ft. square; foundry, 100 by 200 ft.; coal and iron shed, 50 by 200 ft.; blacksmith shop, 100 by 200 ft., and stores, 50 by 150 ft. The latter building will be surrounded by a platform, 75 by 350 ft., for the rough stores. To the rear of the stores will be the scrap bins, with track scales in one of the stores service tracks, and with the oil storage tank nearby. The passenger car shop, 100 by 200 ft., will be directly to the rear of the blacksmith shop. The woodworking department, consisting of the planing mill, 100 by 150 ft.,

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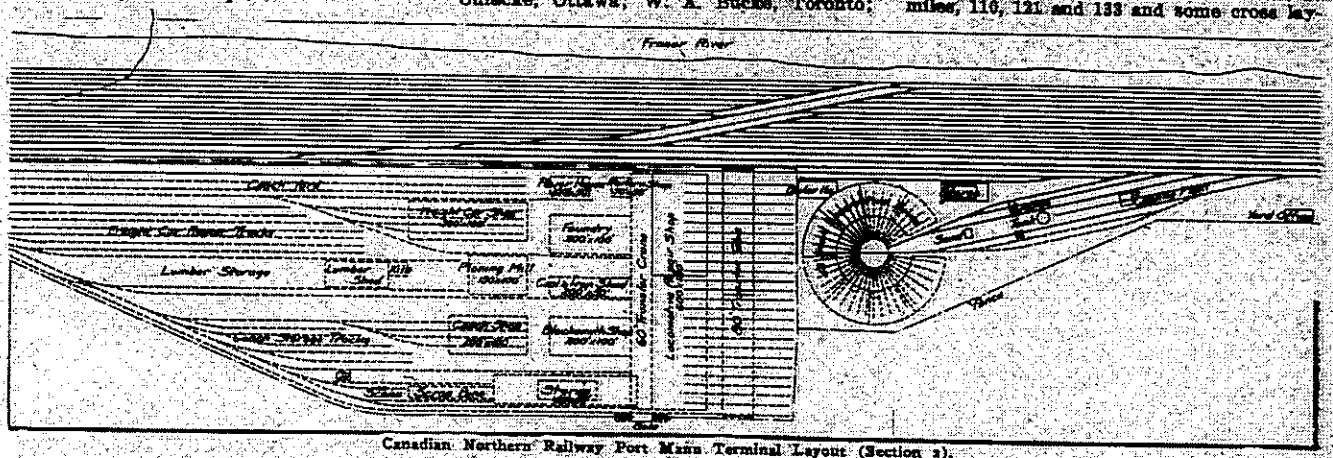
and the lumber shed and kiln, will be directly to the rear of the coal and iron shed, with lumber storage space to the rear of the lumber shed. The freight car shop, 100 by 200 ft., will be to the rear of the foundry, and the power house, 50 by 100 ft., to the rear of the pattern shop. All these buildings will be approached from the west from a ladder track, which will leave the service track along the south of the main line tracks near the west end of the main yards. The ladder, in addition to leading into the shop service tracks, will serve a 6 track freight car repair yard, and a 5 track passenger car storage yard, to the rear of their respective shops.



Canadian Northern Railway Port Mann Terminal Layout (Section 3).

The locomotive house at this point will be to the east of the locomotive shop, and will eventually be a 43 stall unit. Only a 15 stall section is being built now, and with it only half the mechanical yard accomodation. The locomotive house will be approached from the east. Of the mechanical yard arrangements, only the northerly half will be constructed at first, the southerly half awaiting the completion of the locomotive house. Adjoining the locomotive house, there will be a boiler and engine house, and to the east, a stores building.

All the buildings will be of concrete, the same as the buildings of the shop layout, and all of them have been, or are being built by the Imperial Construction Co., Toronto. We are indebted to J. Montgomery of this company for the data on which this article is based.

The Canadian Northern Ex. Co. has opened offices at Solina, Ont. and Neelin, Man., and has closed its office at Polwarth, Sask.

Canadian Society of Civil Engineers Annual Meeting.

The annual meeting was held in Montreal, Jan. 27 to 29. The reports of committees, and which are of interest to railway engineers, were published in Canadian Railway and Marine World for February.

The following officers were elected:—President, M. J. Butler, Montreal; Vice President, R. A. Ross, Montreal; Members of Council, J. M. R. Fairbairn, Montreal; Prof. H. M. Mackay, Montreal; R. McColl, Halifax, N.S.; A. R. Decary, Quebec; R. F. Uniacke, Ottawa; W. A. Bucke, Toronto; F. Lee, Winnipeg, and G. R. G. Conway, Vancouver.

The society has 2,794 members and assets of $108,300, including the new premises on Mansfield St., Montreal, valued at $90,000.

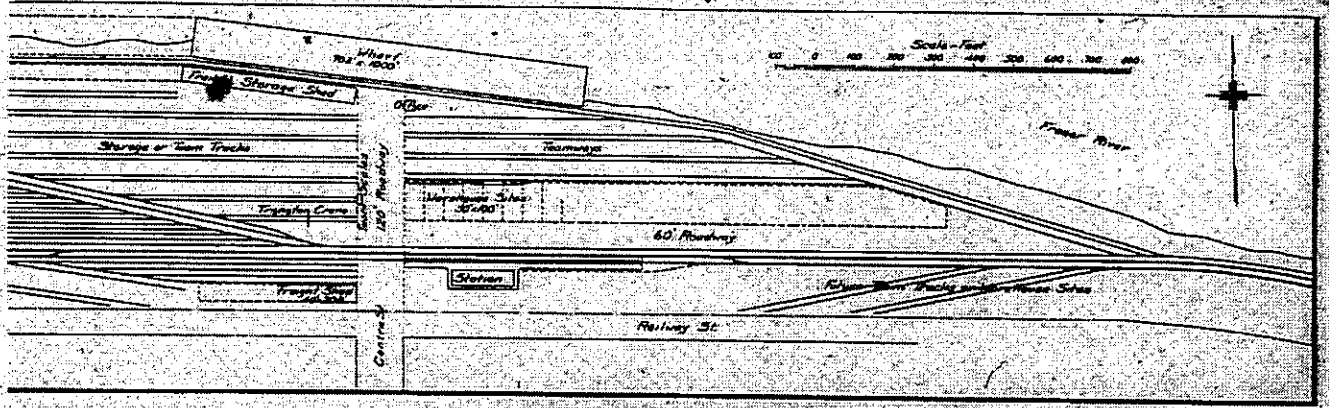
The features outside the business meeting included a luncheon tendered by the Montreal members; a smoking concert and a dinner at the Engineers Club, presided over by the Vice President, H. H. Vaughan, Assistant to the Vice President C.P.R., in the absence of the President, Phelps Johnson. A visit was paid to the St. Lawrence Bridge Co.'s plant at Rockfield, and also to the Canadian Northern Ry.'s Mount Royal tunnel.

Dominion Railway Subsidy Agreement.—The Dominion Government entered into an agreement, Jan. 20, under the act granting aid in the construction of railways, with the Esquimalt and Nanaimo Ry., for lines from McBride Jct., towards Sandwich, B. C., 45 miles; and from Sandwich to Campbell River, B.C., 33 miles.

Dominion Government Railway to Hudson Bay.

Replying to a question in the House of Commons, Feb. 2, the Minister of Railways said the length of this railway from Pas to Port Nelson, Man., is 413.5 miles. The whole mileage is under contract, viz.—Pas to Thicket Portage, 185.5 miles; Thicket Portage to Split Lake Jct., 63 miles; Split Lake Jct. to Port Nelson, 165 miles. The state of construction is.—Miles of steel laid, 86; miles surfaced, 56; grading fairly completed with the exception of a few cuts at miles, 116, 121 and 133 and some cross laying, 137.

In a discussion on the project in the House of Commons, Feb. 11, the Minister of Railways stated that while Port Nelson is not an ideal harbor for the seaboard terminal of the railway, it is superior to Fort Churchill. To reach the latter port it would be necessary to carry the line across 70 miles of "badlands." The misadventures of vessels during the last season of navigation were due to various causes but the loss and damage had not been anything like so serious as was reported. As much progress has been made with the terminal work as could reasonably be expected. It is intended to send in a strong force of men overland, so as to make an early start on the work, and make as much progress as possible during the open season this year. (Feb., pg. 70.)



Canadian Northern Railway Port Mann Terminal Layout (Section 4).

The Canadian Northern Rr. Co. has opened an office at Hafford, Sask. and has closed its offices at Barton, Ladysmith, Neelin and White Plains, Man., and Chandler and Fairlight, Sask.

MARCH 1914

Canadian Northern Railway Construction, Betterments, Etc.

Mount Royal Tunnel and Terminal Ry.—The Board of Railway Commissioners has approved revised location of the tunnel line from St Antoine St. to its main line at Montreal and rescinded order made Nov. 27, 1913.

Preliminary plans for the passenger terminals in Montreal have been prepared. They will be located between Cathcart and Lagauchetiere, St. Monique and Mansfield streets, and it is said they will comprise a group of buildings of considerable architectural attractiveness; that the platforms will be 1,200 ft. long, and will be 45 ft. below the upper level at Dorchester St., and 20 ft. above the general level of the city. Press reports, Feb. 13, stated that excavation has been started for the station and terminal buildings, and that the erection of a temporary station will be undertaken as soon as the weather permits. It is expected that passenger trains will be running through the tunnel early in the autumn.

Toronto-Hamilton Line.—A bylaw, submitted to the ratepayers of St. Catharines, Ont., to give a bonus of $100,000 towards the building of the projected railway from Toronto to the Niagara River, was defeated by a vote of 744 to 324, Jan. 31.

Canadian Northern Ontario Ry.—It has been announced that the branch on the Toronto-Sudbury line from Uhthoff into Orillia, will be opened for traffic, Mar. 1.

Montreal-Ottawa-Port Arthur line.—The Board of Railway Commissioners has approved of revised location plans of the line at Grand Lake, in Nipissing District, mileage 126.37 to 129.94 from Ottawa.

We have been officially supplied with the following information with regard to the work done on this line during 1913:—Average force employed for every working day in the year, 6,880 men, and 808 horses; largest force employed in any month, 8,736 men and 1,195 horses; smallest force employed in any month, 3,838 men and 298 horses; outlay in wages, $720,000, equal to about $20,000 each working day; yardage moved, about 11,000,000 cubic yards, equal to 366 miles of completed grade, allowing 30,000 cubic yards a mile, or [illegible] miles of grade for each working day. There were 15¼ million feet of timber built in trestles; 4½ million feet in culverts; 43,399 cubic yards of concrete were put in culverts and bridge foundations; and 2,900 tons of steel were put into the superstructures of bridges. Track was connected upon the Sudbury-Port Arthur section of the line, 550 miles, on Dec. 31, 1913, just 29 months after the grading was commenced.

Canadian Northern Ry.—In a recent interview at Winnipeg, Sir Donald Mann, Vice President, is reported to have said, that the company, before undertaking any new construction, would complete its main line and branches now under construction.

Press reports state that contracts will shortly be let for the construction of a number of large steel bridges on western lines, at a total estimated cost of $4,000,000. These include bridges at Snarling River, Minette, and at Athabaska.

The Manitoba Legislature has passed an act incorporating the Canadian Northern Manitoba Ry. Co. to build the following be approved from time to time by the Lieutenant-Governor-in-Council. The provisional directors are:—H. Sutherland, P. C. Andrews, E. Langham, O. G. Clark, K.C., C. W. Jackson, Winnipeg.

Sir William Mackenzie, President, is reported to have stated at Winnipeg, Feb. 12, that construction will be proceeded with at once on the new line from Grand Marais to Victoria Beach, and the line from Deerfield to Lake Manitoba. The Manitoba Legislature has passed an act guaranteeing the company's bonds for $13,000 a mile for the building of these two lines, 15 and 12.5 miles long, respectively.

Plans have been deposited in the Land Titles office at Moose Jaw, Sask., showing revised location of the Maryfield branch through tps. 5 and 6, ranges 25-29, west of the 2nd meridian. In connection with this line, Sir Donald Mann is reported to have recently said:—"Our present entrance to Moose Jaw is by the Maryfield branch—a round about route. It is likely that we shall come to some arrangement with the G.T. Pacific Ry. in order to secure a more direct entrance, but it will not be yet."

It was understood that the line into Calgary, which, from near Drumheller, Alta., carried traffic coming off the line through from Saskatoon, and the traffic from the line south from Vegreville, would have been opened for traffic Feb. 1. The Board of Railway Commissioners, however, refused to sanction its opening until the temporary bridges east of the city are strengthened. It is expected that operation will be started early in March.

The company has secured, D. B. Hanna, Third Vice President, is reported to have recently said, a site in Calgary for its station, and is going ahead with the preparation of plans for building it.

In connection with the building of a line into Macleod, Alta., press reports, Feb. 9, stated that engineers have been going over the route, on which some grading has been done, between the C.P.R. tracks and the Old Man River, and have been locating a site for the construction of a bridge there.

The proceeds of the bond issue recently placed on the London, Eng., market will be used in the construction of the following lines under agreement between the C.N.R.'s subsidiary, the Canadian Northern Western Ry., and the Alberta government:—From Oliver northeasterly to St. Paul de Metis; from Bruderheim via Vermillion, Wainwright and Medicine Hat to the International boundary, with a branch northeast of Vermillion to the eastern boundary of the province; from Camrose to Alsask; from Calgary northwest to the Brazeau line; from Strathcona southwest via Cochrane to Pincher Creek, and from Athabaska north of Lesser Slave Lake to Peace River Crossing.

The annual report of the Minister of Railways for Alberta for the calendar year 1913, shows that during the year the company built 249 miles of railway in the province. There had been built, or were in process of completion under provincial guarantee the following lines:—

	Guarantee	Mileage
CANADIAN NORTHERN WESTERN RY.—		
Onoway northwest to Pine River Pass	$20,000	100
Oliver northeast to St. Paul de Metis	13,000	100
Bruderheim via Vermilion, Wainwright and Medicine Hat to International boundary, with a branch northwest of Vermilion to Eastern Boundary	13,000	30
Calgary northeast to Brazeau line	13,000	100
Camrose to Alsask	13,000	80
Strathcona via Cochrane to Pincher Creek	15,000	20
Blackfalds to Goose Lake line	13,000	118.
Total		1-323.

Steel is reported to have been laid o the Brazeau line to about 45 miles west o Rocky Mountain House, and grading is sai to be in progress right through to the Bra zeau coal fields. The bridge across the Sas katchewan River on this line, it is reported will be built jointly with the C.P.R., whos Alberta Central Line parallels the C.N.R line for a considerable distance.

Canadian Northern Pacific Ry.—Th British Columbia Legislature passed an act Feb. 13, affecting the guarantee of bonds o the company. The Premier stated that had not been found a workable plan to ran the 4½% securities as provided by the ac of 1912, with the 4% securities which wer provided for under the original act. Th amendment now carried provides that th 4½% securities shall be applied only fo the construction of the lines specially men tioned in the act of 1912, viz.:—From th 100-Mile post on the Vancouver Island lin to Duncans; from Kamloops to Kelowna, i the Okanagan, with a spur line to Lumby the branch from New Westminster to Stev ston; the line from Patricia Bay to Vi toria; the line from New Westminster t Vancouver.

It is reported that there are only abou five miles of grading south of the Albred Summit, B.C., on which no work has ye been done, along the whole line. At thi point several routes have been laid out, bu a definite decision has not been arrived a as to which will be followed. The remai ing portions of the grading, on which trac had not been laid up to Dec. 31, 1913, i well advanced to completion. It is expecte to have the track laid through early in th fall. (Feb., pg. 73.)

A Victoria, B.C., dispatch of Feb. 21, sai that the Premier had introduced a bill i miles, principal and interest at 4½% unt 1960, the total amount being $12,360,20 the Legislative Assembly providing that th Province guarantee Canadian Northern P cific Ry. bonds for $10,000 a mile for 51 The time for the completion of the line to be extended to 1916.

Government Grain Elevators.—The Mi ister of Trade and Commerce in respons to a letter from the Member of Parliamen for North Grey, stated recently, that th Government has no present intention building elevators at any point on Georgia Bay; the Government's policy, apart fro the elevators already built by it, or throug commissioners, at Halifax, St. John, Po Colborne, Fort William, Saskatoon, Moo Jaw, Quebec, Montreal, and the erection another elevator at Calgary, two transf elevators, one in British Columbia and th other on Hudson Bay, being to leave suc construction to private parties or corpor tions.

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The Manitoba Legislature has passed an act incorporating the Canadian Northern Manitoba Ry. Co. to build the following lines:—From the Oak Point branch of the C.N.R., in tp. 27 or 28, westerly to the eastern shore of Lake Manitoba; from the Oak Point branch near Gypsumville, northerly to the authorized line of the C.N. Ry., between Shevlin and Grandview on the C.N.R., southeasterly to Portage la Prairie; from Portage la Prairie southerly and southeasterly to the C.N.R. between Emerson and Sprague, and such other lines as may carried traffic coming off the line through from Saskatoon, and the traffic from the line south from Vegreville, would have been opened for traffic Feb. 1. The Board of Railway Commissioners, however, refused to sanction its opening until the temporary bridges east of the city are strengthened. It is expected that operation will be started early in March.

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	Guarantee per mile.	Mileage Guaranteed.
CANADIAN NORTHERN RAILWAY—		
Strathcona via Camrose and Calgary to Lethbridge	$15,000	355
Camrose to Vegreville	15,000	45
Crossing of second above line and Little Bow River, south via Macleod to the International boundary	15,000	110
Near Macleod to the Western Boundary	15,000	65
Morinville to Athabasca Landing	15,000	72.3
Mile 175 of the Goose Lake line to Munson	15,000	127.5

the construction of the lines specially mentioned in the act of 1912, viz.:—From the 100-Mile post on the Vancouver Island line to Duncans; from Kamloops to Kelowna, in the Okanagan, with a spur line to Lumby; the branch from New Westminster to Steveston; the line from Patricia Bay to Victoria; the line from New Westminster to Vancouver.

It is reported that there are only about five miles of grading south of the Albreda Summit, B.C., on which no work has yet been done, along the whole line. At this point several routes have been laid out, but a definite decision has not been arrived at as to which will be followed. The remaining portions of the grading, on which track had not been laid up to Dec. 31, 1913, is well advanced to completion. It is expected to have the track laid through early in the fall. (Feb., pg. 73.)

A Victoria, B.C., dispatch of Feb. 21, said that the Premier had introduced a bill in miles, principal and interest at 4½% until 1950, the total amount being $12,860,200 the Legislative Assembly providing that the Province guarantee Canadian Northern Pacific Ry. bonds for $10,000 a mile for 511 The time for the completion of the line is to be extended to 1916.

Government Grain Elevators.—The Minister of Trade and Commerce in response to a letter from the Member of Parliament for North Grey, stated recently, that the Government has no present intention of building elevators at any point on Georgian Bay; the Government's policy, apart from the elevators already built by it, or through commissioners, at Halifax, St. John, Port Colborne, Fort William, Saskatoon, Moose Jaw, Quebec, Montreal, and the erection of another elevator at Calgary, two transfer elevators, one in British Columbia and the other on Hudson Bay, being to leave such construction to private parties or corporations.

The Intercolonial Ry. and Branch Lines.—Replying to a question in the House of Commons, Feb. 2, the Minister of Railways said: "In view of the action of the Senate last session" in throwing out the bill providing for the purchase, under certain conditions, of branch lines, "it is not considered that the introduction of such legislation during the present session would be of any use."

MARCH 1914

Canadian Northern Railway Construction, Betterments, Etc.

Canadian Northern Quebec Ry.—Press reports state that the company is preparing to erect a large coal discharging plant at Quebec and to extend its coal wharf 150 ft.

Mount Royal Tunnel and Terminal Co.—Work was started Mar. 10 on Cathcart St., Montreal, sinking a shaft to the level of the tunnel for the purpose of assisting to get in construction material.

The clearing of the buildings on the blocks bounded by Cathcart, Ste. Monique, Lagauchetiere and Mansfield Streets is being pushed forward. The tenants of the buildings on the north side of Dorchester St., which have been acquired by the company for its terminals in the city, have been notified to leave. It is expected that excavation for the terminals will be started at an early date. The area will be excavated to 50 ft. below the ground level, involving the moving of over 500,000 cubic yards of earth and 95,000 cubic yards of rock. It is estimated that there will be required in the construction of the terminal buildings 100,000 cubic yards of concrete, 3,500,000 lbs. of reinforcing steel, and 8,000,000 lbs. of structural steel.

Montreal-Ottawa-Port Arthur Line.—Press reports state that grading on the unfinished portion of the Ottawa-Capreol section of the line is expected to be completed about Sept. 1 and the track laying finished Dec. 30.

Canadian Northern Ontario Ry.—The New York State Legislature has under consideration a bill for the incorporation of the Niagara-Ontario Connecting Bridge Co. to build a bridge across the Niagara River from Lewiston, N.Y., to the Canadian shore, for electric and steam railways. The incorporators are:—E. G. Connette, H. Holden, C. L. Ingham, F. A. Dudley, L. Albright. It is reported that Canadian Northern Ry. interests are associated with this project.

Canadian Northern Ry.—H. K. Wicksteed, M. Can. Soc. C.E., Chief Engineer of Surveys, Mackenzie, Mann & Co., and a representative of the company's legal staff had an interview with the Port Arthur City Council, Mar. 10, to discuss and settle various matters connected with the eastern entrance of the railway and the closing of certain street ends. An agreement is said to have been arrived at as to the closing of the streets, but the matter of the eastern entrance is to be further considered.

Press reports state that the company has under consideration plans for the erection of a new storage shed for incoming freight in the south section of Port Arthur.

It is reported that a new station is to be erected at Kakabeka Falls, Ont., during the summer.

The new station at St. Boniface, Man., has been opened for business.

