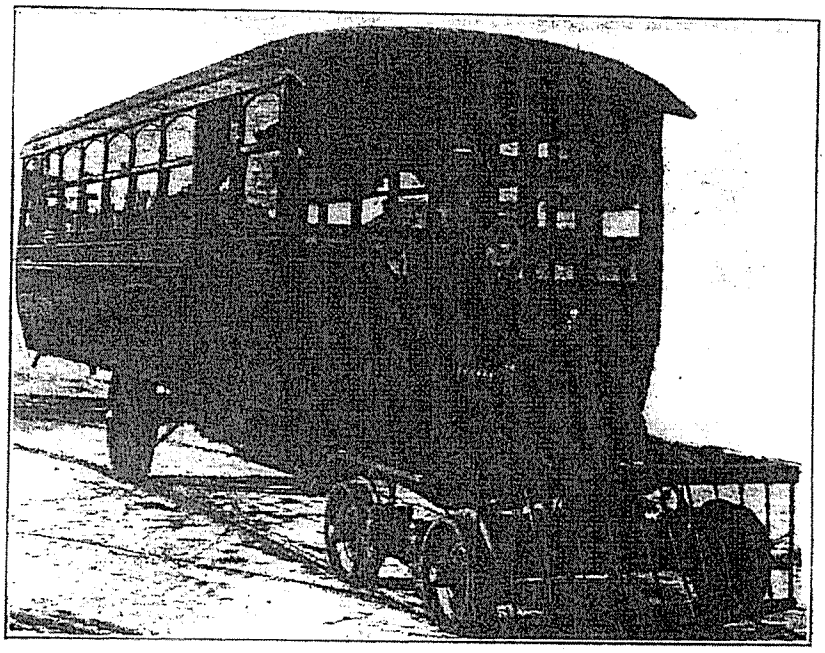
CANADIAN SELF-PROPELLED RAIL CARS AND GAS-ELECTRIC'S

C.H. RIFF

Self Propelled Cars on Steam Railways.

The Manitoba Power Co., which is allied with the Winnipeg Electric Ry. Co., has imported from the United States a gasoline motor passenger car for use on the Winnipeg River Ry. between Lac Du Bonnet and Great Falls, Man., where it is building a 170,000 h.p. hydro-electric plant. A standard gauge track of 14 miles was built by the Winnipeg River Ry. Co., some years ago, from Lac Du Bonnet, the terminus of a C.P.R. branch, of 21.5 miles from Molton, 38.1 miles east of Winnipeg on the main transcontinental line. The management feels that it will be able not to only affect a considerable saving in the cost of transportation between Lac Du Bonnet and Great Falls, but will also make the service between those points much more frequent and efficient than it was when operated by steam trains.

The car, which is illustrated herewith, is gasoline operated, by a 25 h.p. engine. The body, built on a standard chassis, is



Gasoline Motor Passenger Car, Winnipeg River Railway.

of wooden construction, and the interior, from the lower part of the windows, is lined with sheet iron. The body is 21 ft. 8 in. long, 7 ft. 10 in. wide, and 9 ft. 11 in. high from top of rail to top of car. The lower part is painted in maroon, with black trim and stripe. Seats are arranged transversely. Space is provided in the front for carrying packages and express matter, and an arrangement has been made for the removal of one of the side panels to provide a larger opening for loading and unloading packages too bulky to go through the door. The car is lighted by electricity and heated by exhaust from the engine. The interior is finished in white enamel. It is provided with regulation lamps on both front and rear for operation on steam railway lines. The rear wheels are artillery type, with steel tires, the front wheels being of rolled steel.