Press reports state that a number of new sidings are to be put in at the quarries of the Manitoba Gypsum Co. at Gypsumville, Man., during the summer.

It is reported that a spur line is to be built from Radville, on the Maryfield branch, northerly to Weyburn, Sask.

Plans have been deposited in the Land Titles offices at Moose Jaw, Sask., and at Saskatoon, Sask., showing the right of way of the C.N.R. as located through tps. 26-23, ranges 26-29, west of the 3rd meridian.

Press reports state that the company will start construction this year on a line from Brudetheim to Vermillion, thence to Wainwright, and through Medicine Hat to the International boundary between Alberta and Montana. This line is one of the projected lines of the C.N. Western Ry., for the building of which bonds have been placed on the London, Eng., market. A press report states that a contract for building branch lines in Alberta has been let to Foley, Welch and Stewart, Spokane, Wash.

A train service has been put in operation out of Calgary on the newly completed line south from Vegreville, which is joined near Drumheller by a line from Saskatoon, Sask. At present only one station has been opened between Calgary and Drumheller.

Press reports state that it is expected to have about 20 miles of the line south from Calgary to Lethbridge open for traffic this year.

The line from Onoway, Alta., to the Peace River country is completed to the Pembina River, over which a large bridge is under construction. Grading has been completed for a considerable distance beyond the Pembina River. A. T. Fraser, district engineer in charge of construction, was in Edmonton, Mar. 14, and is reported to have stated that considerable further grading will be done during this year.

Canadian Northern Pacific Ry.—The British Columbia Legislature has granted further aid, by means of a guarantee of bonds, for the construction of this railway. The act sets out that in addition to the bonds guaranteed under chap. 3 of the statutes of 1910, the Government is authorized to affix the provincial guarantee to the company's bonds as to principal and interest for $10,000 a mile for the line from the south end of New Westminister bridge to the Yellowhead Pass, 500 miles, and for a line from the north end of the New Westminster bridge to the terminals in Vancouver, 11 miles. The interest on this further issue of bonds is not to exceed 4½%, and the principal is payable April 2, 1950. These bonds are to be secured by a mortgage on the lines mentioned, and are to rank next after the bonds guaranteed under the act of 1910. The act also grants an extension of time to July 1, 1916, for the completion of the lines.

In support of the act the Premier informed the Legislature, Feb. 27, that 16 of the steel bridges across the Fraser and Thompson Rivers, having a total length of 12,214 ft., have been completed. There are still 19 bridges, having an average length of 224 ft., to be completed. The total construction cost of the line is now put at $33,029,200, or about $8,000,000 more than the original estimates. This is accounted for by the high standard of construction required and the increased cost of labor and materials. The extension of time granted applies only to the Okanagan and another branch line, as it is expected to have the main line finished this year.

T. G. Holt, executive agent, is reported to have stated at Ottawa, Mar. 12, that track would be laid on the entire line from the Yellowhead Pass to Vancouver by August.

Vancouver Island Lines.—Referring to the construction of the line on Vancouver Island, the Premier is reported to have said in the Legislature, Feb. 27, that the line from Patricia Bay to Alberni is expected to be completed by the end of this year, although, under the act, the time for completion has been extended to July, 1915. (Mar., pg. 126.)

The ninth annual dinner of the G. T. R. apprentices at the Stratford locomotive shops was held in the G.T.R. Assembly Hall, Stratford, Ont., Mar. 23, R. Patterson, Master Mechanic, occupying the chair. H. G. Kelley, Vice President [illegible]

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Canadian Railway and Marine World

May, 1914.

The Location and Construction of the Canadian Northern Pacific Railway in British Columbia.

By J. V. Nimmo, B. Sc., M. Can. Soc. C. E., Division Engineer, C. N. P. R., Vancouver.

The route followed by the Pacific Section of the Canadian Northern Railway System in reaching tide water from the interior, is of remarkable interest, not only because it follows the best natural highway through the Pacific mountain system of North America, but because there appears to be no other instance where a great mountain region is traversed by a railway with such easy gradients and with such comparative economy of construction. To understand this situation it is necessary to consider briefly the main physical features of British Columbia.

TOPOGRAPHY.—In broad outline the Canadian Cordillera may be divided into four provinces: (1) The Rocky Mountain system; (2) The Middle or Interior Range, including the Purcell, Selkirk, Columbia, Cariboo and Cassiar Mountains; (3) The belt of interior plateaus; (4 The Coastal System, including the Coast, the Cascade, and the Vancouver-Queen Charlotte Ranges. The first, third and fourth of these provinces extend, with but minor interruptions, through Yukon Territory and Alaska to the Behring Sea. The middle ranges are specially broad in southern British Columbia, but practically disappear about latitude 54 degrees, and reappear again between latitudes 56 and 62 as the Cassiar Range. Thus, briefly, we have two main mountain systems, one composed of the Rocky Mountain and Middle Range systems, the other the Coast Range, and between the two lies the belt of the interior plateaus. The striking feature of the first group of mountains which form the first and principal obstacles met with in approaching tide water from the prairies, is that they are subdivided by a number of great depressions running approximately northwest, and making a small angle with the main axis of the mountain ranges. The greatest of these depressions extends from Flathead Lake, in Montana, to the Yukon trenches, and on the south by the loop of the Kootenay River in Montana and Idaho. A third depression extends from near latitude 52 degrees, where the Columbia River leaves the Rocky Mountain trench and flows south in a wide valley 310 miles long to the Columbia lava fields of Washington State, passing through the Arrow Lakes on its way. This depression is sometimes referred to as the Selkirk Valley. East of the Selkirk Valley, and west of the two master trenches, is the Selkirk Mountain system, which, like the Rocky Mountain and Purcell systems, extends into the United States. The rugged mountains to the west of the Selkirk Valley have been grouped under the name of the Columbia Mountain system. Between the 54th and 56th parallels the western wall of the main Rocky Mountain trench is much less prominent than it is either to the south or the north, where it is formed by the Cassiar Mountain Range, so much so that between these two parallels the interior plateaus might be said to extend right up to the trench. The various ranges to the west of the Rocky Mountain trench and south of the 52nd parallel concentrate into one north of the Selkirk Valley. The single range has its narrowest width and lowest pass at Albreda Lake, almost opposite the Yellowhead Pass.

In so far as this generation is concerned we may consider latitude 56 degrees as the northernmost limit of the territory across which a transcontinental railway would be constructed. Between this latitude and the International Boundary there are seven main passes through the Rocky Mountain chain, as follows:—The Crows Nest, at an elevation of 4,449 ft.; the Kicking Horse, at an elevation of 5,200 ft.; the Howse, at an elevation of 4,500 ft.; the Athabasca, at an elevation of 5,710 ft.; the Yellowhead, at an elevation of 3,718 ft.; the Smoky River, at an elevation of 5,400 ft.; the Pine, at an elevation of 2,850 ft.

cades. The main alternatives are by the way of:—The Fraser River to Burrard Inlet; Nomathco to Bute Inlet; the Bella Coola to the North Bentinck Arm; the Salmon River to Dean Inlet; the Kemano River to Gardner Inlet; the Skeena River to Prince Rupert. Of these only the first and last are routes that pass through major breaches in the Cascade Range, and the only ones that do not offer gradients somewhere in their course which would be a serious obstacle to transcontinental traffic. The Coast Range is less mountainous towards the north than it is in the south, hence, although the Skeena in reality is not as great a river as the Fraser, yet it is so relatively to the country through which it passes, and provides almost an equally suitable approach to the Pacific. The second condition of the problem, viz., the satisfactory connection between the Rocky Mountain pass and these breaks in the Cascades, is wonderfully fulfilled by both routes. Instead of the great trenches being obstacles, as is the case in the southern routes, they now form part of the connecting link. The northern route through the Skeena follows the Rocky Mountain trench until the western wall of the latter comes to an end, whence there is an easy way across the great interior plateau by the Nechako and Buckley Rivers. For the southern route there is the providential opening through the Columbia Mountain system at the Albreda summit, from which flows a branch of the Thompson, the main tributary to the Fraser. Here is another illustration of how railways must, as far as possible, follow nature's highways, the rivers. Seldom, however, does nature put her great waterways in as suitable a position for the use of railway locators as she has done in this case. Of these two routes the northern is followed by the Grand Trunk Pacific, and the southern by the Canadian Northern Pacific.

THE GEOLOGICAL HISTORY of the Can-

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The Crows Nest and the Kicking Horse passes have been taken by the C.P.R. They cross the Rocky Mountain and Selkirk groups of mountains at its widest and lead to routes which inevitably cut square across the great trenches enumerated above, and pass over intervening summits of magnitude. There is only one suitable route open to them across the Cascade and Coast Ranges, viz., the Fraser River Valley, to enter which involves, not only a circuitous route, but heavy gradients. The Howse offers no suitable approach from the east, and leads to the same difficulties as the Kicking Horse. The Athabasca and the Smoky are too high, and the approach to them from the west and the east is too rapid for easy grades. The Pine is good, but the geographical situation places it at a disadvantage as compared with the Yellowhead, which alone complies with the necessary requirements of:—Easy approach from the west and the east, access to an easy pass through the Cascades, and to a first class deep water harbor.

This leads to the consideration of the approach to the Pacific through the Cas- great a river as the Fraser, yet it is so relatively to the country through which it passes, and provides almost an equally suitable approach to the Pacific. The second condition of the problem, viz., the satisfactory connection between the Rocky Mountain pass and these breaks in the Cascades, is wonderfully fulfilled by both routes. Instead of the great trenches being obstacles, as is the case in the southern routes, they now form part of the connecting link. The northern route through the Skeena follows the Rocky Mountain trench until the western wall of the latter comes to an end, whence there is an easy way across the great interior plateau by the Nechako and Buckley Rivers. For the southern route there is the providential opening through the Columbia Mountain system at the Albreda summit, from which flows a branch of the Thompson, the main tributary to the Fraser. Here is another illustration of how railways must, as far as possible, follow nature's highways, the rivers. Seldom, however, does nature put her great waterways in as suitable a position for the use of railway locators as she has done in this case. Of these two routes the northern is followed by the Grand Trunk Pacific, and the southern by the Canadian Northern Pacific.

THE GEOLOGICAL HISTORY of the Canadian Cordilleras is yet largely a matter of mystery. The formation is chiefly sedimentary, and there is little evidence of volcanic action. There appear to have been several sedimentary periods alternating with periods of upheaval; and the evidence tends to show that the sediment was from detritus from mountains to the northeast. Probably the Rocky Mountain Range is younger than the Selkirks. There is no doubt that the region of interior plateaus was covered during the Pleistocene period by the cordilleran ice cap. With the waning of this ice cap it gradually gave place to alpine, cirque and valley glaciers, which slowly retreated until the time of maximum extension of the Keewatin ice sheet on the east, when the second period of valley glaciation took place. These glacial conditions, followed by eons of disintegration and slow (and probably discontinuous) land upheaval, appear to have modified the original form of the Cordilleras to their present condition. By what exact process the wonderful rift was made, which is followed by the C.N.P.R. through these mountains, can only be determined if ever, by very much more geological study

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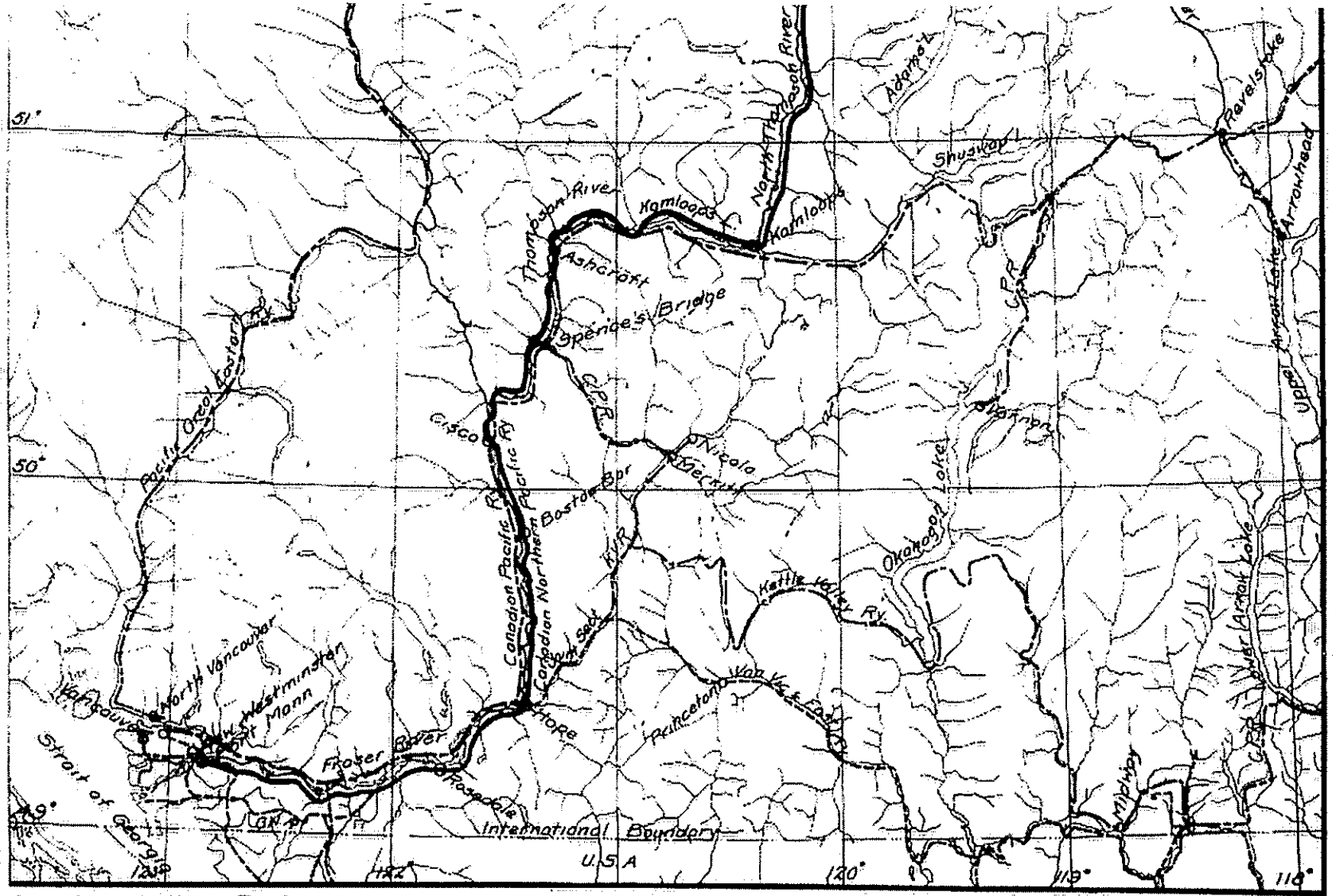

Route of the Canadian Northern Pacific Railway in British Columbia.

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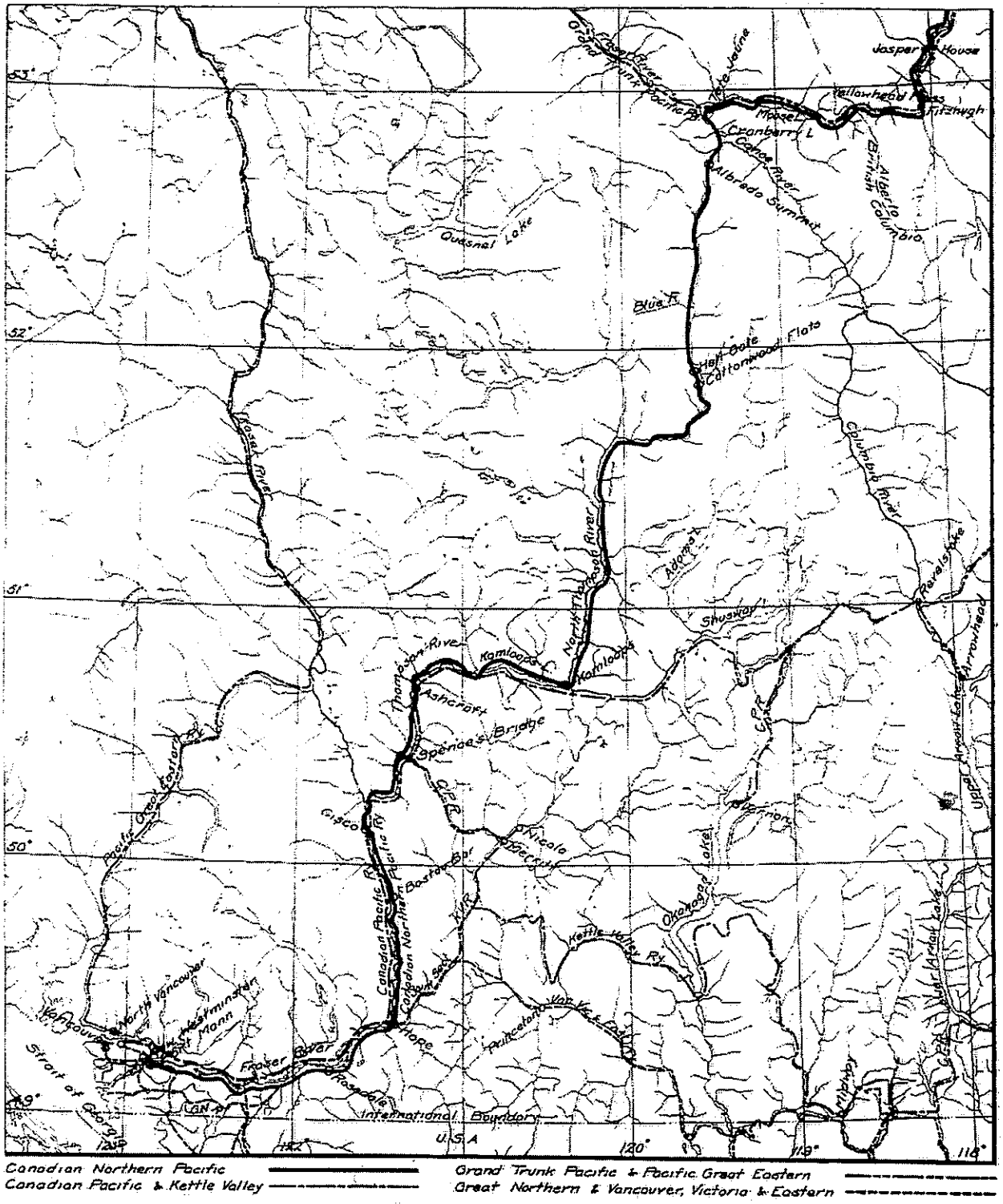

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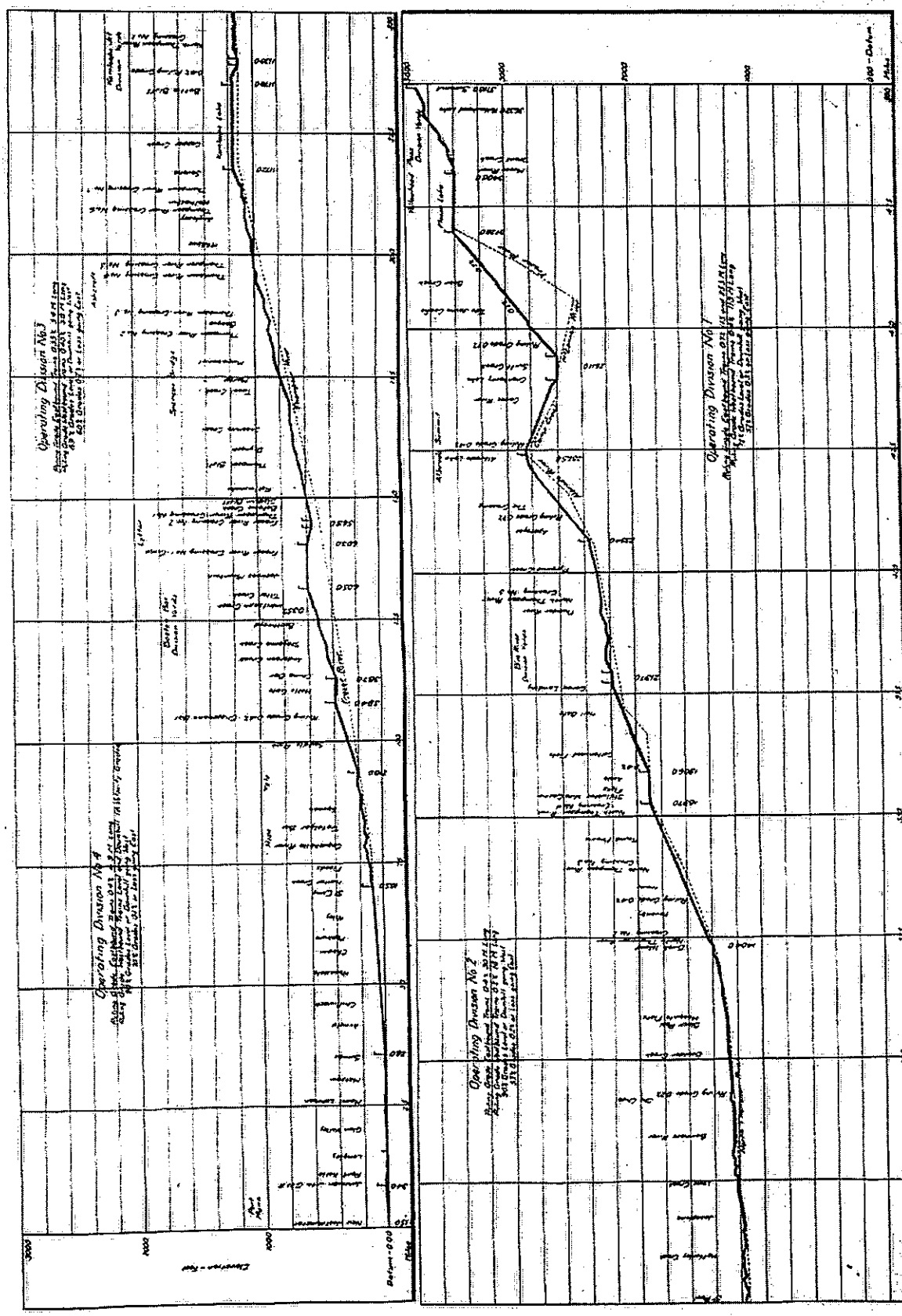

Profile Showing Grades of Main Line Canadian Northern Pacific Railway, New Westminster Bridge to Yellowhead Pass.

limestone, argillaceous and siliceous shales lie, etc., but the predominating features Spences Bridge to Boston Bar. The most for several thousand feet. The rock, of and quartzites, mica, schist, some granite which a good deal is encountered, consists are the gravel and boulder formations and striking feature of this territory is the pre- chiefly of shale, sandstone and limestone. and gneiss, a great deal of gravel and boul- glacial clay. This latter forms the prin- dominating occurrence of gravel and boul- ders and some glacial clay. The rock in the cipal material met from the West end of ders. The slope of the valley for miles con- 2, Boston Bar to Hope. This comprises the second section is composed largely of shales, Kamloops Lake to Spences Bridge. The sists of unknown depths of this material, Fraser Canyon proper, and is almost en- conglomerate sandstone, limestone, quartz- third section may be subdivided into:—1, sometimes running up the mountain side tirely in rock, which consists of grano-dyar-

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ite, sandstone, limestone and shale. 3, Hope to Rosedale. The railway here passes on the benches consisting largely of gravel and sand. 4, The Fraser Delta. This is alluvial formation.

LOCATION.—For the consideration of the location in greater detail, the route will be followed in a general direction of east to west. The principal features of the route have long been well known, by reason of the very able and exhaustive surveys made under the direction of Sir Sandford Fleming from 1872 to 1880, both reconnaissance and in detail, on behalf of the Dominion Government, in order to find the best route for a transcontinental railway, which had been promised on British Columbia entering Confederation. One cannot pass this subject without expressing one's admiration for the ability and energy displayed by Sir Sandford and his able assistants, as is evidenced by the monumental reports on their work, which were published by the Dominion Government, and to which the author owes much of the information in the early part of this paper. Amongst others, an instrumental survey of the route now followed by the Canadian Northern was made, and Sir Sandford recommended that route to the Government. Why this advice was disregarded, and the C.P.R., the outcome of the Confederation policy, was built over the Kicking Horse Pass will, no doubt, be disclosed some day. But however surprising such a choice may appear to the engineer, there can be no doubt that this selection has been of great benefit to the country as a whole, inasmuch as it has opened up the southern portion of British Columbia more efficiently and earlier than otherwise could have been done. Moreover, this choice left open to its younger, and consequently less vigorous rival, a route without which the latter could hardly have become a transcontinental railway as soon as it now promises to be; while the broad back of the C.P.R. is well able to carry, and its financial strength to surmount, the difficulties which the Kicking Horse route is responsible for.

The approach to the Yellowhead Pass from the east is gradual and easy; and the crux of the whole problem lies in the part between the Yellowhead and the Albreda summit, which is a water shed for the Columbia River system on one side, and the Thompson River system (that is, the Fraser River system) on the other. Hence the route leaves the Fraser only to eventually return to it again, but a glance at the map shows the gain that this gives in distance. The water flowing north from the Albreda summit is called Camp Creek, and empties into the Canoe River, a tributary of the Columbia, at a point only about four miles south of Cranberry Lake, the source of the McLennan River, a tributary of the Fraser. The divide between Cranberry Lake and Canoe River, that is, the watershed between the Fraser and the Columbia system, is only a few feet high; hence McLennan Creek, Cranberry Lake and Camp Creek form one continuous wide valley. To put it in another way:—Cranberry Lake lies in the bottom of an enormous flat bottomed bowl, which is broken, as it were, into four quarters, by the Canoe River east and west, and McLennan Creek and Camp Creek, north and south. Hence we see that the Rocky Mountain trench, here drained by the Canoe River, Cranberry Lake, McLennan Creek and the Fraser River, is the key to the situation. From the Yellowhead, the Rocky Mountain Pass and from the Albreda, the Selkirk Mountain Pass, wide, gently falling valleys connect with the trench; and Cranberry Lake Flat, which must be crossed, is the governing feature of the connection. From the Yellowhead summit to Cranberry Lake, mile 439, there is a fall of about 1,100 ft. in 60 miles. That portion of this distance, however, which governs the grade, lies between Moose Lake, mile 473, and Cranberry Lake Flats, mile 439. From Moose Lake to the east end of Cranberry Lake Flats is 25 miles and the total fall is 816 ft. This gives a continuous seven tenths grade, when due compensation is made for curvature and passing tracks, and was considered to be the economic grade for that country. Thus was fixed the ruling grade for east bound traffic for the operating division whose eastern extremity is at the Yellowhead Lake, mile 495, and the western extremity at Blue River Flat, mile 384. From Cranberry Lake the line rises with a four tenths compensated grade to Albreda Lake, mile 425, at an elevation of 2,854 ft. Since the Albreda falls at the rate of 43 ft. to the mile, a supported grade going south was inevitable, but for the sake of economy in construction it was desirable to reach the North Thompson Valley bottom as soon as possible, hence a seven tenths grade was introduced, striking the valley bottom at mile 406, or 10 miles below the mouth of the Albreda. From this point to Hell's Gate, mile 372, the Thompson falls 7 ft. to the mile and the line follows the river bottom. Thus the first operating division, ending at Blue River, has long ruling grades compensated for curvature and passing tracks, of seven tenths for eastbound, and four tenths for westbound traffic. From Hell's Gate, mile 372, to Cottonwood Flats, mile 367, the Thompson falls at the rate of 37 ft. to the mile, while the railway is again supported, dropping with a continuous four tenths compensated grade. At mile 367 it once more strikes the river bottom, which it follows to mile 353 along the Stillwater Flats, the river falling at the rate of 1.4 ft. to the mile. From the west end of Stillwater Flats to Birch Island, mile 322, a four tenths supported and compensated grade is again followed, as the river falls over the first part this distance at the rate of 13½ ft. to the mile. From Birch Island to Kamloops, mile 243, the river, whose average fall is only 3 ft. to the mile, is followed closely. From the Blue River, mile 384, to Kamloops Jct., mile 243, the starting point of the Vernon branch, is the second operating division, the eastbound grade being governed by the long supported four tenths grade referred to before. Against west bound traffic the ruling grade is two tenths per cent., less than two miles long. From the west end of Kamloops Lake, mile 218, to Lytton, mile 146, the main Thompson River is followed, the average fall being 9 ft. per mile. From Lytton, mile 145, to Hope, mile 77, the Fraser River has an average fall of 5½ ft., and from Hope to Rosedale, mile 47, 3 ft. per mile. The third operating division is from Kamloops Jct. to Boston Bar, mile 119, over which distance there are short ruling grades against eastbound traffic, of four tenths compensated for curvature. Against westbound traffic there is a four tenths grade compensated for curvature, about three miles long, at the east end of Kamloops Lake. This grade, however, if traffic demands it, can be replaced without much difficulty, by an easier one. The true ruling grade is that between the two crossings of the Fraser River south of Lytton, for this is a fixture. It is three tenths compensated and 3½ miles long. The fourth operating division is from Boston Bar to Port Mann. Against westbound traffic there are virtually no grades. While the ruling grade eastbound is fourth tenths compensated, 1.3 miles long. In the 500 miles from

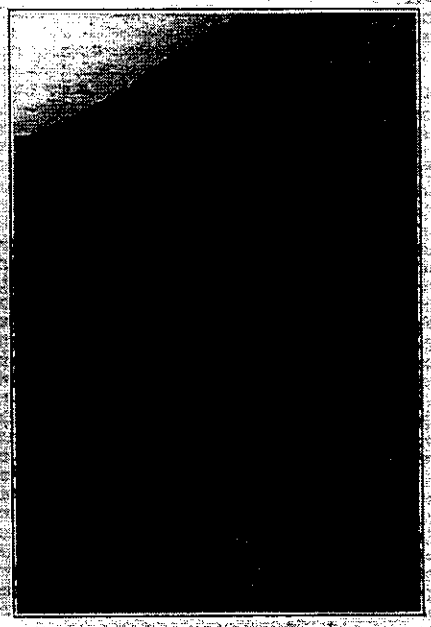
Tilton Creek Concrete Culvert, Mile 130.5, Before Fill Had Been Made.

Cisco Bridge Over Fraser River, Near Lytton, Mile 140.

FROM	TO	Miles	Eastbound trains		Westbound Trains	
			Ruling grades	Other grades	Ruling grades	Other grades
Port Mann	Boston Bar	119	.40%-6.9 Miles	.70% .1% or less	8 vel. grades level and down hill	90% level or down hill
Boston Bar	Kamloops Jct.	123	.35%-3.4 "	.80% .2% " "	.40%-3 miles	80% " " " "
Kamloops Jct.	Blue River	141	.4 %-20 "	.53% .22% " "	.2%-1.5 (Vel.)	90% " " " "
Blue River	Yellow Head	111	.2%-25.5 "	.52% .3% " "	.4%-11.3 "	72% " " " "

the Yellowhead summit to Port Mann there are only 22.3 miles of adverse grades, or 4½% of the total distance. The maximum curvature throughout is eight degrees, and this has been used as sparingly as possible.

There were no particular engineering difficulties encountered in the surveys but plenty of hard work, and even danger. The procedure was that customarily in vogue. The crux of the problem lay between Birch Island and the Yellowhead Pass. Even here the main lines are well defiled, and the alternatives few, the paramount difficulty being one of transportation and supplies. The country west of the Albreda summit was, at the time of the surveys, most readily accessible from Kamloops. This involved a pack train about 100 miles long. The physical difficulties in keeping a survey party equipped with supplies, quite apart from the strenuous work of the survey itself, makes this piece of location a most praiseworthy one. During the winter months communication was entirely cut off, except for the monthly trips of the mailman. The records of these trips are a story in themselves. The difficulties, however, were not over on the disappearance of the snow, for between that time and the rise of the rivers, which during high water are unfordable and covered large portions of the trail, there was only sufficient time for one trip of the pack train, and continuous packing could only be carried on after the floods had subsided and ceased in the autumn. Much credit is due to those who faced and



Gladwin Bluff, Above Lytton, Mile 151.

surmounted these difficulties. The first survey parties were sent out in May, 1909; construction was started from Port Mann to Hope in July, 1910; from Hope to Kamloops in Aug., 1911; from Kamloops to Birch Island in Oct., 1911; from Birch Island to the Yellowhead Pass in May, 1912; from the Yellowhead to Albreda in Aug., 1912, and from Blue River to the Albreda in May, 1913. The line should be open for operation by next autumn.

CONSTRUCTION.—We will now reverse our direction, and consider ourselves as going from west to east. For a railway passing through one of the main mountain regions of the world the work is, on the whole, extremely light. From Port Mann to Rosedale, mile 47, the grading is largely prairie work, although spurs from the main mountain range give rise to heavier work at intervals. From Rosedale to Hope, mile 77, the work becomes heavier as the valley narrows, and still more so from Hope to Yale, mile 91; but so far there is nothing calling for special comment. At Yale the canyon proper is entered, and the heaviest work on the whole railway is encountered, the heaviest mile costing $326,300, without fence, telegraph or track. From Yale to Boston Bar, 26 miles, the rock work is extremely heavy, and there are 15 rock tunnels, aggregating 3,321 ft. The rock is mostly granite, and bluff follows bluff, all with almost perpendicular faces. A great deal of this rock was shot into the river, but a surprising number of fills were successfully constructed. As the rock was largely in huge masses, partly owing to its rough nature, and partly owing to the fact that it was often separated into large blocks by natural seams, these fills are well calculated to stand even the Fraser floods. This piece of line was perhaps the most difficult one to locate and cross section. From Boston Bar eastward, gravel is frequently encountered; indeed, from mile 128 to Savona, mile 318, there is almost more steam shovel work than anything else. The heaviest yardage is in the neighborhood of Tilton Creek, mile 130. Here cuttings aggregating 414,000 cu. yds., were led to one large fill. Jackass Mountain, extending from mile 134 to 134.5, consists of massive conglomerate and shale, the yardage for this half mile was 182,000 cu. yds., with two tunnels aggregating 548 ft. One of these tunnels was, however, carried out in an enormous slide in the hill side on the night of Nov. 18, 1912, which followed a period of heavy rain about six weeks after the tunnel was finished. The formation through which the tunnel was driven was very broken. A large black shale seam about 2 ft. wide, which made an angle of about 20 degrees with the vertical, and 30 degrees with the centre line of the tunnel, crossed the line of the tunnel about one third way through from the east end, separating the country rock on the upside from an overlying rock formation on the other. This overlying material was very broken, and interspersed with soft clay. It seemed to be debris from the mountain side above, and bore no relation to the country rock. Whether the hill slid on the shale seam, or whether the clay, swollen by the heavy rains, exerted excessive pressure on the tunnel timbers, causing them to collapse, thus releasing the toe of the hill, it is impossible to say. The whole slide had been removed, and the hill side dressed to an apparently safe slope, when three weeks later, on Aug. 25, 1913, another slide of considerable magnitude occurred. This was in turn removed, and the slope redressed, leaving now an open cutting, probably safer than any other part of the mountain.

The line crosses the Fraser at Cisco to follow the north or left hand bank, thus avoiding the C.P.R. It recrosses again at Lytton, and three quarters of a mile further on crosses the mouth of the Thompson River, since it was considered less costly to build these two crossings than one large one across the Fraser, above the mouth of the Thompson. A piece of heavy work is met with at Gladwin's Bluffs, mile 149 to 151. This is a contact zone between the Coast Range Batholith and the Paleozoic Schiztose rocks, the whole traversed by many Tertiary dykes and Chonolithic intrusions. It is a particularly awkward place on which to locate. The quantities for this two miles of work are as follows:—478,946 cu. yds. of excavation and 990 lin. ft. of tunnel. The average cost per mile is $222,650, without track, telegraph or fence. Just beyond Gladwin Bluffs the line is constructed along the top of a rock cliff and at the foot of immense gravel slopes, which rise at an angle of between 1¼ and 1½ to 1 to a height of some 700 ft. This gravel, which was well cemented, was excavated by the hydraulic method; excess roadbed width being allowed, depending on the height of the face. The faces have stood splendidly, although the debris naturally accumulates at the foot of the slope, but not to a greater extent than such maintenance forces as must necessarily be employed by a railway through such mountainous country will be able to cope with. Bad bluffs were encountered at Thompson and Drynoch. The rock

Grading Chutes, Mile 30 West of Yellowhead Pass.

at Thompson was even more broken than that at Gladwin, and a huge slide has occurred which is still being removed. At mile 162 there is a heavy clay slide, which is still moving, although 350,000 cu. yds. have been removed to date (Feb. 3). There is no evidence of water seepage, and there is nothing to do but to keep on excavating until the material reaches its angle of repose. Drynoch Bluff, mile 163, was a most dangerous place on which to locate, and offered the usual difficulties in construction. It has three short tunnels and the open slope is very high, surmounted by a good deal of gravel and other debris. Crib traps have been installed at various points on this slope, but here, as in other places, constant watch must be kept by the maintenance organization. At mile 184 the line crosses on to the C.P.R. side of the Thompson river and recrosses at mile 188.5, passing direct from the bridge into a tunnel, 1,319 ft. long, in the famous Black Canyon. This formation is a black cretaceous shale and sandstone. Just east of this tunnel there is a slide similar to the one on the C.P.R. side, west of its Black Canyon tunnel. Occurring, which made its appearance about one-third of the way down the slide, was tapped by a water tunnel and led to an adjacent gully. At every high water, however, the slide moves and has moved for some [illegible] since the records were first taken. It is thought that this is due partly to saturation from the melting snow, and partly from the backing of the high water in the river, although that

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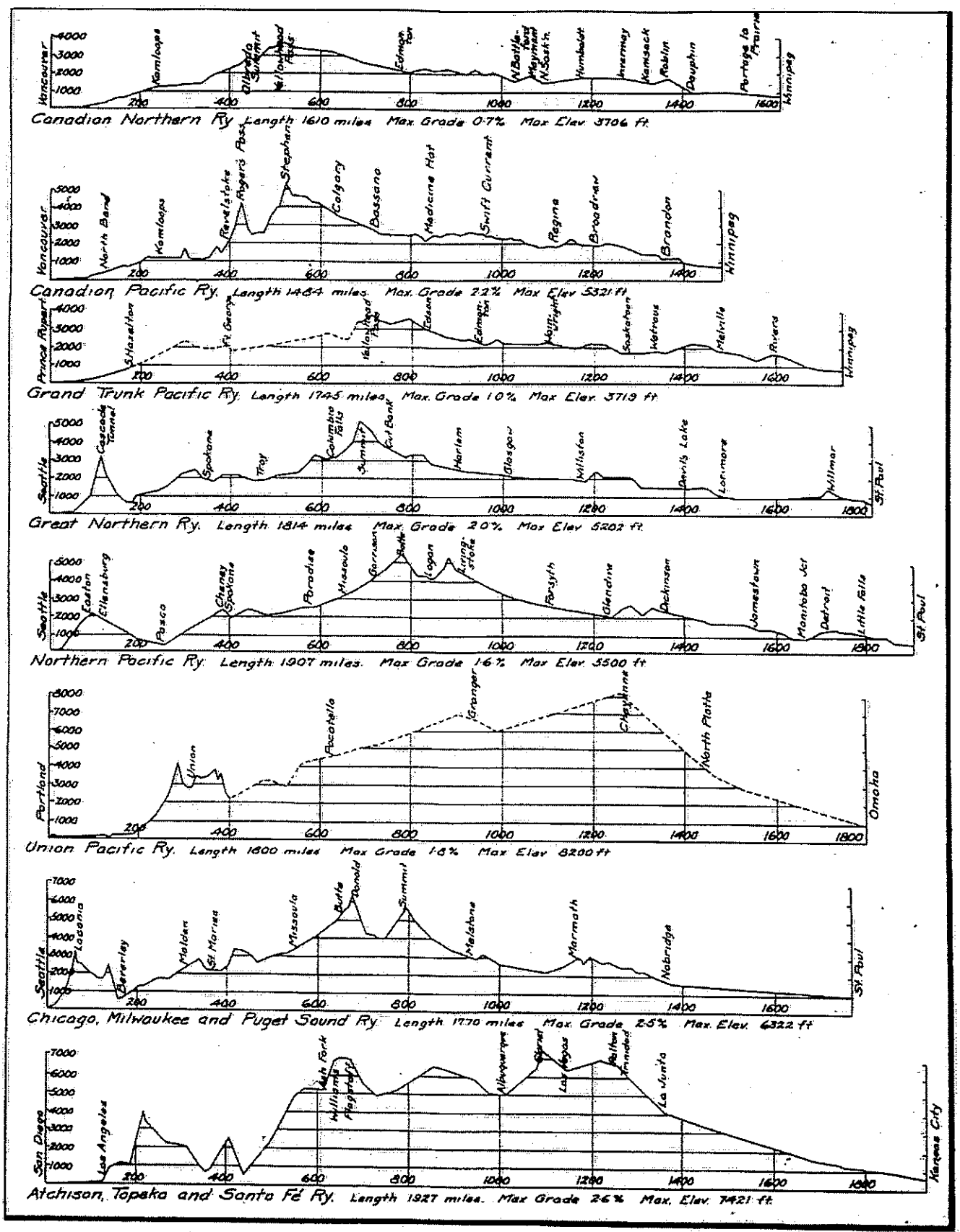

Comparative Profiles of Railways Crossing the Western Mountain Ranges.

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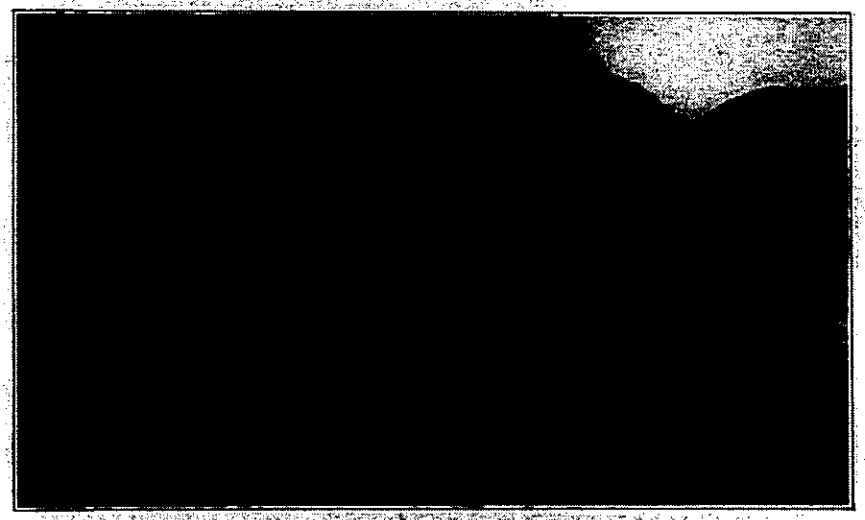
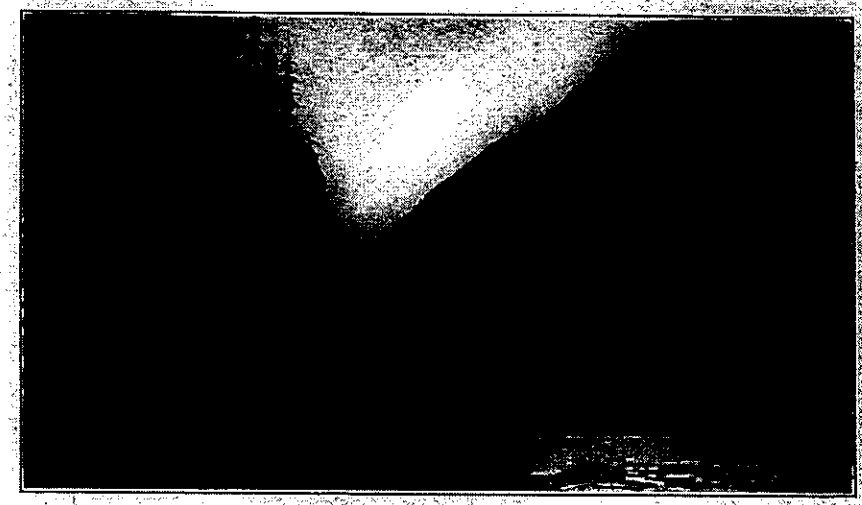
happens exactly is not yet understood. Borings showed 26 ft. of clay and then gravel, but they were not taken down through the gravel.