This car is operating at a cost of 25c. a car mile, and doing work which for-

Self Propelled Cars on Steam Railways. MAY 1922

Greater Winnipeg Water District Railway.—The Greater Winnipeg Water District Commission has bought a gasoline operated railway motor car for operation on its railway, which extends from St. Boniface, Man., to Shoal Lake, adjoining Lake of the Woods, 92 miles. It has the following general dimensions:—

Length over all	42 ft. 6 in.
Width over all	8 ft. 4 in.
Height from rail to top of ventilators	11 ft.
Truck centers	22 ft.
Weight, body and frame	7 tons
Weight of car complete	13 tons

The car underframing consists of four 6 in. 8 lb. channels with cross members, gussets, etc., and the body framing consists of 1½ x 1½ x 3/16 in. steel tees, continuous, forming carline and posts. The siding, to the belt rail, is 3/32 in. steel plate, hot riveted, while the belt rail is 2½ x ⅜ in. steel. Each end of the car is slightly rounded, as shown by the illustration. The vestibules are sheathed outside with 13 gauge sheet steel, and inside with 20 gauge sheet steel. The car flooring is double; the bottom layer is 13/16 in. yellow pine, tongued and grooved; over this are 3 layers of tar paper, and the top flooring is also of 13/16 tongue and groove yellow pine. The flooring in the baggage compartment is of 1⅛ in. yellow pine.

The roof is of the plain arch type, extending the full length of the body, and the roof boards are of ⅜ in. poplar, tongued and grooved, and covered with no. 8 canvas, well bedded in white lead. The roof is reinforced by continuous side posts.

The car is driven by a 4-cylinder 4-cycle, valve in head, heavy duty type gasoline engine, with cylinders 4½ in. diam. by 6 in. stroke. The engine is equipped with a pressure oiling system, in which a gear driven pump supplies oil, under pressure, through crankshaft to all main crank and camshaft bearings, the pressure being regulated by automatic control from the intake manifold, so that the oil pressure varies with the load. The oil pump delivers 1.7 gall. a minute at 1,000 r.p.m. The crankshaft is 3 in. in diam. and is carried on 3 main bearings, the total main bearing length being 10¾ in. The connecting rod bearings are 3 in. diam. by 2¼ in. long, and the pistons are 4⅞ in. long and fitted with 3 concentric rings ¼ in. wide. The valves, of special alloy steel, are 2¼ in. diam. and have a 7/16 in. lift. The piston displacement is 381.6 cu. in. The horse power at speed is as follows:—At 800 r.p.m., 37.5 h.p.; at 1,000 r.p.m., 46 h.p.; at 1,200 r.p.m., 53 h.p.; at 1,400 r.p.m., 59 h.p.; at 1,500 r.p.m., 61 h.p.; at 1,800 r.p.m., 66 h.p.

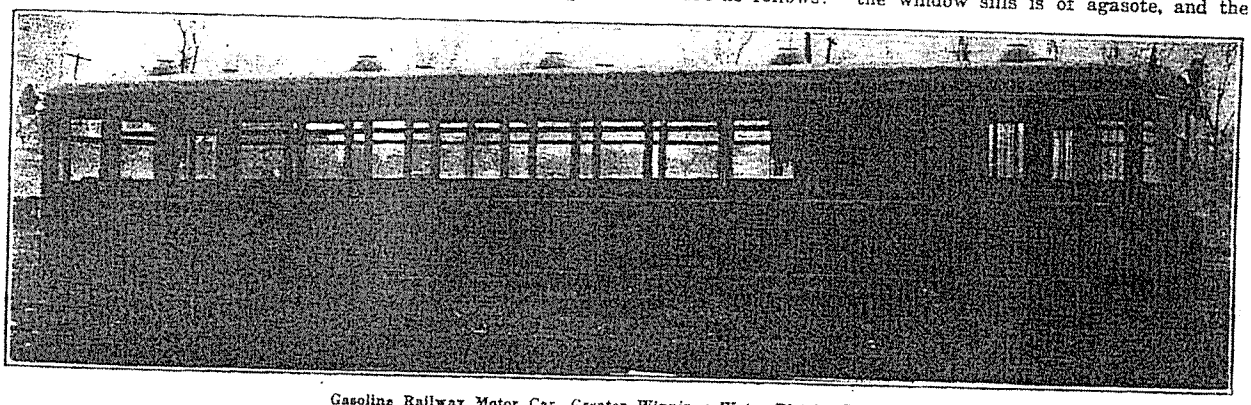
The cooling system consists of a tube and continuous fin type radiator, with a frontal area of 715 sq. in. and a 20 in. diam. 4-blade fan, driven at twice engine speed, by a 2 in. belt. The water pump, of the propulsion type, delivers 22.5 gall. of water a minute at 1,000 r.p.m. Ignition is through high tension magneto, equipped with impulse coupling, and the car is also equipped with a starting motor. The transmission is of the 4-speed, heavy duty type, mounted in a unit with the engine, and the gears are made from carbonized and oil-tempered nickel steel, and carried on nickel steel shafts and taper roller bearings. A multiple dry disc clutch is employed. The gear ratios are as follows: 1st, 5.35 to 1; 2nd, 2.12 to 1; 3rd, 1.68 to 1; 4th, 1 to 1.