Some two miles further east the grade was first constructed at the foot of the bluff, partly in cut and partly in fill, the latter standing well until the flood of 1913. An extensive crib is now being constructed at this place. From Ashcroft, mile 194, to Savona, mile 218, it is almost all steam shovel work in glacial clay. Rock work is again encountered along Kamloops Lake, including a tunnel at Battle Bluffs, 2,835 ft. long. At mile 244, the line crosses to the east bank of the North Thompson. Immediately east of the bridge is the Kamloops division yard. Between Lytton and Kamloops there are three crossings and recrossings of the Thompson River, to avoid heavy clay bluffs, the work on the C.P.R. side at these places being generally very light. From Kamloops Jct., mile 243, to Birch Island, mile 324, the work is easy on the whole, although occasionally the line hits a rock slope with some severity. From Birch Island to the third crossing of the Thompson River at mile 339 there is heavy steam shovel work along the supported grade. From mile 330 to the fourth crossing at mile 351, although the work was largely steam shovel material, it was entirely carried out by hand, owing to the difficulty of getting in machinery. There is little to call for comment from here on, except to refer to the extraordinarily light work across Stillwater Flats, until the supported grade is reached at mile 360 to 376 (Canoe Landing). This is the heaviest portion of the North Thompson River work, particularly at Hell's Gate, where the river passes through a minature Fraser canyon, involving heavy rock cutting and two small tunnels. From mile 376 to the next supported grade at mile 406, the work is extraordinarily light for a mountain railway. From mile 406 to 417 extends a region of heavy sand, gravel and clay cuttings and tunnels, one of these



Mullen Bluff, Fraser Canyon, Showing Tunnel 6, Mile 98.31.

latter being 1,000 ft. long. All this work is done by hand, as it is not practicable to take in machinery. From mile 417 to the Albreda Summit, the work is again very light, indeed at the summit itself it would be cheap for prairie country. The two crossings and recrossings of the North Thompson are to avoid heavy work, and to get better alignment. The first two of these crossings are 80 ft. deck plate girders, supported on pile piers, consisting of a group of 32 piles, capped by a three course grillage of 12 by 12 timbers. This in turn is topped by a 1 in. steel plate, bored to receive the anchor bolts from the girder bearings. Placed about the piling is a timber crib pointed on the up stream and square on the other end. These cribs are not attached to the piling, but form a sleeve, and are sufficiently free of the piling to permit their sinking, as they are built up from the water surface. The tops are completed to about 5 ft. above high water and then are rock filled. The third crossing is a temporary pile bridge below the permanent crossing, which will be of concrete piers. The other two crossings are low and short, and are over wooden pile bridges. From mile 425 to Canoe River crossing at mile 436 the rock work is fairly heavy, although there are a good many gravel cuttings also. Canoe River is crossed on a steel viaduct. From this point to mile 445 the work would be light even on the prairies. No really heavy work is encountered until the Fraser Valley is entered at mile 453. From this point the Grand Trunk Pacific is paralleled and the two roads are never more than a few hundred yards apart. From mile 456 to Moose Lake, mile 472, there are some very heavy rock cuttings. Difficulties were particularly great for the last ten of these miles, owing to the fact that the grade had to be constructed immediately above the G.T.P.R., then in operation. The two lines run on the north shore of Moose Lake, side by side as double track. From Moose Lake the G.T.P.R. falls with a 1%, and the C.N.R. with a seven tenths compensated grade. Hence the two lines rapidly diverge in elevation but remain very close in alignment. All mucking over this portion from the C.N.R. had to be carried across the



Hells Gate, Fraser Canyon, Mile 130.8.

G.T.P.R. on trestles and shot direct into the Fraser River. Six of these trestles and chutes were constructed. From Moose Lake to Yellowhead the work calls for no special comment, as it is light, and the valley wide and uniform enough to provide an easy route for both railways.

There is not much in this work of interest to railway engineers, except the bridging; the steam shovel work in gravel and clay, and the resulting slopes; the rock blasting; the classification. As the steel bridges were designed and entirely under the supervision of Waddell and Harrington, consulting engineers, the author does not propose to make any reference to them, beyond showing some views in the hope that a paper will be read some day before the Canadian Society of Civil Engineers by a member of Waddell and Harrington's firm.

In regard to the steam shovel work in gravel and clay, and the resulting slopes, no one would deny the value of steam shovels, or their necessity, if such work as is now being described, is to be carried on economically and expeditiously. At the same time the engineer would be delighted to dispense with them, were that possible, unless the material was being excavated to a final angle of repose. In some cases this was done, but speaking generally such a plan is a counsel of perfection, and not economically practicable. The difference in yardage between 1 to 1 slopes and 1½ to 1 slopes, on side hills that extend upwards for hundreds of feet, is self evident. Moreover, in most gravel cuttings, a 1 to 1 slope, if not permanent, would give very little trouble for a number of years, when it could be economically handled by steam shovels with mainline equipment. But when 1 to 1 quantities are dug by steam shovel and the slopes left standing nearly plumb, it means that the company has frequently to face comparatively heavy further excavation expenditure after the line is opened. Sometimes a portion of the slopes

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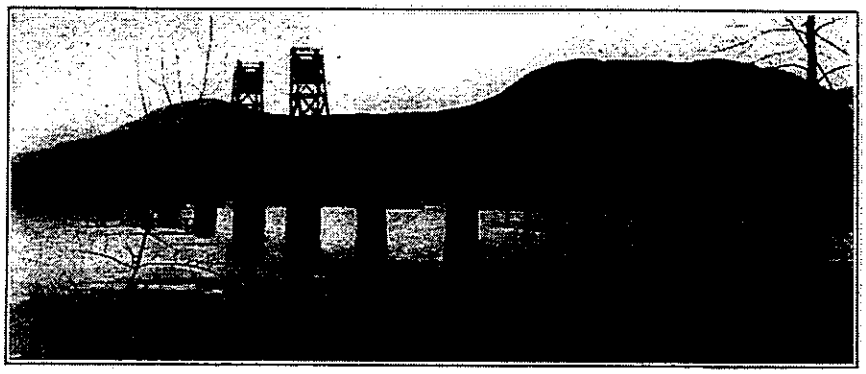
in steam shovel work was lightened by having the top hand sloped, but in the more cemented gravels and harder clays, the slope was left as dug by the steam shovels. Undoubtedly, all things being equal, unless the quantities to be excavated in the first instance are those contained by slopes at the angle of repose, hand slope work is infinitely more satisfactory than steam shovel work. Most of the gravel and clay lies in the dry belt, otherwise it may be supposed there would be little left. Hence the conditions on this construction were unusually favorable for the safety of undressed slopes.

One of the main difficulties the railway engineer encounters is to prevent the contractor from using too much powder. Such work as is here described is usually carried out by stationmen working under sub or sub-sub contractors of the main contracting company. The stationman, who seems to live in a state of perpetual hope, is strongly tempted to over shoot, with a view to breaking up his rock as small as possible, and to save handling, where, as was largely the case on this work, the material was wasted direct into the river, whose course the railway is following. That this may result in over-break the stationman is well aware, but his faith and hope in the engineer's charity will induce him to chance the disallowing of the over-break. If allowed, he stands to gain heavily. Besides there are seams, which with a little flattery and talk about the experience of the engineer, etc., etc., he may hope to pass off as the cause of the over-break. Indeed the engineer will often be in a quandary to know whether the rock, even though lightly shot, would not have broken to a clearly indicated seam. The sub contractor has little inducement to check the stationman from overshooting, for the more powder the stationman uses, the more profit the sub contractor stands to make. If no more than the estimated yardage is paid for, the sub contractor makes at least as much profit as he set out to make, and if over-break is included he is that much to the good. Thus with blarney and bluster pressure is brought to bear on the engineer on all sides, which it is frequently very hard to resist, especially by the younger members of the profession. The Canadian Society of Civil Engineers excludes in its Standard Specifications the use of powder in large blasts in seams, drifts, shafts and coyote holes. This again is merely a counsel of perfection, nor would its strict enforcement tend to economy. The remedy must always be in the judgment and experience of the engineer in charge, who should make a point of at once warning the contractor against the results of heavy shooting, as soon as he sees any signs of such a course being proceeded with, and hold him strictly to account if his warnings and instructions are neglected. From the experience of this work the author is strengthened in his convictions that more than from 1 lb to 1¼ lbs. of explosive to a cubic yard of excavation is needed only in very rare cases; and in ordinary sandstone and limestone, if at all seamed, ¾ lb. per yard would generally be sufficient. For shales ½ lb. or less is plenty.

From Port Mann to Hope, and from Kamloops to the Yellowhead Pass, four classifications were used in accordance with the C.N.R. standards, as to which no special comment is necessary, except as to the definition of solid rock, which is the same through the whole work. From Hope to Kamloops there are only two classifications,



Deck Girder Bridge, With Lift Span, Over North Thompson River, Near Kamloops.

which read as follows:—"All stones or boulders found in excavation measuring more than 27 cu. ft., and all solid quarry stone requiring blasting in order to remove it, shall be termed 'solid rock.'" "All other materials other than solid rock as described above, shall be termed 'all other materials,' and paid for at the schedule rate for 'all other materials.'" The solid rock definition is a great deal more definite than most, and leaves very little room for the questioning of engineers' decisions. It may be thought at first sight that this solid rock definition and the two material classifications would remove many of the classification difficulties, which all engineers have to face. In practice, however, even through country where as in this case the material can be broadly classed as rock and gravel or clay, grades of rock are met with, which although strictly coming under the "other material" classification, must in equity, be allowed for in part as solid rock, and one is again left with the conclusion that no specification can be drawn up which does not require to be interpreted on the broad grounds of professional intelligence and common sense.

The foregoing paper was read before the Canadian Society of Civil Engineers, Vancouver branch, recently. We are indebted to T. H. White, M. Can. Soc. C.E., Chief Engineer, C.N.P.R., for the diagrammatic profiles accompanying the paper, and for the photograph of the Kamloops bridge; also to the author of the paper, Mr. Nimmo, for the photographs from which the other illustrations have been made.

Comparitive Profiles. — Following are figures relating to the comparative diagrammatic profiles given of eight transcontinental railways:—

	Maximum Grade.	Maximum Elevation.	Length Miles.
Canadian Northern	0.7%	3,706 ft.	1,610
Canadian Pacific	2.2%	5,321 ft.	1,484
Grand Trunk Pacific	1.0%	3,719 ft.	1,746
Great Northern	2.0%	5,202 ft.	1,814
Northern Pacific	1.6%	5,500 ft.	1,907
Union Pacific	1.3%	8,200 ft.	1,800
Chicago, Milwaukee and Puget Sound	2.5%	6,322 ft.	1,770
Atchison, Topeka and Santa Fe	2.6%	7,421 ft.	1,927

Tilton Creek Culvert. — Mr. Nimmo has given us the following data about this culvert:—Height from grade to top of culvert at the junction with the tunnel, 137 ft. The culvert is 21 ft. 7 ins. wide, 19¾ ft. high, giving an opening of 312 sq. ft. The tunnel was taken out a foot wider than the culvert to allow for future lining. The length of tunnel is 300 lin. ft., and of the culvert, 226 ft. There are 3,150 cu. yds. concrete in culvert, and 90 cu. yds. in tunnel lining. The total cost of the water tunnel and culvert was about $70,000.

Kamloops Bridge.—This structure, over the North Thompson River at Kamloops, is a deck girder bridge, 1,209 ft. long, and has a deck girder lift span 93 ft. long. There are 12 fixed spans, also of 93 ft. length. Approaches at both ends of the bridge, of timber trestle construction, total about 1,100 ft. The lift span weighs 118 tons, and is fully counterweighted. The sixteen 1¼ in. lifting cables are equalized in the attachment to the span. Centring castings provide for keeping the span in proper alignment as it comes down to bearing, and also take the longitudinal braking thrust. The lift of the span is 53 ft., giving a 55 ft. clearance above high water. The motor is capable of raising the span in 100 seconds. The lifting power is a gasoline engine, which, with all the machinery, except the operator's levers, is located below the deck, at the middle. Limit switches coming into operation near the ends of travel of the span control the igniter circuit of the engine.

The bridge was designed by Waddell and Harrington, of Kansas City, Mo. The lift span is built with the arrangement and details used by them in their various lift bridges built in recent years.

Imperial Service Medals for long service have been awarded to Canadian Government Railways employes, as follows:—J. Anderson, foreman, Moncton, N.B.; T. Bowes, shed foreman, Halifax, N.S.; J. Enman, station master, Summerside, P.E.I.; F. E. Harrington, ticket agent, St. John, N. B.; J. W. Henderson, conductor, Moncton, N.B.; R. Howell, machine man, Moncton, N.B.; J. Kennedy, machinist, Moncton, N. B.; W. M. Kingston, baggage master, St. John, N.B.; D. LeBlanc, track man, Moncton, N.B.; D. H. Lockhart, fitter, Moncton, N.B.; T. McCurdy, section foreman, New Mills, N.B.; D. McKenzie, fitter, Sydney, N.S.; A. McKim, baggage man, Moncton, N.B.; J. A. McMullan, track foreman, Pugwash, N.S.; J. Martin, station master, St. Fabien, N.B.; D. Montgomery, station agent, Georgetown, P.E.I.; F. Morin, section foreman; G. Murray, foreman carpenter, Truro, N.S.; P. Murray, spring maker, Moncton, N.B.; A. Ormiston, general foreman, Truro, N.S.; J. Patterson, track master, Campbellton, N.B.; A. Patterson, seamstress, Halifax, N.S.; J. Royer, baggage master, Campbellton, N.B.; J. Scott, tank man, Alton, N. S.; G. Souci, conductor, Riviere du Loup, Que.; W. Spear, freight checker, Sussex, N. B.; D. Stewart, repairer, Mulgrave, N.S.; J. Stewart, repairer, Mulgrave, N.S.; J. Stratton, engine man, Moncton, N.B.; J. Wood, section man, Kent Jct., N.B.; and C. Wood, section man, Kent Jct., N.B.

The preservative value of salt is said to have been demonstrated in the Great Salt Lake district of Utah, where, in the replacement of a timber trestle the engineers found the piles perfectly sound after 43 years' service. The same action is not met with in ocean waters, as the latter are not sufficiently strong, the Great Salt Lake water being practically a saturate solution.

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The Dominion Parliament has incorporat a company with this title to build a railw from Naas River, on the Pacific Coast, Prince Albert, Sask., by a route describ in a former issue. (Mar., pg. 121.)

Pacific and Hudson Bay Ry.—The Boa of Railway Commissioners has approv location plans for this projected railw from Bella Coola, easterly to Hagensbor B.C., 10.00 miles. (Jan., pg. 22.)

Pacific Great Eastern Ry.—The first po tion of the line, viz.: from Vancouver Fort George, B. C., has been under co struction for nearly two years, and tw sections are in operation. The first is fro North Vancouver to Dundarave, 4.5 mile and the second is from Squamish, the ne name given to Newport, to Cheakamus, miles, which includes the seven miles track laid by the old Howe Sound ar Northern Ry. The recent decision of th British Columbia Legislature to extend th line from Fort George to the Peace Riv country and to have the extension ready handle traffic through to the Alber boundary in 1916, has apparently given great impetus to construction. It has bee announced that 10,000 men will be di tributed along the line between Vancouv and Fort George. The construction is we advanced to Kelly Lake, 200 miles fro Vancouver, and we are officially advise that contracts have been let for the lin southerly from Fort George, to Kelly Lak to H. E. Carleton & Co., 25 miles; A. I Griffin & Co., 25 miles; and Burns, Jorda & Co., 50 miles. These contractors hav just completed subcontracts on the G. T Pacific Ry. west of Fort George, and it wa reported, April 3, that their outfits wer being transferred to the P. G. E. route. Th points between which these contractor will work had not been decided at the dat of our advice. The construction on the 28 miles between Kelly Lake and Fort Georg is reported to be light. The main points o the route with distances from Vancouve are:—Squamish, 43 miles; Pemberto Meadows, 100 miles; Lillooet, 163 miles Clinton, 210 miles; Lac la Hache, 235 miles Quesnel, 395 miles; Fort George, 480 miles

In connection with the extension of th line from Fort George to the Peace Rive Valley, where a junction would be mad with the Edmonton, Dunvegan and Britis Columbia Ry., preliminary surveys hav been completed, and locating parties ar going over the 330 miles of the route. Th location for some miles out of Fort Georg has been settled, and it is expected tha contracts for grading the first 100 mile will be let at once. The line will start a the confluence of the Salmon and Frase rivers, following the first named to Summi Lake, thence along the Crooked Rive valley to Fort McLeod, and McLeod Lake thence along the Missinchurka Rive through Pine Pass and along the Pin River to Hudson's Hope, following th Peace River to the Alberta boundary. Th distance from Fort George to Pine Rive Pass is 142 miles, and from Fort George t the Alberta boundary, 330 miles.

In preparation for the construction o docks for ocean going vessels and railroa terminals at Squamish, which is the poin in Howe Sound where the line leaves tide water, the company is reclaiming a tract o land about a mile long. Foreshore right along the waterfront were recently granted to the railway company by the Dominion Government, conditional on the expenditur by the company of $2,000,000 in improving the harbor. The dredging and refilling t be carried out this year at Squamish are t cost about $200,000. (April, pg. 166.)

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Electric Railway Department

Electrical Equipment for Mount Royal Tunnel, Canadian Northern Railway.

Canadian Railway and Marine World, for Dec., 1913, contained a general description of the electric locomotives for Mount Royal tunnel and the Montreal terminal. Following is a more detailed account of some of the apparatus on the locomotives, and also a description of the 8 multiple unit car equipments and substation apparatus:

LOCOMOTIVES.—The motors on each locomotive will consist of 4 CGE-228 commutating pole type motors. These have a standard rating of 315 h.p. each, or a total of 1260 h.p. per locomotive. The magnetic frame will be practically octagonal in shape, and of the box type construction. The frame is provided with bored openings at each end through which the armature, pole pieces, and field coils can be inserted or removed. The frame heads carrying the armature shaft bearings will be supported in the recess ends of the magnet frame, and will be held in place by tap bolts, which will be securely locked against turning. In each head will be two tap holes diametrically opposite, and when bolts are screwed into these holes the frame head will be forced off.

The armature bearing housings containing the bearing sleeves will have liberal sized pockets for holding oily waste, which will be held against the shaft on the low pressure side of the bearing. The heads will be provided with auxiliary oil wells for gauging the depth of the oil and inserting new oil. The 4 exciting field coils will be located at the sides, top and bottom of the frame, and the 4 commutating coils will be located in the corners of the frame at an angle of approximately 45 degrees to the horizontal. The motor frames will have large hand holes for inspection at each end, which will be closed by covers with gaskets. The opening through the frame over the commutator will be large and inclined at an angle, allowing easy access to the commutator and brush holders. The cover over the commutator will be held in place by a spring locking device, no part of which will project above the top of the motor.

The armature bearing linings will be made of bearing metal with a thin layer of babbit sweated to the bearing shell. The armature bearings will be lubricated by means of oil and waste, and the waste will be held against the shaft on the low pressure side of the bearing. Waste oil from the armature bearing will be prevented from entering the interior of the motor by a series of oil deflectors which will throw it into grooves in the heads from which it is conducted away. Axle caps will be tongued and bolted to machined surfaces on the frame, which will be inclined at an angle of 60 degrees to the horizontal. The bearings will be lubricated by means of oil and waste, and the caps will be provided with auxiliary oil wells. The motor will provide a 7 in. diameter of axle in the motor bearings.

The field coils will be all wound with strip copper, the whole being mummified and insulated with varnished cambric and heavy tape. The armature core will be built up of soft iron laminations and mounted on a steel spider. The laminations will be keyed to the spider, and the spider in turn keyed to the armature shaft. The armature will be so constructed that the shaft may be removed without disturbing the commutator or windings, as the commutator and armature heads will all be located on the spider. The armature is especially designed to give thorough ventilation, so that the forced draught will circulate through longitudinal holes in the armature and over the surfaces of the armature and field coils. The armature shaft will be of special high grade steel, and the keys of treated steel, the thrust collars being made from steel drop forgings shrunk on the shaft.

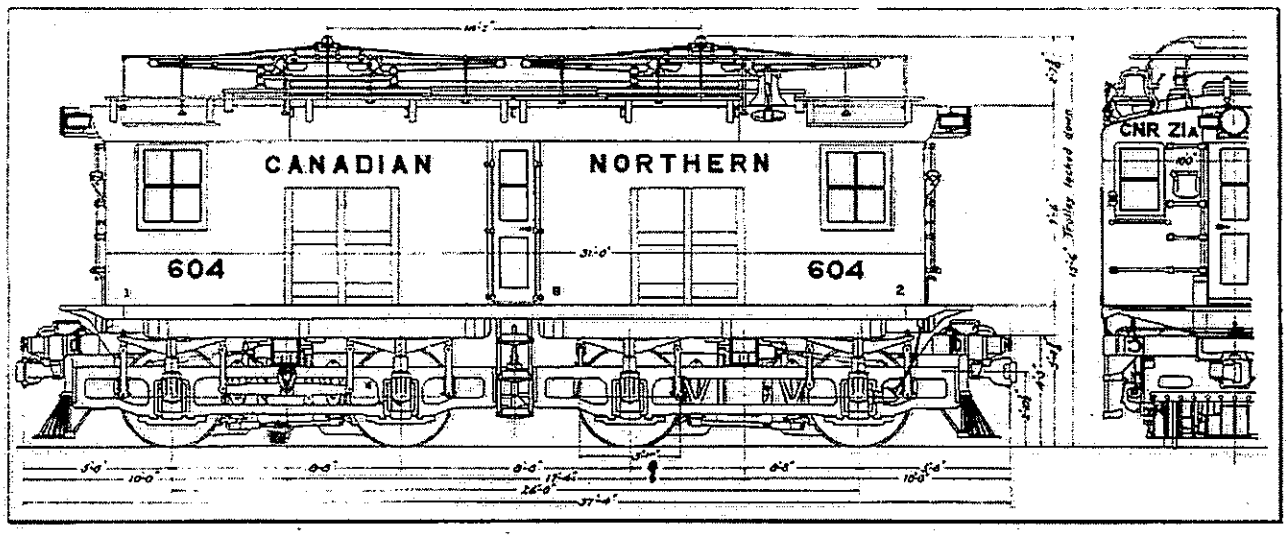
The commutator shell and cap will have the surfaces accurately machined and insulated with the best grade of mica. The commutator bars will be of hard, drawn copper, machined accurately to gauge, and will be insulated from each other by the best grade of mica. The commutator will be mounted directly on the spider and may be removed without disturbing the windings or punchings.

Each brush holder will rest on a support which will consist of two mica insulated studs pressed into a drop forging. The support will be secured to the frame against accurately machined seats by tap bolts accessible from the outside of the motor frame. The brush holder bodies will be secured to the brush holder supports on accurately machined seats. The brushes will slide in finished ways and will be pressed against the commutator by fingers which will give a practically uniform pressure throughout the working range of the brushes. The arrangement of springs actuating the fingers is such that there will be but slight pressure on the pins on which the fingers pivot. This will prevent any tendency of the fingers to stick on the pins and will reduce wear to a minimum.

The magnet frame will carry an opening for a flexible connection to a low pressure blower. Air will be forced in at the opposite end from the commutator, through the field coils and over the armature, then under the commutator through the armature heads and punchings. Gears will be of rolled steel forgings and the pinions of special treated high grade steel. Each motor will have two pinions, one mounted on each end of the armature shaft. Each set of gears and pinions will have 4 in. faces and the teeth will be cut to a diametral pitch of 2½ ins.

The contactors which will handle the main current will have the operating coils energized from 125 v. supply from a motor generator set, and will be removed by special insulation some distance from the contact tips which will carry the 2,400 v. energy. An insulating wooden rod will connect the contact lever to the solenoid plunger, the principle of operation of these contactors being similar to 600 v. type.

The arc chute will have a very powerful magnetic blow out and arching horns of considerable length extending from the contact tips, consequently, the ends of the arc will move rapidly over comparatively cold metal, causing a minimum burning of arc chute sides are a positive rupturing of the arc.



Side and End Elevations, Electric Locomotives, Mount Royal Tunnel.

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The main motor and auxiliary fuse boxes will all be provided with a very effective magnetic blow out, which will be energized by the current passing through the fuse, and have hinged covers to facilitate fuse renewals. Fuses will be of the copper ribbon type, having a hole in the centre to localize the heating. These fuse boxes will be all

Electric Locomotive of Similar Type to those ordered for Mount Royal Tunnel.

arranged to blow into a common chamber arranged to take care of the arc.

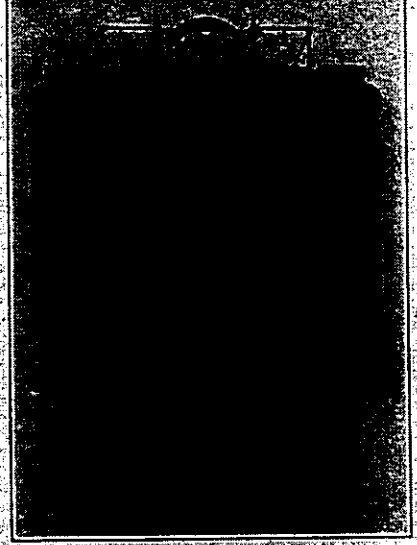
The motor generator set will consist of a 125 v. generator of suitable size to take care of lights, head light and control circuits, direct connected to and driven by a 2,400 v. motor having two 1,200 v. commutators. A fan for providing air to blow through the main motors will be direct connected to one end of the motor shaft.

MULTIPLE UNIT CAR EQUIPMENT.—Each of the 8 multiple unit cars will be supplied with 4 CGE-239 motors, of the commutating pole type, fully ventilated, wound for 1,200 v. and insulated for 2,400 v. Two of these motors will be permanently connected in series for 2,400 v. operation. Their standard rating will be 125 h.p. each, or a total of 500 h.p. per car. In the construction of these fully ventilated motors, the pinion end frame will be provided with a ring which will divert the air discharge from the armature fan through the openings in the head, while the incoming air will be drawn through a screened intake. This construction will insure a definite longitudinal circulation of air through the whole interior of the motor.

The Sprague GE type M multiple unit control will be provided, the design arrangement and construction being such that it will be equally well adapted for either single car or train operation. The control equipment will include a motor generator set for supplying 600 v. current for the control circuits, air compressor and lights. This set will consist of 2 1,200 v. motors, operating in series at 2,400 v., direct connected to a 600 v. generator.

The construction of the motors and control apparatus will be essentially of the same general type as for the corresponding items used on the electric locomotive equipments. The method of heating the cars will be very satisfactory on account of the excellent distribution of hot air secured. The heating equipment will consist of a heating unit, blower and regulating mechanism, the controlling switch and thermostat of the regulating mechanism being arranged for operation from the 600 v. supply. Air will be forced over the heating unit and distributed to the car through air ducts along the sides of the car.

SUBSTATION EQUIPMENT. — Power will be purchased at 62½ cycles 11,000 v., and the present equipment of the substation, which will be located near the west portal of the tunnel, will consist of 2 1,500



End View, Electric Locomotive.

k. w. C.G.E. motor generator sets. Each of these sets will be four bearing, and consist of a 2,750 k.w. compound wound commutating pole generators, wound for 1,200 v. and insulated for 2,400 v., direct connected to 11,000 v. synchronous motor. The generators will be provided with pole face windings, and will be capable of carrying extremely heavy overloads, the overload capacity of each set being 200% load for one half hour and 300% load for 5 minutes. Three bearing 125 v. motor generator exciter sets will be supplied, each 125 v. 60 k.w. compound wound commutating pole generator being driven by a 550 v. 3 phase induction motor. The switchboard will consist of 32 panels of natural black slate and be 58 ft. long over all. The switchboard will make provision for considerable future extension.

All the apparatus above mentioned is being furnished by the Canadian General Electric Co.

Electric Railway Finance, Meetings, Etc.

Brantford St. Ry.—Grand Valley Ry.—The matters connected with the settlement of the litigation arising out of the affairs of the company in which the City of Brantford, Ont., is interested, were mentioned in the Second Appellate Division of the Ontario High Court, May 4. It was reported that the settlement negotiations were proceeding satisfactorily, and the cases were further enlarged.

The Brantford City Council, on May 4, finally passed the bylaw to raise $270,000 by debentures for the purchase of these lines.

British Columbia Electric Ry., and allied companies.—Gross earnings for March, $717,251; operating expenses, maintenance, etc., $516,007; net earnings, $201,244, against $720,493 gross earnings; $520,667 operating expenses, maintenance, etc.; $199,826 net earnings, for March, 1913. Aggregate gross earnings for nine months ended Mar. 31, $6,752,082; net earnings, $1,828,859, against $6,402,921 aggregate gross earnings; $1,826,664 net earnings for same period 1912-13.

Calgary Municipal Ry.—The following table, prepared by Commissioner Graves, shows the revenues to April 30, and the expenses to Mar. 31:—

	Revenue.	Opr. Exp.	Revenue per car mile.	Opr. Exp. per car mile.
1912—				
Jan.	$37,575.90	$23,370.98	27.752	17.261
Feb.	35,178.06	28,819.59	26.636	21.832
March	40,051.30	24,825.71	27.328	17.041
April	43,887.50			
	$155,592.75	$76,716.58	82.216	58.134
1913—				
Jan.	$38,738.00	$44,893.07	24.139	19.099
Feb.	51,621.00	40,005.85	23.594	18.359
March	58,294.85	42,659.92	24.023	18.359
April	60,646.45			
	$227,310.30	$127,558.84	71.856	55.041
1914—				
Jan.	$57,640.30	$53,238.93	20.484	18.920
Feb.	52,062.95	44,398.53	20.747	17.693
March	55,606.70	47,480.43	21.019	17.626
April	57,025.70			
	$222,336.55	$145,117.88	82.250	54.343

Cape Breton Electric Co.—Gross earnings for March, $28,550.60; operating expenses and taxes $16,357.81; net earnings $10,192.79; interest charges $5,249.39; balance $4,943.40; bond sinking improvement funds $1,190; balance for reserves, depreciation, etc., $3,753.40, against $28,099.27 gross earnings; $15,965.33 operating expenses, taxes, etc.; $12,133.54 net earnings; $4,891.96 interest charges; $7,241.58 balance; $1,190 bond sinking and improvement funds; $6,051.58 balance for reserves, depreciation, etc., for Mar., 1913. Aggregate gross earnings for three months ended Mar. 31, $81,683.87; net earnings, $31,015.16; interest charges, bond sinking and improvement

JUNE 1914

Canadian Northern Railway Construction, Betterments, Etc.

Sir Donald Mann, Vice President, in an interview, June 13, is reported to have said that now the bond guarantee has been sanctioned by the Dominion Parliament, it is expected that all the money required for the completion of the company's undertaking will be raised. Financial conditions, however, change from day to day, but according to present indications the money will be obtained. In the meantime the company will go ahead with all the construction in hand all over the system, and will proceed with such betterments and improvements as are necessary. Some of this work has been held back pending the conclusion of the financial arrangements, but it will now all be proceeded with. It is expected that all the sections of the transcontinental line will be connected within a year, ready for operation. Traffic will be started on the Toronto-Ottawa line very shortly; and the Montreal-Ottawa-Port Arthur line will be pushed forward vigorously. About 300 miles of the main line in the prairie provinces will be relaid with heavier rails, and the remaining mileage will be relaid in 1915. The whole of the line will then have been laid with these heavy rails tieing in with the new construction now going on. The rails released will be used on branch lines.

It was reported, June 13, that an order had been placed with the Dominion Steel Co. for 45,000 tons of steel rails.

Mount Royal Tunnel and Terminal Co.—The "break up" stage of construction on the main part of the Mount Royal tunnel was completed May 31, and the excavation of the tunnel on the remaining section under the city streets and on about 700 ft. at the western portal is in progress. The excavation at the station site is being progressed with, a depth of over 20 ft. having been reached. The site will have to be excavated to a depth of 35 ft. A plant has been erected in the Model City for manufacturing concrete blocks to be used for the lining of the tunnel, a work which it is expected to start at an early date. Sir William Mackenzie, D. B. Hanna, H. K. Wicksteed, and L. C. Fritch, paid a visit of inspection to the tunnel works, June 12.

Canadian Northern Ontario Ry.—It was announced that a regular through passenger train service would be put in operation between Toronto and Ottawa, June 29, replacing the previous services.

A passenger train service was put in operation on the spur line, completed four years ago, from Udney, on the Toronto-Sudbury line, into Orillia, June 13. The line is about 10 miles long. Press states it is intended to build an extension of this line from Orillia, round the west side of Lake Couchiching, rejoining the Toronto-Sudbury line at Hamlet, thereby enabling the company's trains to run through Orillia.

Canadian Northern Ry.—While no official announcement has been made as to the season's work, it is said that all the construction work in hand will be pushed forward to completion. Arrangements are being made, it is said, to accelerate all the construction work on the branch lines, and to push forward ballasting and other finishing up work on the lines on which track was laid last year. The transcontinental line work to the Albreda Summit is being pushed. The details of the betterment works to be done on the various lines west of Port Arthur, Ont., are being settled.

Application is being made to the Board of Railway Commissioners for authority to build a spur line from between Harold and Vickers streets, Fort William, northerly, for industrial purposes.

Representatives of the Yorkton, Sask., Board of Trade, reported, recently, that they had been assured by the company's officials at Winnipeg, that the laying of steel on the branch through Yorkton to Willowbrook will be completed at as early a date as possible, and that Yorkton will be made a divisional point.

The Mayor of Medicine Hat, Alberta, is reported to have received a telegram from Sir William Mackenzie to the effect that grading will be started on the line from Hanna, on the Saskatoon-Calgary line, into Medicine Hat, Alta., about 100 miles, in July. The line from Saskatoon and the line from Vegreville effect a junction at Drumheller, from which place there is a single line into Calgary.

It is reported that as soon as ballasting is completed on the Vegreville-Calgary line a daily train service will be put in operation.

The Treasurer of Alberta reports that he has received the balance of the $6,500,000 received for the bonds of the C.N. Western Ry. This is to be used for branch lines under construction, or to be constructed in the Province. Details of the several lines and of the work done on each were given in our June issue.

Canadian Northern Pacific Ry.—The Premier of British Columbia is reported to have said in a recent speech that this line is being built to a higher standard than called for in the specifications. When the construction of the line was under consideration three routes were looked into, one over the Hope Mountains, one from Howe Sound, and the present one. The latter was selected as offering the best gradients, and furnishing transportation facilities where most required. The fact that the C.P.R. is proceeding with its important second track work, and gradient reduction work, shows the importance of this route. The construction of the important bridge at Cisco was expected to be completed by July 31, after which track laying could be proceeded with along the Thompson River. This bridge is 910 ft. long, and is about the biggest one on the line.

S. K. Sykes, of the company's engineering staff, completed an inspection of the line to the Albreda Summit, June 12. The principal grading yet to be done is along the North Thompson River, where about 80% has been completed. The bridge building is being delayed by scarcity of labor.

Vancouver Island.—It is reported that grading on the Alberni line has been completed to mileage 135. Two routes are under construction from mileage 135 to 140, and grading will be gone on with as soon as it has been decided which route will be adopted. The substructures for the bridges are being put in, and the steel work is being assembled. It is expected that tracklaying will be started on an early day. (June, pg. 272.)

Telephone Dispatching on Intercolonial Ry.—The Dominion Parliament has voted $64,000 for the installation of telephones in connection with train dispatching on the Intercolonial Ry. The acting Minister of Railways stated that the amount was sufficient to cover the system between St. John, N.B., and Truro, N.S. The contract has been awarded to the Hall Switch and Signal Co., for the installation between Moncton and St. John, N.B., and tenders are under consideration for the extension from Moncton to Truro.

July 1914

Steel Multiple Unit Cars for Mount Royal Tunnel.

The C.N.R. has ordered 8 all-steel, electrically operated, multiple unit cars for suburban service through its tunnel under Mount Royal, Montreal.

In the underframing, a plan of which is given herewith, the central box girder construction will comprise two 9 in. 15 lb. channels, 64 ft. 4¼ ins. long, spaced 16¾ ins. back to back, and fitted with a top cover plate, 28 by ½ ins. by 62 ft. 11⅞ ins. long, a main bottom cover plate 24 by ⅜ ins. by 60 ft. 8½ ins. long, and two platform cover plates 24 by ⅜ by 13 ft. 11¾ ins. long. This box girder will extend from end to end of the car, with cast steel buffer castings on the ends. Where the webs of the channels are cut, the cross-sectional area of the original girder will be maintained by the use of four 2¾ by 2¾ by ⅜ in. angles. This construction is all shown in the plan. The centre filler at the centre plate is to be of cast steel, and the centre plate is to be of C.N.R. standard contour, to take the standard malleable iron centre plate used on C.N.R. passenger trucks. This centre girder will be assembled with the bottom of the sills upwards, and allowed to deflect, so that when reversed the camber will be allowed to straighten out by the weight of the metal. The body end sills will be built up of structural shapes, which are to be 1¾ by 4⅛ in. long leaf yellow pine, B.C. fir or white ash. At the belt rail, the sheeting is to be further stiffened and tied in conjunction with the 3-16 in. pressed steel sash rests, by a 4 by ½ in. bar, extending the full length of the body in one place. Above the belt rail, the main piers will be fitted with steel casings, with the outer end portions rivetted on and formed to serve as sash stops. The window posts are to be encased on the outside with a U-shaped plate of ⅛ in. steel, forming the sash stop.

The corner posts are to be built of 3 by 3 in. angles, with 3-16 in. pressed steel cover plate, extending around and over the side and end sheets. The door posts will consist of 4 in. channels, having casings of 3-16 in. pressed steel, which will include and secure the end sheets and door finish inside the car. The belt rail will be of 3-16 in. pressed steel plate. The side plate will be of 3 by 3 by 3-16 in. angles, continuous in one piece, the full length of the body, each side, and fitted with extensions each end, to include and form the vestibule face carline. The letter board is to be ⅛ in. steel plate, rivetted to the side plates, and stiffened on the lower edge by a 1 by 1⅛ by ⅛ in. angle.

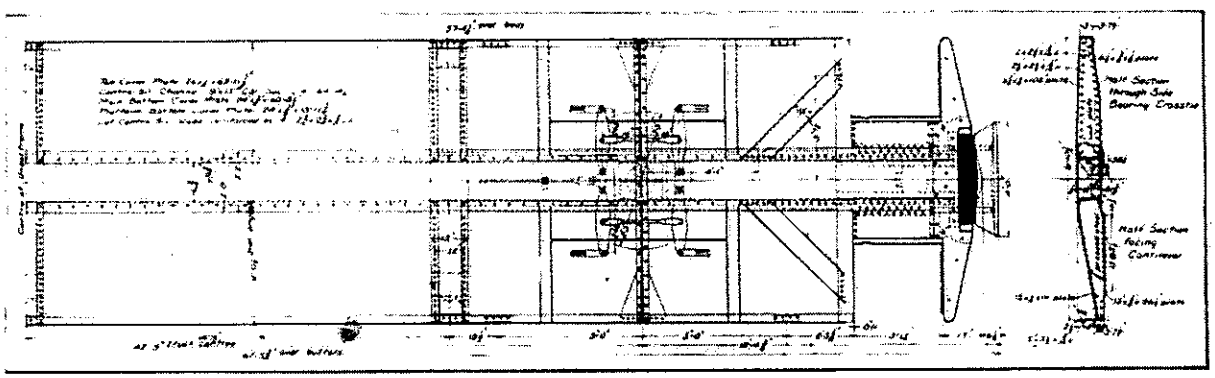
The sash rests will be of 3-16 in. plate, having a continuous stiffener the full length of the body in one piece of 4 by ½ in. steel, bevelled on the top edge to suit the slope of the sash rest. The side sheets or plates are to be 0.11 in. thick, preferably cold rolled, and to be coated with a layer of cork paint on the inside when applied. The outside roofing is to be of steel plate, 0.09 in. thick, coated inside with cork paint, and supported on channel shaped pressed steel carlines ⅛ in. thick, except the three carlines supporting the pantograph, which will be of 3-16 in. pressed steel. The roof plates will be secured by ¼ in. rivets, with the plate edges butted and welded together, and all the rivets sweated and soldered so as to be watertight. The eaves moulding will be of ⅛ in. pressed steel. The roof frame will be braced longitudinally by seven stringers, 1 in. thick by 1¾ in. wide. There will be a stringer, 2 by 3 in., in the roof framing, 2¾ ft. each side of the car centre line, to form a support for the lamps. The end plates, extending from side plate to side plate in one piece, will be of 4 in. channels. There will be safety chain hooks, links and brackets in accordance with C.N.R. standards.

The vestibule corner posts and diaphragm post casings will be 3-16 in. pressed steel, and the vestibule end sheeting will be the same as the body sheeting, as will also the body end sheets. The floor plates will be ¼ in. thick. The diaphragm posts will be 5 in. 9 lb. channels. The vestibule floor covering will be of 5-16 in. pebbled dot rubber. The vestibule windows will be circular, of double thickness, 19 ins. diam., 7-16 in. thick, of heat resisting clear glass.

There will be 8 windows per car. The two end doors will be fitted with round stationary sash, the glass in which is to be heat resisting and wired, 19¼ ins. diam.; two body end doors, with drop sash and double lights of heat resisting glass, 15 by 17 ins.; and four vestibule side doors with drop sash and two lights of ¼ in. plate glass, one 10¼ by 25 ins., and the other 23½ by 25 ins. The door trimmings will be C.N.R. standard. The car lighting will be from a 600 volt generator under the car, the lighting circuits from which will be divided into five lines.

The cross seats of the cars are to be of the C.N.R. low back style, with corner diagonal style of grab handles, and upholstered in canvas backed rattan. The interior woodwork is to be birch natural finish, with the ceiling of 3 ply poplar veneer, canvas faced. The end finish will be of 0.06 in. steel plate.

Each of the cars will be supplied with 4 CGE-239 motors, of the commutating pole type, fully ventilated, wound for 1,200 v. and insulated for 2,400 v. Two of these motors will be permanently connected in series for 2,400 v. operation. Their standard rating will be 125 h.p. each, or a total of 500 h.p. per car. In the construction of these fully ventilated motors, the pinion end frame will be provided with a ring which will divert the air discharge from the armature fan through the openings in the head, while the incoming air will be drawn through a screened intake. This construction will insure a definite longitudinal circulation of air through the whole interior of the motor.



Underframe of Multiple Unit Steel Cars for Mount Royal Tunnel.