The engine and transmission are mounted at the front of the car so as to be removable as a unit. The drive is through propeller shafts, having two universal joints each, used between the engine and the auxiliary transmission, and between the auxiliary transmission and each of the driving axles. The auxiliary transmission is mounted in the cast steel swing bolster, and transfers the drive through 2 propeller shafts to each driving axle. It is arranged to provide 2 ratios for forward operation, and one ratio for reverse, making a total of 8 speeds forward and 4 reverse. The driving axles are in the forward truck.

The 4-wheeled trucks are pivoted to take curves of radius as short as 70 ft. The truck frames are of 6 in. material. I beam side rails extend fore and aft over each axle inside of wheels, supporting channel transoms, which in turn carry the swing motion links. The I beams are tied at the ends by gusset plates and cross channels. The axles, of 3 in. diam., are of heat treated steel. Axle housings carry underslung semi-elliptic springs, which support the truck frames. The wheels have cast steel centers, rubber cushioning elements, and M.C.B. rolled steel tires, 30 in. diam. The car is equipped with Westinghouse semi-automatic air brakes, and all wheels are equipped with brake shoes, supported by inside hung rigging. Hand brake staffs for emergency use are fitted at each end of the car. Brill dumpit type sanders are provided for each of the 4 driving wheels. The gasoline tank is of 50 gall. capacity. Electrical equipment consists of a 12 volt engine driven electric generator of 300 watts capacity, fitted with automatic cut-out and voltage control, and a 140 a.h. storage battery. Control is by a foot operated clutch and hand operated gear shift; the spark and throttle control are by hand.

The interior of the car is divided into passenger and baggage compartments, separated by a paneled partition. The baggage compartment has a sliding door on each side. The inside finish of the car, including all doors, sash, mouldings, etc., is of cherry. The side lining below the window sills is of agasote, and the baggage compartment is lined from floor to top rail with ⅜ in. poplar tongued and grooved sheathing. The seats in the passenger compartment are of cherry, and are arranged transversely. They are finished in brown artificial leather, with the bottom cushions removable. The passenger compartment has accommodation for 38 passengers, and in addition there are folding seats of ash in the baggage compartment to accommodate 8 passengers. There are 11 windows on each side of the car, with double sash, the top sash being stationary and the lower made to raise. Each side window is provided with a pantasote curtain. There are 10 exhaust ventilators in the roof, 7 of these being in the passenger compartment, 1 in the lavatory saloon and 2 in the baggage compartment. The car is heated by exhaust from the engine, the waste gases being carried in thin steel wall tubes along either side of the car beneath the seats. The car is lighted by sixteen 15-candle power electric lights inside the car, 2 over the steps, 1 in the saloon, 4 in the baggage room and the remainder in the passenger compartment.

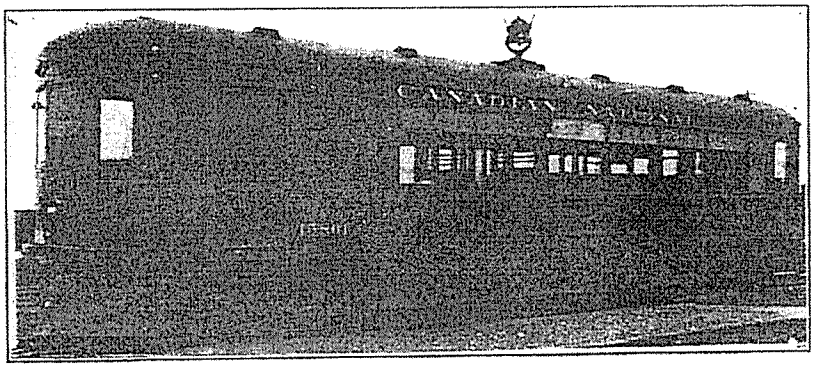
We are advised by the Greater Winnipeg Water District Commission that it