The body bolsters will have a web plate, 9½ by ⅜ ins., and double top stiffener angles 2½ by 2½ by 5-16 ins., and bottom angles of 2 by 2½ by 5-16 ins., with top cover plate extending across top of centre girder, 6½ by ¼ by 103 ins., and a bottom one, 6½ by ⅜ by 78 ins., with the stiffener angles cut and bent around to form angle connection to the side sill angles and centre sill channels.

The cantilevers, of which there will be three, are to be located at 14 ft. centres, and will be formed of double pressed steel diaphragms, ¼ in. thick, with flanges formed to take a top cover plate, 15 by ¼ by 111 ins., and a bottom cover plate, 15 by ⅜ by 96½ ins., with the rivet gauge set at 12 ins. There will be about 35 cross supports of 5 in. 6½ lb. channels, to support the electrical and air brake apparatus under the car.

The side sills, of 5 by 3½ by 5-16 in. angles, will extend from end sill to end sill, and form a connection for the sheeting, bolsters, cantilevers and equipment supports. A pressed steel channel brace, ⅜ in. thick by 9 ins. wide, secured to the end and centre sills, will be located at each corner of the underframe.

In the side framing, the main side posts, which are to be continuous from side sill to the plate, will be 3 by 2 by 5-16 in. angles, acting as stiffeners for the side sheeting, suitably connected to the wooden side posts.

The control will be provided, the design arrangement and construction being such that it will be equally well adapted for either single car or train operation. The control equipment will include a motor generator set for supplying 600 v. current for the control circuits, air compressor and lights. This set will consist of two 1,200 v. motors, operating in series at 2,400 v., direct connected to a 600 v. generator. The construction of the motors and the control apparatus will be essentially of the same general type as for the corresponding items used on the electric locomotive equipments, which were fully described in Canadian Railway and Marine World for June.

The method of heating the cars will be very satisfactory on account of the excellent distribution of hot air secured. The heating equipment will consist of a heating unit, blower and regulating mechanism, the controlling switch and thermostat of the regu-

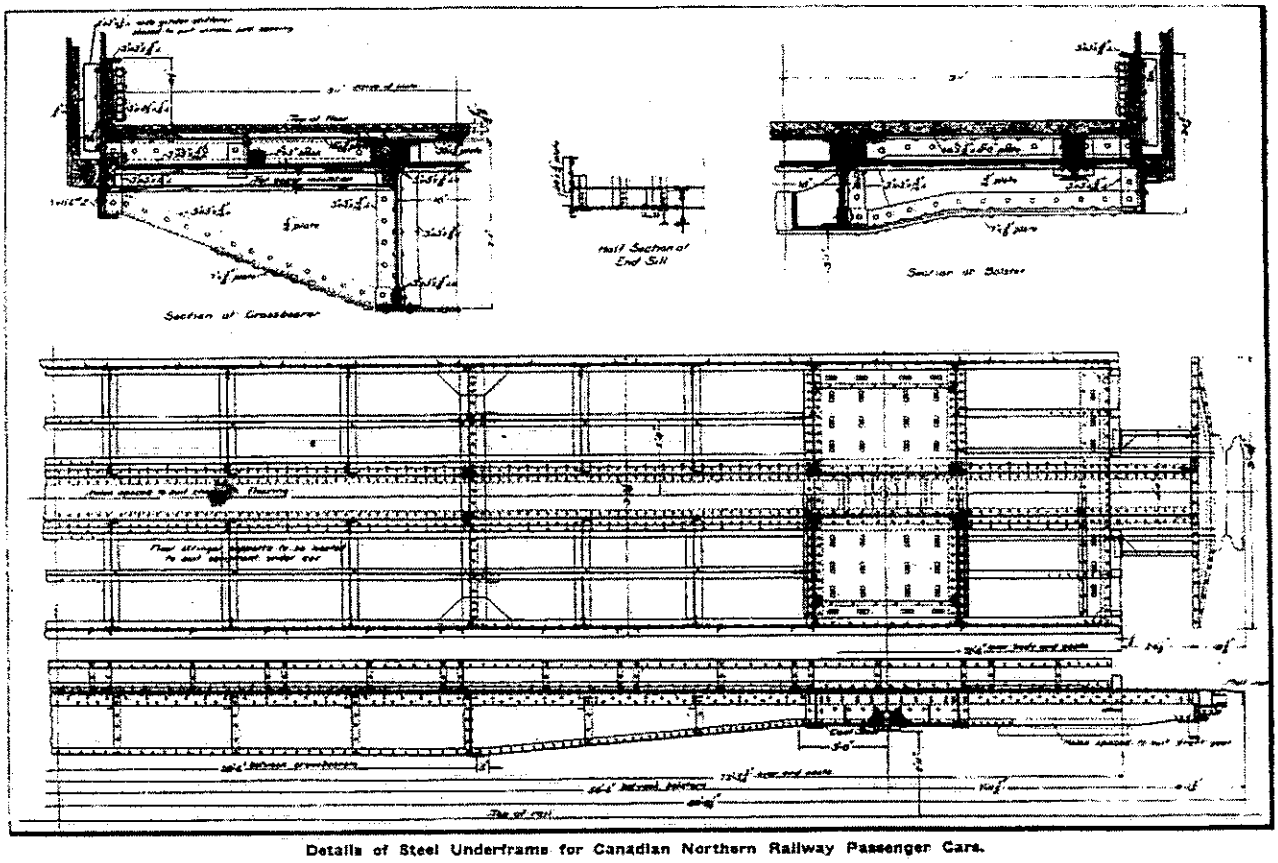
August 1914

Steel Underframe for Canadian Northern Railway Passenger Cars.

The type of steel underframe adopted by the C.N.R. is shown in the accompanying illustration, and is intended for use under all classes of passenger equipment. It is practically the same as the Barney and Smith standard design for equipment exceeding 70 ft. in length over end sills. The principal differences lie in the refinement in the method of insulation, etc., to care for the more severe climatic conditions to be encountered in the north country, and they are also arranged, as regards the height of body centre plate, to suit trucks now in use under the company's wooden passenger equipment, which has been found to be a difficult feature to embody in steel underframes of any design. The principal dimensions of the steel underframe are as follows:—

Length over buffer angles	80 ft. 3¼ ins.
Length over wooden end posts	72¼ ft.
Length over steel end posts	72 ft. 5⅝ ins.
Length between crossbearers	28½ ft.
Width over side sill stringers	9 ft. 10½ ins.
Width over side sill Z bars	9 ft. 8⅜ ins.
Width over steel buffer beam	9 ft. 4⅝ ins.
Width between side girder plates	9 ft. 1 in.
Width over platform step stringers	4 ft. 4 ins.
Truck centres	54½ ft.
End of car (steel frame) to centre line of bolster	7 ft. 11⅞ ins.
Height, top of rail to underside of centre sill angles at bolster	3 ft. 1 in.
Height, top of rail to underside of body centre plate	3 ft. 11 ins.
Height to centre line of coupler	3 ft. 1 in.
Height, top of rail to top of platform buffer angle	4 ft. 2 11-16 ins.

The underframe is of structural steel throughout, in accordance with the American Society of Testing Materials latest specifications. The centre sill is of the fish belly girder type, with a 25⅛ by 5-16 in. web plate, reinforced at the top by 5 by 3 by ⅜ in. angles, inside and outside, and at the bottom by 3 by 3 by ⅜ in. angles, inside and outside, with a 30 by ⅜ in. cover plate, running the full length of the car. The side girder is composed of a main member, consisting of a 24 by 5-16 in. plate, with a 3 by 3 by ¼ in. centre angle, 3 by 3 by ⅜ in. top angle, 2 by 2 by ¼ in. angle stiffener at the side posts, and a 5 in. 11.6 lb. bottom Z bar. The top angle of the side girder has a ¾ in. camber, the side girder plate being run straight, with the top and bottom edges parallel to the rail. The rivet gauge in the top angle is 2 ins., beginning 1⅞ in. down on the web plate at each end, rising to 1¼ in. at the centre of the car.



Details of Steel Underframe for Canadian Northern Railway Passenger Cars.

The crossbearers are built up on 25¼ by 5-16 in. web plates, with 10 by ⅝ in. top plates, 7 by ⅜ in. bottom cover plates connected to the side girders with 12 by 5-16 by 30 in. gussets and 3 by 3 by 5-16 in. angles, and to the centre sills with 3 by 3 by 5-16 in. angles, and having 3 by 3 by 5-16 in. top and bottom angles. The body bolsters are built up on 13⅜ by 5-16 in. web plates, with 86 by 5-16 in. top cover plate and 7 by ⅜ in. bottom cover plate, the centre filler and centre plate being of cast steel.

The body end sills are of 8 in. 16.25 lb. channels, with 12 by 5-16 in. top cover plate and 8 by ½ in. bottom cover plate, connected to the side girder by ⅝ in. gusset plates and having malleable iron centre filling stop to suit the buffing device. The buffer beams are composed of 6 in. 8 lb. channels inside, and 6 in. 14.75 lb. I beams outside, and fitted with 8⅝ by 5-16 in. top and bottom cover plates. The end construction is composed of 4 in. 13.8 lb. Z bar posts, with 8 by 3½ by ½ in. end plate angles connected to the Z bar posts with 5 by 5 by ⅜ in. angles.

The following weights and loads formed the basis of the design calculations:—

Assumed weight of car	140,000 lbs.
Assumed live load	5,000 lbs.
Total	145,000 lbs.
Deduction for two trucks	40,000 lbs.
Total weight of body	105,000 lbs.

This load of 105,000 lbs. was assumed to be evenly distributed over the entire length, and only the portion of the load which came between the truck centres was considered, the overhang being neglected. The latter, had it been taken into account, would have somewhat reduced the determined fibre stresses at the centre of the car, as the virtual centre to centre distance between supports in an overhanging beam is less than in an end supported beam.

With these assumptions, the maximum bending moment at the centre of the car was found to be 6,900,000 inch pounds. The side girder was calculated to have a section modulus on the compression side of 121 and on the tension side of 184. The centre sills at the centre gave a section modulus of 333 on the compression side and 420 on the tension side. The total section modulus on the tension side for the combined side sills and side girders is 804, with 564 as the section modulus for the combined members on the compression side. With the maximum bending moment of 6,900,000 inch pounds at the centre, these section moduli give a fibre stress on the tension side of 11,530 lbs. per sq. in., and on the compression side of 12,230 lbs. per sq. in. This is based on the assumption that there is no

September 1914

The Military Concentration Camp at Valcartier.

On the outbreak of war the Canadian Militia Department, in anticipation of the acceptance by the mother country of the offer of Canadian troops for service abroad, proceeded to lay out a concentration camp at Valcartier, Que., 16.2 miles from Quebec, on the Quebec and Lake St. John Ry., now part of the Canadian Northern Ry. system, where the troops might be placed in condition to be effective in assisting the British arms. To handle the large contingent promised by this country special railway facilities were required in a great hurry, and the railway officials proceeded immediately to put in such railway accommodation as would meet the requirements. The accompanying plan shows the railway facilities provided, the solid lines showing the existing tracks, and the dotted lines the trackage laid for military purposes. Three miles of track were laid in a week.

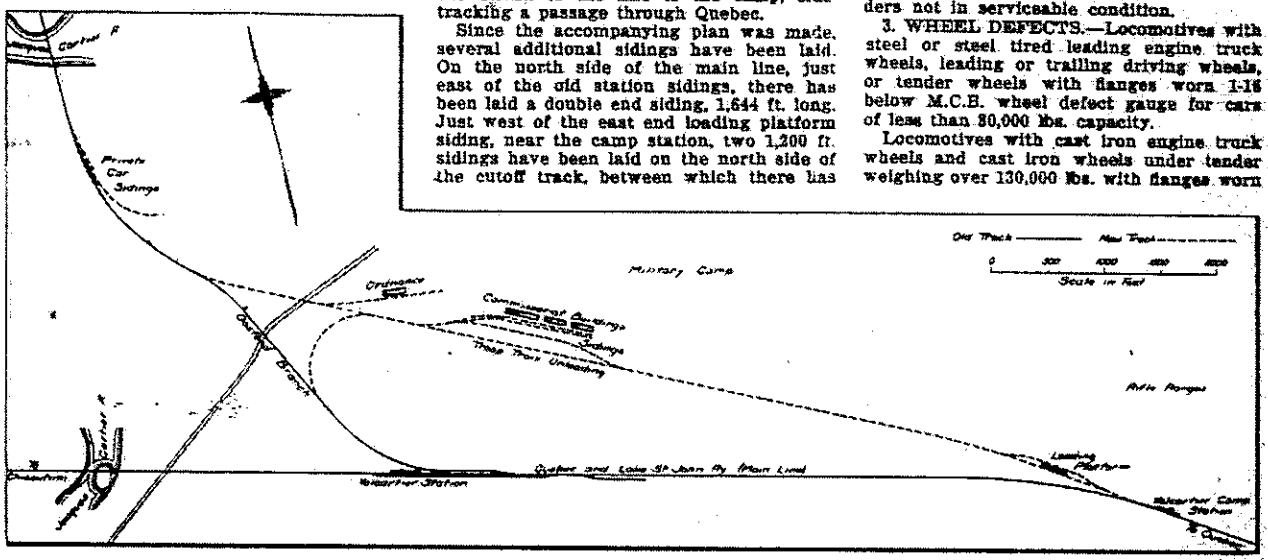
At Valcartier station the old Gosford branch of the Q. and L. St. J. Ry. leaves the main line. The site selected is in the area bounded by this line on the west, and by the main line on the south. As the main railway connection to the camp, a line 3,800 ft. long was laid from mileage 15.05 to a point on the Gosford branch, and a little west of midway in this line, three sidings were laid as the main transfer point, one of these sidings being double ended, the other two entering only from the west. Several additional sidings are being laid. A 12 degree loop from the west end of the sidings is connected back into the Gosford line in the return direction, so that the traffic may make a return loop back to Quebec, providing an effective means of giving an uninterrupted service in the immediate vicinity of the camp. On this siding the Militia Department has erected three commissariat buildings, each 48 ft. wide, two 300 ft. long, and the third 300 ft. long.

To the west of these three sidings another blind siding has been laid, on which the Militia Department has erected an ordnance building, 48 by 300 ft. A double ended siding has also been laid near the east end of the military cut off, where an unloading platform has been erected. Beyond the west end of the cut off a double ended siding has been laid, with two branching blind sidings, to be used for official cars. The camp station is located at mileage 15, near the east end of the cut off.

At this point the railway is particularly well supplied with siding accommodation for holding trains in readiness. The Gosford branch at the west end has no passenger service, so that it may be used as a long siding if required, and in the meantime there is a large amount of siding provided some distance along this line at a large lumber mill, the sidings for which will be utilized. This accommodation is in addition to the three sidings at Valcartier station.

For the handling of troops from points west of Quebec the Q. and L. St. J. Ry. has a good connection a short distance outside Quebec city. Both the Canadian Northern Quebec Ry. and the Q. and L. St. J. Ry. run into Quebec from the north over tracks that parallel each other for some distance near the city. A switch at the point where these lines meet transfers the traffic from the C.N.R. to the line to the camp, sidetracking a passage through Quebec.

Since the accompanying plan was made, several additional sidings have been laid. On the north side of the main line, just east of the old station sidings, there has been laid a double end siding, 1,644 ft. long. Just west of the east end loading platform siding, near the camp station, two 1,200 ft. sidings have been laid on the north side of the cutoff track, between which there has been built a loading platform 380 ft. long, and at the stub ends of the sidings there are 40 ft. end loading ramps. At the west end of the cutoff an additional siding has been laid paralleling the ordnance siding, and at the stub end of the older siding a further building, 300 by 36 ft., has been built by the Militia Department. On the north side of the commissariat siding, between the switch and the buildings, an additional unloading platform, 320 ft. long, has been built. Additions have also been made to the private car sidings.



Railway Connections for the Valcartier Military Concentration Camp.

The engineering work was done by C. H. N. Connell, Engineer of Maintenance of way, C.N.R., and all the railway arrangements in connection with the camp are in charge of F. M. Spaidal, General Superintendent, Quebec Grand Division, assisted by W. A. Kingsland, Auditor.

The C.N.R. has carried a large number of troops from Toronto and other points west of Quebec to Valcartier, and on Aug. 24 started a direct passenger service leaving Toronto daily, except Sunday, at 9.30 a.m., via Ottawa, Joliette and Shawinigan Jct., arriving at Valcartier the following morning at 10.23. Westbound trains leave Valcartier at 4.41 p.m., reaching Toronto the next day at 9.15 p.m.

Order re Locomotive Defects.

The Board of Railway Commissioners has issued general order 131 under date of July 6, as follows:—

Re locomotive defects, and circular 127, Feb. 24, submitted by direction of the Board to railway companies for their consideration, upon reading replies to the circular, filed by the railway companies, and the reports of the Board's operating officers, the railway companies, after various meetings and discussions, consenting to the adoption of the regulations particularly set out in this order, it is ordered that locomotives be not allowed to leave terminals, or be used at terminals, in traffic service, on which any of the following defects exist, namely:—

1. STEAM LEAKS from any part of the locomotive which render it impossible for engineer to see signals in sufficient time to enable him to bring his train to a stop within the required distance.

2. AIR BRAKES on locomotives or tenders not in serviceable condition.

3. WHEEL DEFECTS.—Locomotives with steel or steel tired leading engine truck wheels, leading or trailing driving wheels, or tender wheels with flanges worn 1-16 below M.C.B. wheel defect gauge for cars of less than 80,000 lbs. capacity.

Locomotives with cast iron engine truck wheels and cast iron wheels under tender weighing over 130,000 lbs. with flanges worn 1-16 below M.C.B. defect gauge for cars of 80,000 lbs. capacity, or over.

Locomotives with cast iron wheels under tender weighing 130,000 lbs. or less, with flanges worn 1-16 below M.C.B. defect gauge for cars of less than 80,000 lbs. capacity.

Locomotives with truck or tender wheels having shelled out or flat spots over 2½ ins. long, or so numerous as to endanger the safety of the wheel.

Steel tires on locomotives worn hollow ⅜ in. in depth, or which are worn below safe limit of thickness. Railway companies to file with the Board their standard limit of thickness of tires on all classes of locomotives, for approval.

Flat or shelled out spots on locomotive driving wheels 3 ins. long.

4. SPRINGS.—Locomotives with defective springs on any part of locomotive or tender which are unable to carry their respective weights when locomotive is standing.

And it is further ordered that the railway companies be required, on or before Jan. 1, 1915, to equip their locomotives with double windows in the front of the cabs during the winter, Nov. 1 to April 30, the same to be made airtight.

September 1914

The Break in a Canadian Northern Railway Wharf at Port Arthur.

As stated in Canadian Railway and Marine World for August a section of the C.N.R. wharf at Port Arthur, Ont., sank on night July 4 under a load of about 2,100 tons of steel rails. The s.s. McKee had completed unloading a cargo of rails in the afternoon and had left a short time before the accident occurred. The rails were 80-lb. A.S.C.E., 33 ft. long, and had been placed in three piles, each pile being about 33 by 66 ft., with transverse spaces a few feet wide between piles. The section that failed was about 75 ft. square. Two piles of the rails were carried down with it, each pile containing about 1,050 tons. The entire length of the wharf was loaded with rails, some of the piles weighing 1,200 or more tons. The rails on the portion not wrecked were hastily loaded on cars to save from further loss and to facilitate the salvaging of lost rails.

The wharf, which was about 75 by 450 ft., was constructed in the winter of 1912-13 by the Thunder Bay Harbor Improvement Co. under the supervision of the C.N.R., according to plans and specifications furnished by the railway. The pier was built similar to the others originally used for unloading steel rails and later was covered and used for package freight as occasion demanded. It is stated that some of these older wharves had supported piles of rails weighing as much as 1,400 tons, without sign of failure.

The piles used were sound tamarack from 40 to 50 ft. long, with 12 in. butts, and were driven to hard bottom. The water varied from 12 to 20 ft. in depth. In places the bottom of the lake was covered with several feet of soft mud. No batter piles or sway bracing was used. The piles were spaced about 5 ft. each way and were capped with 12 by 12 in. fir running transversely. The longitudinal stringers were 6 by 10 in. fir, spaced 24 in. on centres. The flooring was 2 by 12 in. material. The deck is about 8 ft. above the level of the lake. The portion of the wharf which remained standing supported several piles of rails, the edge of one being only a few inches from the rupture.

Of the accompanying illustrations the left hand one shows the east end of the break and the manner in which the stringers were sheared off also a small pile of unloaded rails. The stringers were sheared off on a straight line across the wharf. The few rails shown are some of those which had been removed by derrick and diver. The right hand view shows the slip side and west end of the break, also the portion (about 12 ft.) of wharf which remained standing at that end. It shows the manner in which a section on the slip side was pushed upward. A section on the track side was pushed upward in a similar manner. These views would indicate that the first part to go was the east end of the break where the stringers were sheared off. This is proved by the manner in which the rails laid in the water. The diver who removed them states that they slid toward the east end of the break.

The foregoing information was furnished by C. E. Henderson, Assistant City Engineer, Port Arthur, to whom we are indebted for the photographs from which the illustrations were made.

M. H. MacLeod, General Manager and Chief Engineer, C.N.R., has furnished us with the following additional information:—"The construction of the dock was as follows:—Piles driven to rock at 5½ ft. centres each way, with 12 by 12 in. caps running transversely on dock, on top of which were placed 6 by 10 in. joists covered with 3 in. surface plank. Tamarack piling and British Columbia fir superstructure, all bolted and drifted together. The rails were piled interlocked to a height of 10 ft. above dock level, the load at the centre being about 1,244 lbs. per sq. ft. There were 2,129 tons of rails on the portion that failed. The damage to them was very slight. The dock is 400 by 74 ft., and the portion which collapsed was 80 ft. in length near the shore end. The dock was overloaded considerably in excess of what it was designed for, through some mistake of the men unloading the rails, as they apparently wished to complete unloading a cargo late at night."