Gasoline Railway Motor Car, Greater Winnipeg Water District Railway.

is expected to have the car in operation by about the middle of May, after which it is intended to use the present steam train service for freight only, making about one trip a week. During the past winter the Commission has operated a mixed train three trips weekly, in addition to which during the past two months a special freight train has been making two trips weekly, on account of the large quantity of wood and wood products to be brought out. The schedule for the motor car is not yet worked out, and it will necessarily depend upon the demand for service. It is probable that it will make four round trips a week at least. The car was manufactured by the Service Motor Truck Co., Wabash, Indiana.

The Canadian National Rys. management is continuing development work in connection with self propelled cars for branch line service, and has placed an order with Ledoux, Jennings Ltd., Montreal, for a gasoline driven passenger motor car, 26 ft. long over all, 7 ft. 8 in. wide and 10 ft. 2 in. extreme height from top of rail. The steel car body wil lbe mounted on two 4-wheel trucks. The car will be driven by a Reo 6-cylinder 50 h.p. engine, equipped with self starter, dynamo, etc., and water cooled. The cooling system will include a centrifugal pump. The drive will be through a shaft to the front axle of the rear truck, and side rods on the wheels of the rear truck will transmit the drive from the leading to the following wheels of this truck. The axles will be of heat treated steel, those in the front truck being 2½ in. diam. and in the rear truck 3½ in. The front wheels will be M.C.B., chilled iron, 20 in. diam., and the rear wheels 30 in. diam. Brakes will include ordinary type brake shoes and beams, operated by toggle joints and pull rods, geared to a hand wheel convenient to the operator. The general finish of the interior of the car will be white and mahogany stain. The floor will be of 2-ply wood, insulated, and the roof of ⅜ in. tongued and grooved wood, covered with canvas and painted. The body will be equipped with 2 side doors for regular use by passengers and an emergency door at the rear. The seating capacity will be 32, and the seats, arranved transversely on each aisle, will be finished in rattan. This car will be used on the run between Picton and Trenton, 30.6 miles, on the Ontario District, Ottawa Division, Picton Subdivision, and it is expected that delivery will be made and the service inaugurated by May 15.



Electric Storage Battery Car, Canadian National Railways, with Snow Plough Attached.

The question of the operation of self propelled cars on steam railways has engaged the Board of Railway Commissioners' attention for some time, and on March 25 the Board issued order 32,224 upon a Canadian National Rys. application for permission to operate the car now being built by Ledoux, Jennings Co., as follows:—"Upon reading the application and the submissions filed in support thereof, and upon the report and recommendation of the Board's Mechanical Expert, the Board orders that the applicants be authorized to operate upon their railway a passenger car propelled by gasoline and constructed to detail plans on file with the Board, the motive power to be a 6-cylinder gasoline engine; and that, before the car is put into operation, it be inspected and approved by the Board's Mechanical Expert. That the Board reserves the right at any time hereafter, upon the report of its Chief Operating Officer or its Mechanical Expert, to order any changes or improvements in the said plans, or in any car constructed thereupon, which to it may seem necessary for the safety and convenience of the public or the applicant's employes; and the Board further reserves the right, at any time, to direct the discontinuance of the passenger service to be afforded by any car built according to the said plans, and the substitution therefor of other service."

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The electric storage battery car, described in preceding issues of Canadian Railway and Marine World, is still in operation between Bathurst and Campbellton, 62.96 miles, on the Maritime District, Campbellton Division, Bathurst Subdivision. One of the accompanying illustrations shows this car equipped with a snow plough which will remain on the car permanently. This car is continuing to give good and dependable service at the favorable costs mentioned previously, and despite delays of as great as 30 minutes has no difficulty in making its trips in schedule time on this busy subdivision.

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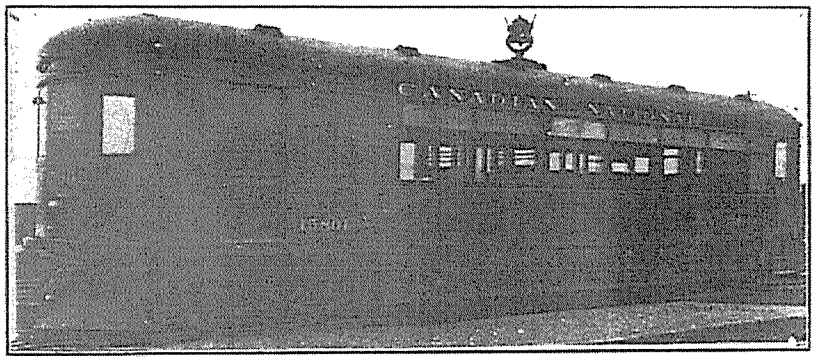

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Self Propelled Cars on Steam Railways.

The Canadian National Railways' management has bought a gasoline railway passenger motor car for the Maritime District, very similar to the one bought by the Greater Winnipeg Water District Ry., which was described and illustrated in Canadian Railway and Marine World for May, pg. 231. An elevation and plan are given herewith. The car, which is mounted on two 4-wheel trucks, has a design embracing a radical departure from the automobile type of motor-driven vehicle, and is a typical rail transportation unit. The light weight per passenger is notable; the weight is about 13 tons complete, and as 46 passengers can be accommodated, the car weighs only 560 lb. per passenger. The general dimensions are: Length over all, 42 ft. 6 in.; width over all, 8 ft. 4 in.; height from rail to ventilators, 11 ft.; truck centers, 22 ft. 2 in.

The car frame is of steel construction throughout, and the body is of composite construction. The underframe consits of four 6-in. channels, 8 lb. a foot, with cross members, gussets, etc. The car framing consists of 1½ x 1½ x 3/16 in. steel T sections, continuous, forming the carlines and posts. The car siding to the belt rail is of 3/32-in. steel plates; the belt rail is 2½ x ⅝-in. steel bar with no. 16 pressed steel window sill capping. A description of the interior of the Greater Winnipeg Water District Ry's car, together with other details, was given in our May issue, and, as stated above, the two cars are practically identical. Some enlargement on the description of the driving mechanism, etc., given in the article referred to, seems desirable, however.

An interesting feature of the car's construction is that the drive is through the 4-wheel truck at the front, while the 4-wheel truck at the rear is an idler. The engine is mounted between the sills at the front of the car, so as to be removable as a unit. The primary transmission of the 3-speed, heavy duty type, is mounted in unit with the engine. A motor truck type propeller shaft connects the primary transmission to the secondary transmission, located in the cast steel swing bolster. From this auxiliary transmission the drive is transmitted through propeller shafts to each driving axle in the leading truck. The engine is a 4-cylinder, 4-cycle, valve-in-head, heavy duty type, with 4¾-in. bore and 6-in. stroke. At 800 r.p.m. it develops 41.8 h.p.; at 1,000 r.p.m., 51.3 h.p.; at 1,200 r.p.m., 59.1 h.p.; at 1,400 r.p.m., 65.8 h.p., and at 1,500 r.p.m., 68 h.p. Ignition is furnished by an Eisemann high tension magneto, equipped with impulse coupling, and equipment includes a starting motor.