The Break in a Canadian Northern Railway Wharf at Port Arthur.

Notes on Roadmasters' Work.

By J. W. Powers, Supervisor, New York Central and Hudson River Railroad.

Every practical trackman must admit that our railways are in a state of gradual development. If the older employes will look back 20 or 25 years and compared the past with the present they will observe a wonderful change for the better. Crude methods of track construction and maintenance have developed as the years roll by, until at the present time track work must be looked upon no less skilled and important than the work performed by other departments. This is as it should be. Every passing year should add to our experience and teach us lessons to be heeded in the future. The demand made upon railways in the way of speed, comfort and capacity makes it imperative that the permanent way be of the highest possible order and that such may be the case, requires the best talent, intellectually and physically, to have charge of maintenance of track.

In order to maintain and improve the present standard of efficiency in railway progress suitable encouragement should be given to induce ambitious and progressive men to enter this department and sufficient inducements should be given to retain them. This cannot be accomplished by the rules adopted and now in force on a prominent eastern road where the promotion of practical men is limited to that of assistant supervisor, regardless of their ability and when qualified for promotion. The writer believes the adoption and enforcement of such rules detrimental to the company's interest.

It is the writer's opinion that all employes should make every effort to qualify themselves for promotion to more important positions, as the ideal organization is one in which every man is proficient to that extent which will warrant his immediate promotion to the next higher position when the occasion offers. This is the goal for which all employes should strive and the company should give sufficient compensation and encouragement to reach.

Renewing of ties is one of the great items of cost in the maintenance of railways and the company should furnish the best ties within its means. The subject of tie renewals has been discussed from time to time and many articles have been written about it, yet there are also certain phases in it which need further discussion. The writer maintains that a great many defects in track are due to the fact that ties are not of the proper length and uniform cross section. It is his opinion that to obtain the best results, the length of the ties should be twice the gauge and they should all be of equal length, and furthermore they should be of uniform cross section.

If ties would conform to these requirements, track would remain much longer in good line, surface and gauge. It stands to reason that the effect of uniform supports placed at equal intervals under the rail would be more conducive to good track than where adjacent ties are not of uniform size and have varying bearing surfaces. It is customary on some roads using ties varying in length to line the ties true on one side and let the unequal lengths project on the other side. This is contrary to good mechanical principles as the support of both rails should be uniform. The proper method of putting in ties of variable lengths is to have the ends, projecting past the rails, equal.

The most appropriate time to prepare estimates for new ties needed is in the autumn. If estimates are submitted at this time, it is possible to secure favorable contracts and have ties delivered when needed.

Much time and money can be saved by using good judgment in the unloading and distributing of ties. To do this all ties about to come out should be marked, care being taken not to mark any that would last one additional year, but none should be left in the track that should be removed. When distributing ties, if marked in this manner, it can be determined exactly how

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Standard Flanger Car, Canadian Northern Railway.

The accompanying illustrations show the details of construction and the completed form of a new flanger car, adopted as a standard by the C.N.R. The design was developed in Winnipeg in the winter of 1912-13 as a result of experiments and study under actual service conditions, and so successful did it prove in service that last summer 11 were built there, which, during the last winter proved to be efficient and convenient.

Flanger Car on Canadian Northern Railway.

The requirements originally laid down for the design were as follows:—1. The car to be worked by one man. 2. Compressed air to be used for the operation of the apparatus. 3. The flanger to cut over the entire width of track out to the ends of the ties, and to any depth between the rails thought advisable. 4. The angle of the flanger plough to be such that snow and ice will be thrown clear even when running at moderate speeds. 5. The form of the flanger plough to be such that snow and ice will be thrown over a shoulder of moderate height and not rolled over the top of the plough. 6. The actual cutting blades to be so designed that when they strike any solid object, such as a guard rail or crossing plank, they will bend without damaging the plough or connections. 7. All parts of the apparatus to be of simple construction and as strong as possible.

The flanger apparatus is attached to the rear end of the car, just back of the rear truck. The car itself is, in design, very similar to a caboose. The flanger plough faces are of the shape indicated, mounted on a steel frame. At the rear this frame is suspended on either side by two 20 in. links. At the front it is supported from the 20 in. arm of a bell crank, the other arm of which passes up through the car floor. This bell crank is pivoted in bearings fastened to wooden members attached to the under side of the centre sill ends. Movement of

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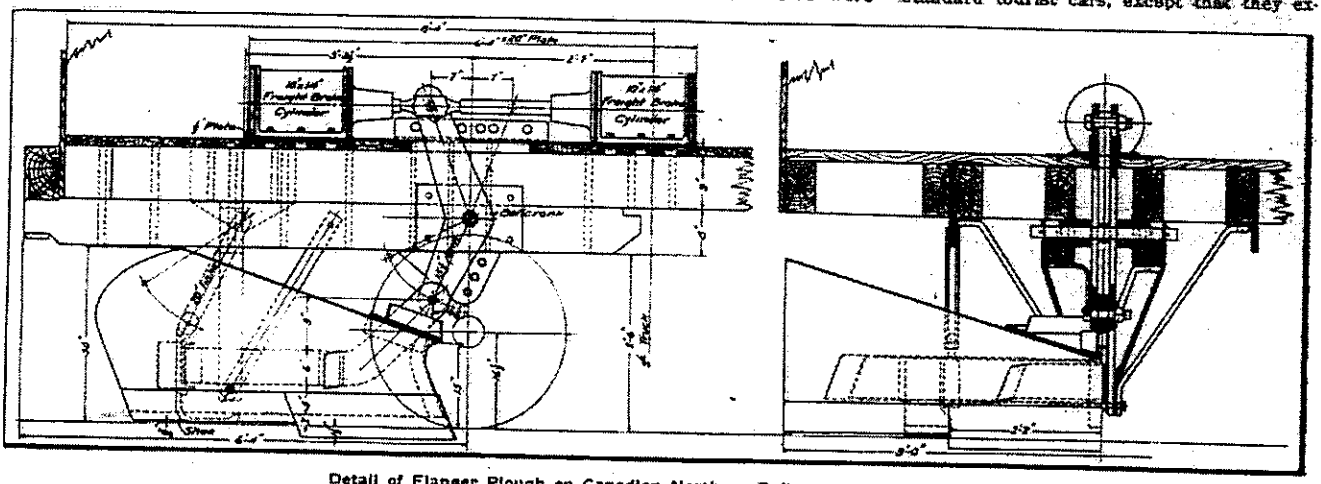
the bell crank causes the plough to swing in a horizontal plane from the front and rear link supports. The under side of the plough has a shoe on each side directly over the rail, so that when let down it rides the rails on either side. The movement is given to the bell crank lever by means of two opposed cylinders on the floor of the car, a pin through the plunger rod connecting the two, engaging slots in the double levers of the bell crank. These opposed cylinders are supported on a steel plate on the car floor.

Motors on the Canadian Pacific Railway Laggan-Lake Louise Line.

Four motor cars were built in 1912 at the C.P.R. Angus shops, Montreal, for the short run from the main line at Laggan, Alta., to the company's hotel at Lake Louise, a 3½ ft. gauge line having been built for the intervening 4 miles. These cars were placed in service that summer, and after some slight remodelling, were used again last season, and have proved most satisfactory. They are illustrated herewith. Two were built for passenger service exclusively, and the other two for the handling of freight and baggage between the main line and the hotel.

All the cars are identical in design with the exception of the bodies, which for the passenger cars are merely applied in place of the flat platform of the freight cars. The passenger car bodies resemble to a degree the construction of the usual type of open street car. The body length is 24 ft. 9½ ins. The step arrangement on both freight and passenger cars is identical.

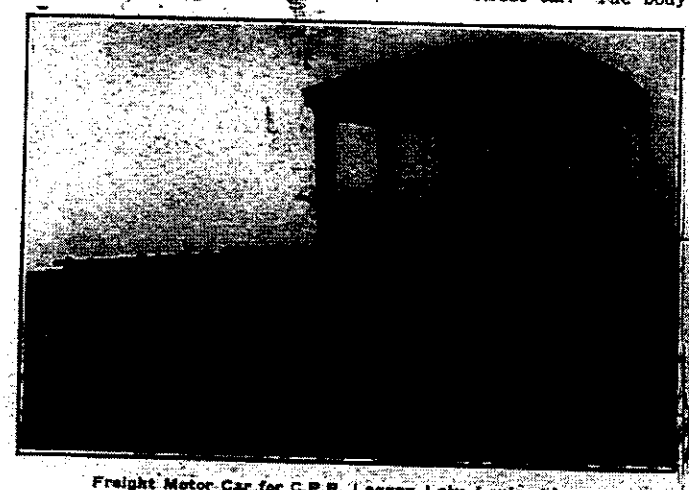
Each passenger car has 7 cross seats at 2¾ ft. centres, which will hold 5, giving a total seating capacity of 35, exclusive of the motorman's accommodation. The sides of the car are made of sheet steel, with brass grab handles. The seats are of rattan, of a similar type to that used in the company's standard tourist cars, except that they extend the width of the car, without the central aisle. The roof of the car is of a modified type of monitor roof, almost flat.



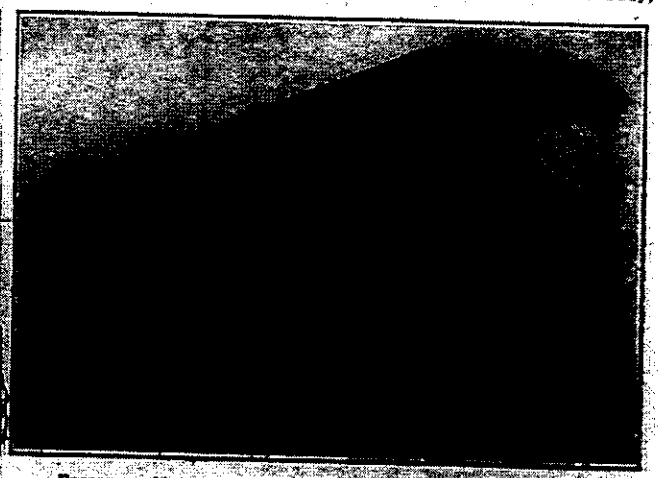
Detail of Flanger Plough on Canadian Northern Railway Flanger Car.

A small cupola is provided on top of the car, directly over the plough end, to accommodate the operator. This cupola has slide windows on each side, as well as front and back, and the operator has a seat similar to that used in a locomotive, and which is mounted near the right hand slide window. Immediately in front of the operator is a four way air cock, by which the movements of the flanger are controlled mechanically.

The main frame consists of two 8 in. channels, 3 ft. 0⅝ in. back to back at the front, widening out under the body of the car to a width of 4 ft. 4½ ins. back to back of the channels. This frame is cross braced by channels, and a built up front body bolster. Outside the main frame, which does not extend the full length of the car body, there is another pair of channels, 4 ins. deep, extending the full length of the car body, flanges inward, 6⅛ ft. back to back.



Freight Motor Car for C.P.R. Laggan-Lake Louise Line.



Passenger Motor Car for C.P.R. Laggan-Lake Louise Line.

The interior of the car is provided with suitable living accommodation for the operator, and in addition a small bed room has been arranged for the roadmaster when he travels on the car.

We are indebted to S. J. Hungerford, Superintendent of Rolling Stock, C.N.R., for the data from which this article has been compiled. He states that, in his opinion, this design represents about the best development of flanger cars up to the present time.

ins. The floor level of both kinds of cars is 3 ft. above rail level, reached by an intermediary step from the station platform, this step being 22½ ins. above the rail level. The motorman's cab in both types of cars is the same, and the cab, as well as the passenger car body roof, is 6 ft. 10½ ins. above the car floor level, giving an over all height of the car of 9 ft. 10½ ins. The car body width is 7 ft. 10 ins., sloping inward near the bottom for the car steps, which have an outside over all width of 8 ft. 9 ins. The step arrangement on both freight and passenger cars is identical.

The cars are carried on a pair of driving wheels nearly midway under the body, and on a four wheeled truck under the front part of the car, this latter being pivoted on the built up body bolster mentioned. This truck has two pairs of 11 in. wheels at 3 ft. centres. The drivers, which are 12 ft. 5 ins. centres from the front truck, are mounted in pedestals secured to the underside of the

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Canadian Northern Railway Construction, Betterments, Etc.

Sir William Mackenzie is reported as having stated, Sept. 5, that the British underwriters of the C.N.R. bonds guaranteed by the Dominion Government, had been able, notwithstanding the war conditions, to arrange for the provision of a considerable portion of the funds required to complete the company's transcontinental line and other works on hand. Sir Donald Mann returned east from a trip over the company's lines under construction as far as Victoria, B.C., and was reported to have said in Montreal, Sept. 18, that construction was proceeding satisfactorily at all points.

Transcontinental Line. There is now continuous track between Pembroke, Ont., and about 40 miles west of the Yellowhead Pass, in British Columbia, and good progress is being made with the balance of the line. Between Montreal and Hawkesbury, Ont., grading is completed and about 34 miles of track laid. The Back River and Isle de Mille bridges are under construction and are to be completed this year, and the whole of the grading, track laying and ballasting is expected to be done this year. From Hawkesbury the line is completed to Fitzroy Harbor, about 40 miles west of Ottawa. Work has been started on the superstructure of the 1,700 ft. bridge over the Ottawa River, which is expected to be completed in February next. From Fitzroy Harbor to Portage du Fort, about 22 miles of grading have been completed, and track laying and ballasting is to be finished this year. At Portage du Fort, where there is another crossing of the Ottawa River, the bridge is practically completed. From Portage du Fort to the bridge crossing of the C.P.R., about 7 miles east of Pembroke, 18 miles, track has been laid and ballasted, so that the line has been completed from Ottawa to near Pembroke, about 87 miles, except the bridges at Fitzroy Harbor and the crossing of the C.P.R. near Pembroke. The substructures of the bridges at the crossings of the Montreal River and of the G.T.R. at Pembroke are completed. From Pembroke track has been laid to Capreol, the junction with the line from Toronto, and from Capreol west there is continuous track to 40 miles beyond the Yellowhead Pass in British Columbia.

Rapid progress is being made on the Canadian Northern Pacific Ry. in British Columbia. From the present coast terminus at New Westminster track has been laid to east of Cisco bridge, about 141 miles. Between Cisco and Kamloops, about 100 miles, there are 10 large bridges over the Fraser and Thomson Rivers, all but two of which are in place and these are being proceeded with. From Kamloops track has been laid both ways, viz., about 15 miles west and about 130 miles east. From Yellowhead Pass track has been laid for about 40 miles west, leaving a gap of about 170 miles between that point and the end of steel being laid east from Kamloops. The grading of the whole line in B.C. is practically completed, except one small tunnel and two cuttings, and it is expected that the whole of the track from New Westminster to Yellowhead Pass will be laid by Feb., 1915, or possibly earlier.

Montreal Tunnel and Terminal Co.—The plans for the temporary station to be erected on Lagauchetiere St., Montreal, which have been prepared by Warren and Wetmore, New York, provide for a three story building—one story being below the street level—of steel and concrete, having a frontage of 160 ft. and a depth along St. Monique St. of 100 ft. The front will be set back 12 ft. from the sidewalk. Seven swing doors will lead into a vestibule, 21 by 100 ft., at the end of which will be the general waiting room, 60 by 100 ft. and 30 ft. high. On one side will be the baggage and express rooms, and on the other ladies' toilet rooms and men's smoking room. The remainder of the ground floor will be laid out for the company's purposes, and the operating offices will be upstairs. There will be three platforms, serving six tracks, which will form part of the trackage of the permanent station. When this is built the present building will be used for other purposes. The cost of the building is estimated at $250,000, and it is said that it will be ready for occupation by next spring. It is said that tenders are expected to be called for during October.

Canadian Northern Ontario Ry.—A contract has been let for the erection of a cooling plant at Trenton on the Toronto-Ottawa line.

The city of Hamilton is reported to have abandoned its objection to the route asked for through the north end of the city, and to be anxious to have construction work started. The route to be followed from Hamilton will connect with the Toronto-Niagara Power line, following it to Falls View, thence circling Niagara Falls city to a point below the whirlpool, where it is proposed to build a bridge across the river to the United States side.

It is expected that a freight service will be started on the main transcontinental line north of Lake Superior from Capreol, Ont., the junction with the line from Toronto, through to Port Arthur, before the end of this year.

Canadian Northern Ry.—The relaying of the Winnipeg-Emerson line with 90 lb. steel is reported completed, and the ballasting almost finished. The track in Saskatchewan is also being relaid with 90 lb. steel. The section on which work is now in progress is between Roblin and Kamsack. It is expected that about 300 miles of track will be relaid with the heavy steel this season. The released 50 lb. steel is being laid on new branch lines.

Grading is reported started by W. J. Cowan, and a number of subcontractors, south of Kindersley, Sask., on the Delisle extension, which it is ultimately intended will connect at Camrose, Alberta. The line will follow the South Saskatchewan River, on the north bank, to the Alberta boundary, where it will turn north. Seven contracting outfits are reported to be at work on the extension.

The Provincial Secretary of Alberta is reported to have said recently that a contract had been let to the Northern Construction Co. for the building of the line southerly from Macleod, and that the McArthur Construction Co. had been given a contract for building about 35 miles to St. Paul de Metis, on the Oliver branch.

Vancouver Terminals.—We are officially advised that there is no foundation for the reports that plans had been filed for a tunnel from Burrard Inlet to the yards now being laid out at False Creek, Vancouver. At present there is no definite information available as to what work is to be done at that point. One of the works to be done is the building of a retaining wall, for which negotiations are in progress with the city council, but we are advised that the details of the agreement have not been worked out, and that the plans have not been prepared, as stated in recent press reports.

Vancouver Island Lines.—It is reported that 100 miles of grading from Parson's Bridge to near the Nitinat River, has been completed and, with the exception of the bridges, is ready for tracklaying. The steel bridges are to be put in as the track is laid at mileages 54, 63, 73, and 75. The grading from mileage 100 to the Alberni Canal, mileage 134.5, is expected to be finished by the end of the year.

The line from Parson's Bridge to Patricia Bay has been graded and is ready for tracklaying, with the exception of the putting in of the steel superstructures of the bridges. Tracklaying is expected to be started on this and the Alberni line in October.

The plans for the wharf at Patricia Bay provide for a dock 441 by 61 ft., with an approach pier, 1,700 ft. long. From Patricia Bay a ferry will be operated to connect with the company's transcontinental line on the mainland. (Aug., pg. 374.)

Grand Trunk Pacific Railway Annual Meeting.

At the annual meeting in Montreal, Sept. 15, President E. J. Chamberlin, who was in the chair, referred to the death of three directors during the preceding 12 months, viz.: Hon. G. A. Cox, W. Wainwright and M. M. Reynolds, and to the retirement, through ill health, of B. B. Kelliher, who was engaged on the preliminary surveys in 1903 and was appointed Chief Engineer in 1905, since when 3,000 miles of railway have been built by the company west of Winnipeg. The present year saw the opening of the line through to the Pacific Coast, and, on Sept. 2, through sleeping car service was established between Edmonton and Prince Rupert. Good progress was reported on the floating dry dock and ship repairing plant at Prince Rupert, a section of which is expected to be ready by the end of November, for repairs to local craft.

The directors for the current year are: E. J. Chamberlin, President; W. H. Biggar, K.C., Vice President and General Counsel; J. E. Dalrymple, Vice President; F. Scott, Vice President and Treasurer; W. H. Ardley, General Auditor; A. W. Smithers, Sir Henry M. Jackson, J. A. Clutton-Brock, Sir Wm. Lawrence Young, H. G. Kelley, E. B. Greenshields, Hon. R. Dandurand, W. M. MacPherson, H. R. Safford and J. R. Booth. The other officers are M. Donaldson, Vice President and General Manager; H. Phillips, Secretary; and J. A. Yates, Assistant Treasurer.

Master Car Builders' Association. The following railway officials in Canada have been appointed members of the M.C.B.A. committees:—H. H. Vaughan, Assistant to President, C.P.R., Montreal, car construction; J. Coleman, Superintendent, Car Department, G.T.R., Montreal, arbitration and car trucks; R. W. Burnett, General Master Car Builder, C.P.R., Montreal, car wheels and joint meetings; E. B. Tilt, Engineer of Tests, C.P.R., Montreal, specifications and tests for materials; A. Copony, Master Car Builder, Western Lines, G.T.R., Chicago, specifications and tests for materials; L. C. Ord, Assistant Master Car Builder, Eastern Lines, C.P.R., Montreal, car trucks; H. G. Griffin, General Car Inspector, settlement prices for reinforced wooden cars.

Cuba Rd.—The gross earnings for the year ended June 30 were $6,164,670, and the net income, exclusive of dividends, $1,516,585, against $1,029,353 and $37,448 respectively in 1905, and $2,569,235 and $672,949 in 1910. During last year 6% was paid on the preferred stock, and 6% on the common stock, against a previous 6% and 4% respectively. Sir William Van Horne is President.

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Canadian Northern Railway Construction, Betterments, Etc.

Montreal Tunnel and Terminal Co.—The tunnel has been widened to the full height and width for nearly 2,000 ft. from the western portal at the Model City. It is 35 ft. wide and 22 ft. high. The work of lining it with concrete blocks has been started. The electrical substruction at the western end of the tunnel is about two-thirds completed.

Canadian Northern Ontario Ry.—The first freight train from Toronto arrived in Port Arthur, Ont., Oct. 10. The section of the line from Capreol to Ruel has been operated over for some time, but the Ruel-Port Arthur section has only been finally completed recently. The line from Capreol to Port Arthur forms part of the Montreal-Ottawa-Port Arthur section of the company's transcontinental line. The line from Toronto to Capreol will be the Toronto branch of the transcontinental line.