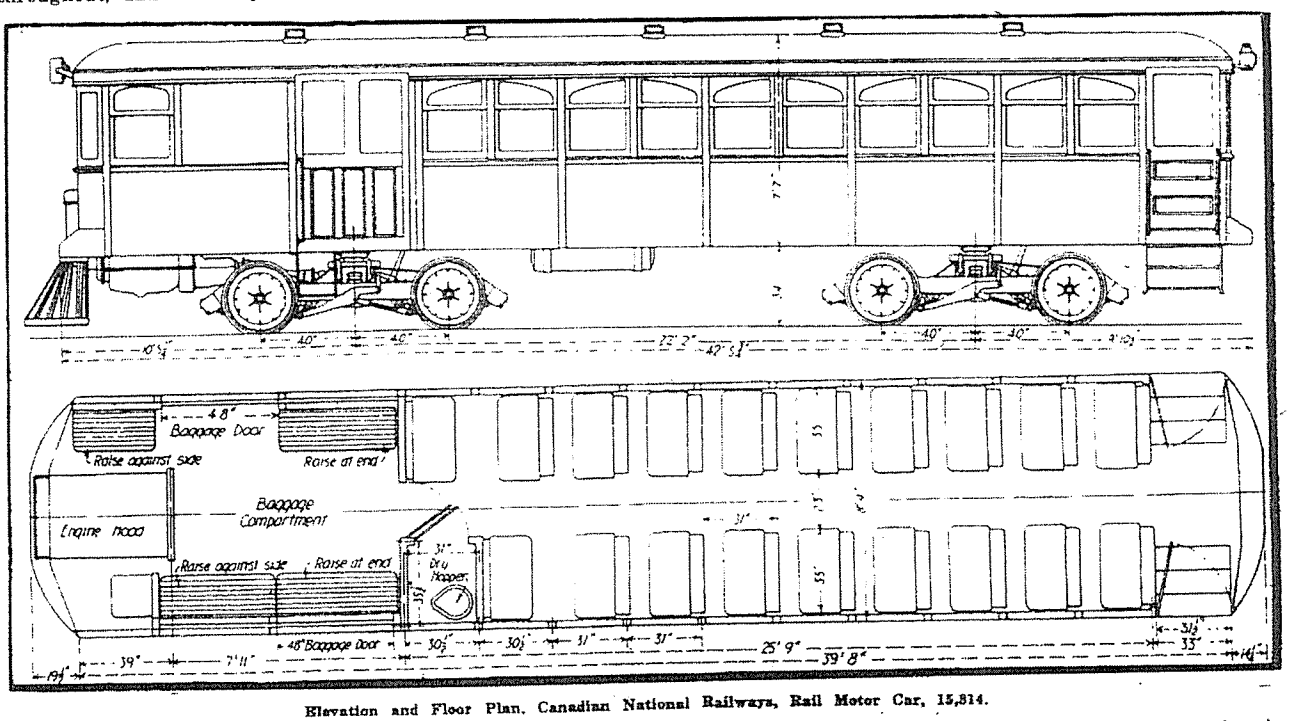
The primary transmission, in unit with the engine, has gears 1¼ to 1¾ in. wide, made from carbonized and oil-tempered nickel steel, and carried on nickel steel shafts and Timken taper roller adjustable bearings. The ratios are as follows: 1st, 4 to 1; 2nd, 1.76 to 1; 3rd, 1 to 1. A multiple dry disc clutch is used. Between the primary transmission and the secondary transmission a propeller shaft, with 2 universal joints, is used. The secondary or auxiliary transmission is, as stated above, mounted in the bolster, and it transfers the drive through 2 propeller shafts, equipped with 2 universal joints each, to each driving axle. All gears and shafts are of carbonized and oil-tempered nickel steel. The secondary transmission is arranged to provide 2 ratios for forward operations (standard ratios 26 m.p.h. and 35 m.p.h.) and one ratio for reverse. This, taken in conjunction with the gear ratios for the primary transmission, as given above, makes a total of 6 possible speeds in forward gear and 3 in reverse. Each axle of the driving truck is provided with bevel gearing, driven through a pinion from the propeller shaft. The axles are heat-treated alloy steel, 3 in. diam., and the bearings are of the Timken taper roller type. The wheels are held by taper and key.

The car is equipped with air brakes, all wheels being equipped with brake shoe, applied by inside hung linkage. The operator's brake valve is connected to a cord running the full length of the car. Hand brake staffs for emergency use are located at each end. Lighting is by a 12-volt, engine-driven electric generator of 300-watt capacity, fitted with automatic cutout and voltage control, and the car is also equipped with a 160 ampere hour storage battery.

The car, which was bought from the Service Motor Car Co., Wabash, Ind., will, when delivered, be put in operation on the Maritime District, Campbellton Division, Bathurst Subdivision, between Bathurst and Campbellton, N.B., 32.96 miles.

As stated in previous articles, the run between Bathurst and Campbellton has been covered for some time by the storage battery car bought by the C.N.R. in 1921. We are advised that results secured with this car continue to be eminently satisfactory, as concerns operating and maintenance costs, and reliability. As there is a heavy steam train traffic on the Bathurst Subdivision, three men have been used in operating the car. Under summer conditions the current consumption has averaged 0.875 k.w.h. a car mile, and under unfavorable winter conditions it has been only on rare occasions that it has been more than 1.30 k.w.h. This car is to be transferred to a run between the Central station, Ottawa, and the Tunnel station, Montreal, 114 miles, on the Quebec District, Montreal Division, Grenville and Tunnel Terminal Subdivisions, as soon as the gasoline motor car bought recently and described above is ready for service between Bathurst and Campbellton, N.B.

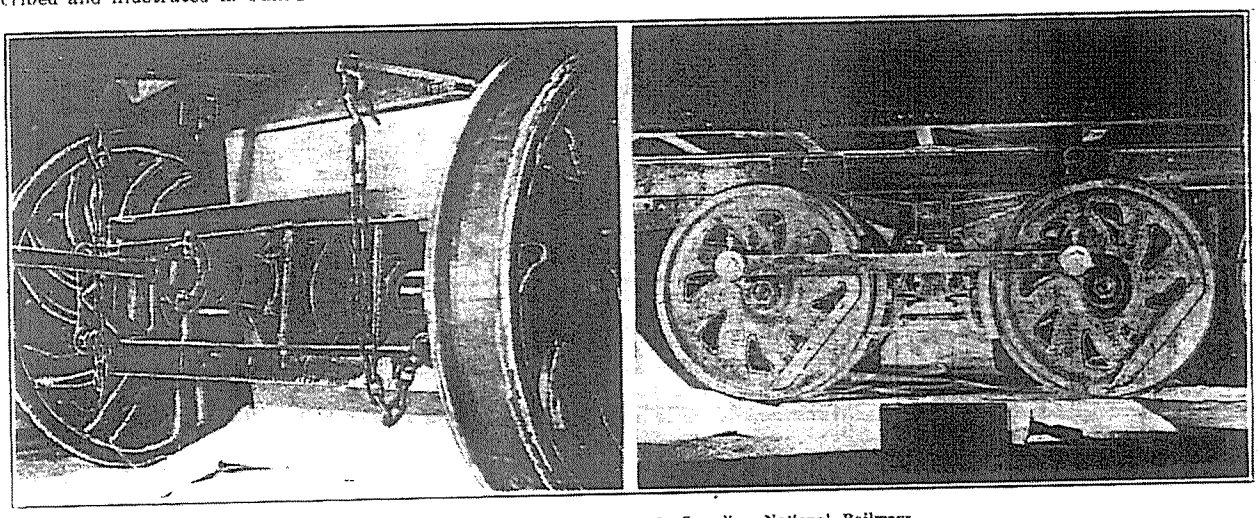
The gasoline motor car built by Ledoux, Jennings, Ltd., Montreal, and which



Elevation and Floor Plan, Canadian National Railways, Rail Motor Car, 15,814.

was operated in 1921 between Brockville and Westport, 44.4 miles, on the Ontario District, Ottawa Division, Brockville Subdivision, has been transferred to the Maritime District, Edmundston Division, and is operating between Cross Creek and Stanley, N.B., on the Nashwaak and Stanley Subdivisions, 5.74 miles. This car was described in Canadian Railway and Marine World for Nov. and Dec., 1921.