We are officially advised that although a train of stock cars went over the line as stated, it has not yet been opened for public traffic.

Canadian Northern Ry.—It is reported a site has been acquired in Fort William, Ont., for the erection of a new station. The ratepayers will be asked to sanction the plans before the purchase is completed.

Reports were current in Moose Jaw, Sask., Oct. 12, that the clearing of houses and other buildings on the land purchased for the C. N. R. right of way meant the immediate building of a line directly into the city, and the building of a central station to replace the present one at South Hill. The report is also revived that a union station with the Grand Trunk Pacific Ry. is being arranged for.

The Saskatchewan Legislature has extended the time within which the Canadian Northern Ry., and the Canadian Northern Saskatchewan Ry., may build the lines for which the province has guaranteed bonds. This act covers the lines which are under construction and gives an extension of time to Jan. 1, 1917, for their completion; and extends the time for the starting of the other lines to Jan. 1, 1917.

A press report states that a contract has been let for the grading of 23 miles from Medicine Hat to Hanna, Alberta, to the Northern Construction Co. The Mayor of Medicine Hat returned to the city from Winnipeg, Oct. 8, and is reported to have stated that Sir William Mackenzie informed him that this work would be started immediately.

Ballasting is being proceeded with on the line from Camrose to Edmonton, and it is expected that a train service will be put on by the end of the year.

The line from Stettler to Nordegg, Alberta, 123 miles, has been taken over by the operating department, and a train service put on. It is reported that about 900 tons of coal a day are being shipped from the collieries at Nordegg.

Track was laid on the Onoway-Grand Prairie line in 1913 to the Pembina River, mileage 32. A bridge is under construction over the river, which involves 2,000 ft. of trestle work, and 400 ft. of steel work, the latter at a height of 74 ft. Grading is reported to be completed to the McLeod River at Whitecourt, 43 miles from the Pembina. The McLeod River will be crossed by a bridge 600 ft. long, which will not be built until the track reaches Whitecourt.

Canadian Northern Pacific Ry.—Sir William Mackenzie returned to Toronto, Oct. 2, from a trip over the line. He is reported to have said in an interview, that there now remains about 90 miles of track to be laid between the ends of steel being pushed westerly from the Yellowhead Pass, and easterly from Kamloops. The work had been somewhat delayed by the slowness of deliveries of steel for the bridge work, but he expects to see the track laying completed in December.

Vancouver Terminals.—A press report states that a contract has been let to H. Peterson, for the erection of a temporary wall, 2,000 ft. long, in False Creek, Vancouver, to hold back material to be dredged from the creek and poured in, and that the work is to be started at once. (Oct., pg. 467.)

Grand Trunk Pacific Railway Hotel at Edmonton.

The G. T. P. Ry. hotel in Edmonton, Alberta, which is to be known as the Macdonald, is reported to be about completed. It overlooks the Saskatchewan River at an elevation of about 200 ft., and commands extensive views both up and down the river. The building is of the chateau style, which the company has adopted for all its hotels, but each building has an individuality of its own. The building is L shaped, the right wing parallels McDougal Ave., and the left the side street. The right wing is 115 by 55 ft., and the left 165 by 87, with an entrance connecting the two wings. The main doorway gives entrance to the rotunda, lounge rooms, offices, tea room, dining room, ball room, and the other public rooms; while the kitchens, etc., are beneath. The mezzanine floor overlooks the rotunda, and opens on the terrace over the main entrance. It comprises a ladies' drawing room, men's writing room, banquet room and three private dining rooms. There are five floors above for bedrooms, 22 rooms on each floor being fitted with bathrooms. On each floor are public lavatories and bathrooms, service rooms, etc. The interior of the entire building has been most carefully planned, and the decorations and appointments are the most modern. The architects are Ross and Macdonald, Montreal, and the contractors are the Canadian Stewart Co. The date for opening the hotel has not been announced.

Australian Freight and Passenger Rates Advanced.

Increases in freight rates of 10%; and in passenger fares ranging from 5 to 50%, are the means by which the government railways of New South Wales, Australia, have undertaken to combat the world wide advance in costs of railway operation. The annual report of these railways as analyzed by the Bureau of Railway News and Statistics, presents detailed outlines of the advances, and attributes them almost wholly to the expansion in wages and costs of materials.

This is looked upon as the most striking recent instance of the facility with which state owned railway systems have been adopting advances in rates to cope with the rapid rise of late years in operating expenses, and is in sharp contrast to the experience of the private transportation systems of the United States, where, in spite of recognition by the Interstate Commerce Commission of pressing need, eastern railways have been refused a 5% advance covering only freight rates, and under emergencies caused by the European war the roads have had to petition for a reopening of their case owing to actual threatening of their credit structures.

Increased charges for freight transportation placed in effect by the New South Wales government roads are uniformly 10%, and with the estimated annual increase in revenue are as follows:—

1st and 2nd class freight rates	$350,000
Class A, B and C mileage rates	230,000
Live stock rates	300,000
Total added freight revenue	$880,000

Advances have been made in passenger fares, despite the fact that "cheap excursion fares" already were on a basis of 4c. per mile first class, and 2c. per mile second class, while "special cheap excursion week end rates" were 3½c. per mile first class, and 1¾c. per mile second class, compared with an average of only 2c. per mile received for all passenger traffic by United States railways in 1913. The increases range from 5% in the case of through fares, to 50% in second class excursion fares. The total new yearly revenue from both services is estimated at $1,750,000, or more than 5.3% of gross operating revenues in 1913. A similar increase in the United States would amount to almost $163,000,000.

In explanation of the increases the minister of the government railways points out that expenses rose $3,742,000 in the last year, of which $2,704,000 was in wages. The operating ratio rose from 68.8% in 1913 to 69.9% in 1914. Wages took up $49.68 of every $100 revenue in 1914, against $48.80 in 1913.—Railway Review, Chicago.

Railway Rolling Stock Notes.

The Intercolonial Ry. has received 2 express refrigerator cars from its Moncton Shops.

The C.P.R., between Sept. 15 and Oct. 15, ordered 9 refrigerator cars from its Angus Shops.

Randolph Macdonald Co., Toronto, has ordered one 4-wheel switching locomotive from the Montreal Locomotive Works.

The Intercolonial Ry. has ordered 6 steel frame 1st class cars from Canadian Car and Foundry Co., and 1 wrecking crane of 100 tons capacity.

The C.P.R., between Sept. 15 and Oct. 15, received 69 steel frame box cars, 7 steel first class cars and 1 class W locomotive, from its Angus Shops.

In 1913 the C.P.R. built 81 locomotives in its Angus Shops, Montreal. It is stated that only one railway in America built more in its own shops during the year.

The G.T.R. has received 4 suburban type locomotives from the Montreal Locomotive Works; 7 first class cars from the Canadian Car and Foundry Co., and 5 baggage cars from the National Steel Car Co.

The Canadian Car and Foundry Co., during September, delivered 11 wooden colonist cars to the Canadian Northern Ry.; 6 steel frame first class cars to the G.T.R., and built 1 all steel 40 ton box car for its own purposes.

A press report from Edmonton, Alta., states that the Edmonton, Dunvegan and British Columbia Ry., has the following rolling stock:—100 box cars, 12 refrigerator cars, 60 ballast cars, 11 passenger cars, 1 private car and 6 locomotives, while other rolling stock is on order, delivery of which will be made shortly.

New York Central Merger Approved.—The consolidation of the New York Central and Hudson River Rd. with the Lake Shore and Michigan Southern Ry. has been approved by the New York Public Service Commission, Second District.

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Canadian Northern Quebec Ry.—The locomotive house at Longue Pointe, Montreal, was destroyed by fire Oct. 30, with three locomotives, and a quantity of machinery. The loss is placed at $150,000.

Montreal Tunnel and Terminal Co.—It is reported that about a mile of the excavation necessary to complete the tunnel to its full dimensions has been done, and that about 600 ft. of the lining has been completed.

Montreal-Ottawa-Port Arthur Line.—The bridge across the Back River at Montreal was reported, Nov. 29, to be completed, but not finally passed for operation. From this bridge the line is completed to Ottawa, and beyond Ottawa to the Ottawa River at Chats Falls, where the bridge across the river was reported, Nov. 20, to be 30% completed. The grading is all completed to North Bay, and the track is laid right through with the exception of about two miles in the town of Pembroke. One lift of ballast has been given on the line through to North Bay, except for 15 miles, while a second lift of ballast has been given on about 100 miles of track to North Bay. It is expected that the steel bridge work on the line will be completed by Jan. 31, 1915. In addition to the ballasting the only work which will be carried over to 1915 will be the buildings at stations, etc.

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steel construction, but for ornamental purposes will be encased in concrete. The concrete will be panelled and the surface specially finished to give it an artistic appearance. Ornamental lights will be placed on the face of each end of the subway, and on the ceiling above the sidewalks, so that the subway will be brilliantly lighted by night.

Where Victoria St. crosses the tracks there is a slight grade downwards towards Church St., and in order to put an overhead bridge at this place it will be necessary to raise the road level 11 ft. The approach to the east end of the bridge will start about 70 ft. west of Church St., and the approach to the west end of the bridge will start about 40 ft. west of Robinson St. This bridge will also be of solid steel construction encased in concrete, panelled and finished similar to the Main St. subway.

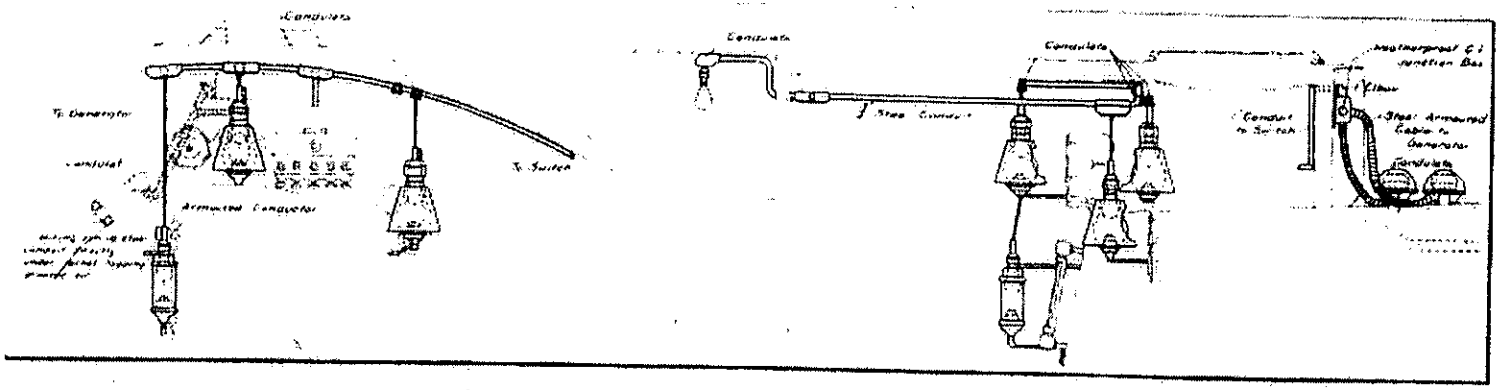
At present Church and St. George Sts. cross the present tracks at a level considerably lower than the original surface of the streets. This depression in the streets will be taken out and the new level will be practically the same as the original street level. At this place the proposed bridge is to be the full width of St. George St., and will be built so that St. George St. from the east will gradually curve round into Church St. another easy flight of steps from Queen St. and by a slight incline from Lutz St.

In the Main St. subway there will be pillars in the centre of the street, which are absolutely necessary to prevent further depression of this street. In order to make one single span across Main St. it would be necessary to depress the street at least 4 ft. more than it is at present contemplated. Many of the subways in the larger cities in 000, and should add greatly to the comfort and safety of the citizens by eliminating the danger of level crossings, and also the blocking of streets. It is the intention to start only the Main St. subway this year, and the contract for it has been given to Soper and McDougall, Ottawa.

We are indebted to C. B. Brown, Chief Engineer, Canadian Government Railways, for the foregoing information.

Locomotive Headlight Installations on Canadian Northern Railway.

The C. N. R. Mechanical Department standardized its locomotive electrical installations recently, so that the manner of installing, and the nature of the wiring, as well as all the parts entering into the installation, have been reduced to a standard form, applying to all road locomotives on the system. The generator is of the Pyle-National E type, located immediately in front of the cab, crosswise of the boiler, with the generator on the left hand side, with a 2 in. exhaust pipe bent at an angle of 45°, just long enough to clear the top of the cab so as to permit the steam to trail backwards over the cab. The supporting shelf is 1½ in. white oak 17 by 18 ins., carried on two ½ by 2 in



Cab Electric Light Installations on C.N.R. Locomotives.

This bridge will also be of solid steel construction, encased in concrete, with the same style and finish as the Main St. subway.

The present bridge at Union St. will be removed, and a new bridge of similar design to that of Victoria and St. George Sts. will be put in. The street level over the tracks at this place will be brought down

wrought iron forged supports, at 12¾ in. centres. On the left side there is a ½ in. grab iron. The generator is secure to this stand by four ½ in. bolts, carrying fibre washers and bushing to thoroughly insulate the generator. Steam for operating the unit is to be as dry as possible, supplied through a ½ in. steam valve with metal disc

and seat, and so located as to be conveniently accessible from the engineman's position. If the valve is necessarily inaccessible, an extension rod on the valve handle is used. The steam pipe is of copper, installed without pockets, and arranged to drain towards the boiler. Only bail or taper joint unions, with no gaskets, are used. The drain from the turbine is of ⅜ in. pipe, contains no valve, and is free from bends, extending below the running board and close to the draught opening of the ashpan, the pipe below the running board being as nearly perpendicular as possible. Preparatory to operating the unit, the top cap over the governor steam valve is removed, and the pipes blown free from dirt and scale.

A diagrammatic plan of the wiring is given herewith. The main leads and arc lamp circuits are of no. 8 B. and S. stranded slow burning weatherproof triple braid wire, black outside, the three wires in one cable, and all other wiring is similar, but no. 14 stranded. The headlight will contain an arc light and

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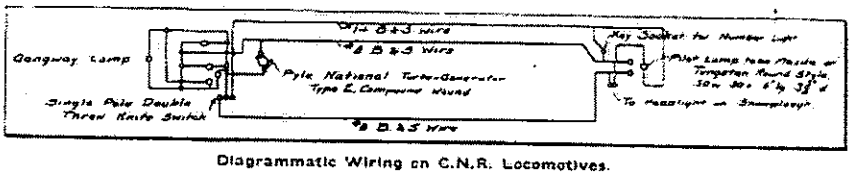
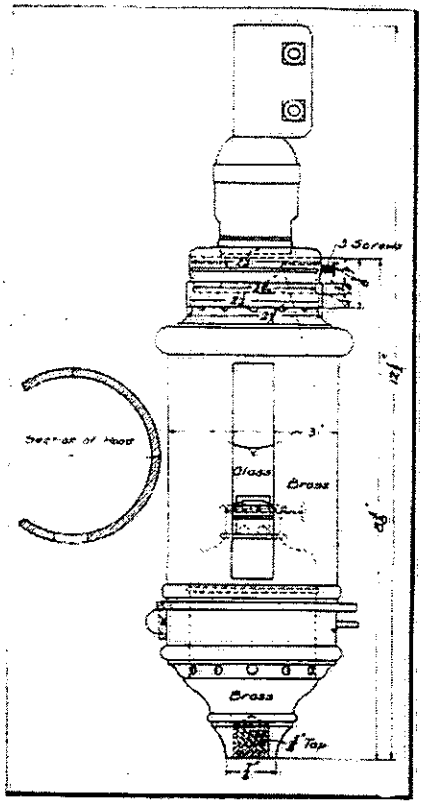
a pilot lamp, the latter either mazda or tungsten, 50 watts, 30 volts, 6 ins. long overall and 3¾ ins. diam. The wiring and lights in the cab are also shown in an accompanying illustration, which shows an 8 c.p. steam gauge lamp, 8 c.p. air gauge lamp, 8 c.p. lubricator lamp, 8 c.p water gauge lamp and 8 c.p. deck lamp in gangway, all either tungsten or mazda lamps.



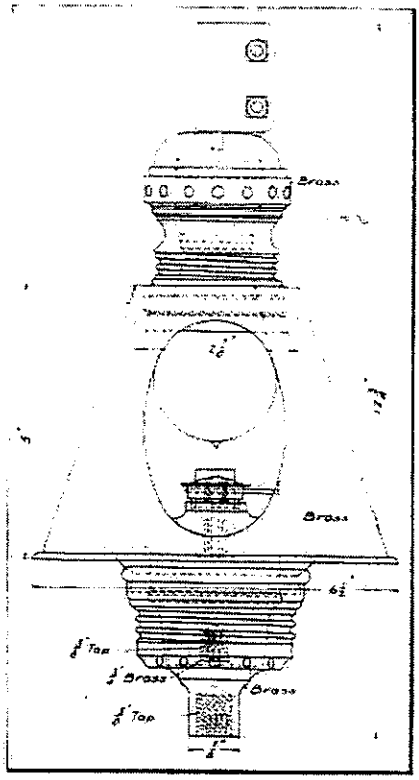
Diagrammatic Wiring on C.N.R. Locomotives.

All the wiring to the cab and deck lamps is protected by 10 amp. fuses and blocks. The leads from the generator pass through a triple to a double plug cut out, and are protected by two 40 amp. 250 v. refillable cartridges, with the fuses all placed on a 60 amp cut out block. The positive wires are tested by ringing with a magneto or some bell arrangement, and not by running the generator. The arc lamp lead is tapped for the pilot lamp at a point just within the case, and not inserted in the binding post within the arc lead. All wire splices are soldered and covered with friction tape, all socket and receptacle cover screws are soldered in place, and all wire connections in the sockets are soldered, making it impossible for screws to back out. All wires are soldered to switch terminal posts. All armoured wire enters the sockets through a standard pipe bushing, to which it is soldered to prevent loosening the socket connections. There is a 40 amp. single pole double throw knife switch above the engineman's position, just over the window casing, operating, in its lower position, the arc lamp, and in the upper position, the pilot lamp.

All the wiring both inside and outside the cab, with the exception of the short connections between the generator and the junction box on the front of the cab, which is in flexible armoured steel conduit, is carried in steel conduit, with bushings where the wire passes in and out of the conduit or through metal. The gauge lamps are connected with the overhead leads by armoured wire, which enters the lamp socket through a standard pipe bushing, to which it is well soldered. Crouse-Hinds condulets are used at these points.



Lamp for Water Glass.



Lamp for Steam Gauge, Lubricator and Brake and Signal Gauge.

The fixtures employed are illustrated herewith, all but the water gauge having wide openings in front, while for the water gauge there is only a vertical slot. In addition to the electric bulb in each, they combine an oil well auxiliary. The lamp socket at the top is of special design, made especially for the C. N. R., but it is claimed that it warrants the additional expense from the fact that it absolutely secures it to the cable.

The headlight has unique features. It has an auxiliary reflector for incandescent lamps, for use in yards and terminals where it would be inadvisable to use the arc lamp. This auxiliary reflector consists of a mirrored surface, 3½ by 10 ins., set at an angle of about 60 degrees from the horizontal, with the incandescent lamp in front, which reflects the light from the auxiliary mirror, into the main parabolic mirror, when the arc is not operating.

The headlight also has a snow plough connection, provided on all locomotives, as it has been found serviceable for many special minor purposes in wrecks, such as lighting clusters of lamps for auxiliary outfits, and making an inspection in the yard after dark.

Checking a Landslide in a Railway Cut.

Checking a landslide in a railway cut by breaking up the slope with massive blocks of concrete built in trenches running up the slope was practised with success on the Ebant & Nesslau Ry. in Switzerland. A sidehill cut had been made through an ancient landslip, the material consisting of clay and loam mixed with boulders and tree trunks, underlaid by a bed of marl. A longitudinal crack, about 300 ft. long, appeared in the slope of the cut, and similar cracks developed in the ground above the edge of the slope, while 33 ft. from this was a main road. A retaining wall was proposed, but it was evident that this would be overturned or carried away before the concrete could set. As an emergency measure, massive concrete blocks were built in the slope, the excavations being carried into the hard material over which the loose mass was sliding, so that the blocks could not move down the slope.

Four blocks, 33 ft. apart, were built, but as the slide continued to squeeze out between them two additional intermediate blocks were built. The slope then stood, but the pressure was so great as to partly raise the blocks, revolving them on their lower ends so that they tended to approach a steeper slope. One block moved outward 32 in. at the top, its foot remaining stationary. The trouble was due to water in the soil, but there was no time to put in any drainage system, and some immediate action was necessary, in view of the main road above the cut, and the possibility of starting a slide of the whole slope of the mountain above the cut.

C.P.R.'s Paris office not closed. — A. Catoni, Agent, C.P.R., Paris, France, has not closed the office there and removed to London, Eng., for the present, as stated in Canadian Railway and Marine World for October, on the authority of a London press dispatch. We are officially advised that the office has not been closed at all, and that, except for a visit of report to London which Mr. Catoni made towards the end of September, he has not been absent from Paris. As stated in Canadian Railway and Marine World for September, the office has been of great service to Canadians, people from the United States and British residents and visitors in France during the war, and as the Dominion Express Co.'s representative Mr. Catoni has been of great service to many who found themselves absolutely without funds.

The practice of assigning a special expert mechanic to laying out all the work to be done in a machine shop, has been found especially advantageous from many standpoints, the principal ones being the dexterity with which he handles the work, the saving in the time of the machines and the centralization of all jigs and templates.

Supplying fans with ball bearings has been suggested as a means of averting trouble from fans throwing oil from flooded bearings, with resulting damage to clothes, carpets, etc.

Many railways have found it desirable to change the driving tires of locomotives for re-turning, instead of dropping the wheels, and turning the tires on the original centres.

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Canadian Northern Railway Construction, Betterments, Etc.

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