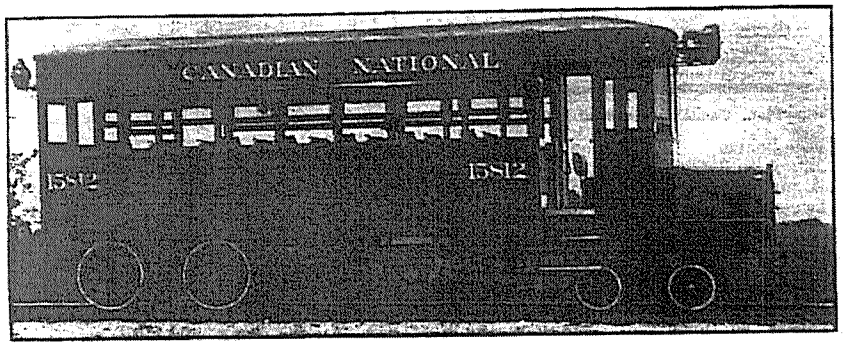
The gasoline car equipped with a Winton chassis and 6-cylinder engine, described and illustrated in Canadian Railway and Marine World for Dec., 1921, and which ran formerly between Cross Creek and Stanley, N.B., has been converted to 3½-ft. gauge at the C.N.R. Moncton shops, and started on July 6 operating between Souris and Elmira, P.E.I., on the Maritime District, Island Division, Souris and Elmira Subdivisions. Trains 23 and 24, which operated between Souris and Elmira daily except Sunday, were cancelled on the date mentioned, and motor car service was installed on the following schedule: Daily except Sunday the car leaves Elmira at 6.20 a.m., Harmony Jct. at 7.03 a.m., and arrives at Souris at 7.30 a.m.; leaves Souris at 5.30 p.m. On Wednesday only Souris at 5.30 p.m., Harmony Jct. at 5.50 p.m., and arrives Elmira at 6.30. On Wednesday only the car leaves Souris at 1.15 p.m., arrives Harmony Jct. at 1.32 p.m., leaves Harmony Jct. at 1.45 p.m., and arrives at Souris at 2.05 p.m. Daily except Sunday and Wednesday the car leaves Souris at 10.45 a.m., Harmony Jct. at 11.05 a.m., and arrives at Elmira at 11.45 a.m.; leaves Elmira at 12.45 p.m., Harmony Jct. at 1.32 p.m., and arrives at Souris at 1.50 p.m. In addition to the motor car service a mixed train service is given between Souris and Elmira on Wednesday only. From Souris to Harmony Jct., the junction between the Souris and Elmira Subdivisions, is 4.8 miles, and from Harmony Jct. to Elmira is 9.85 miles, making the total distance from Souris to Elmira 14.65 miles. Harmony Jct. is 55.5 miles from Charlottetown. No meets having to be made on steam trains, the motor car is being operated by one man. This operation will be in effect for the summer only, the Elmira Subdivision being very difficult to operate in winter, on account of snow. The car hauls a small trailer, used chiefly for the transportation of cream.



Gasoline Railway Motor Car, 15,812, Canadian National Railways.

Front of rear truck, with drive shaft arrangement. Side of rear truck, showing side rods.

The first of the two gasoline cars ordered recently by the C.N.R. management from Ledoux, Jennings, Ltd., Montreal, was, on June 28, as stated in our July issue, placed on the run between Picton and Trenton, 30.6 miles, on the Ontario District, Ottawa Division, Picton Subdivision, and between Trenton and Trenton Jct., 1.6 miles, on the Maynooth Subdivision, also, and between Trenton and Napanee, 34.6 miles, on the Rideau Subdivision. The car's schedule was given in our June issue on pg. 289. The car is giving very satisfactory service. It was described and a plan and elevation were given in our June issue, and herewith are shown illustrations of it and of its truck details.



Gasoline Railway Motor Car, 15,812, Canadian National Railways.

When this car was delivered, it left Montreal under its own power and made the trip to Ottawa, 114 miles, in 4 hours, including all stops and meets. The builders state that between Montreal and Hurdman, 111.4 miles from the Montreal Tunnel station, 107 miles were run on a gasoline consumption of 9¾ galls., with 5 passengers in the car. On arrival at Ottawa, the car was inspected by Board of Railway Commissioners' members and officials, after which it was driven to Trenton, making on part of the trip 20 miles in 30 minutes. The trial trip on the regular runs was made June 28, and with 21 passengers on board 32 miles were run in 55 minutes, including two stops. The builders further state that they have a report that on one day the car made 196 miles on 14 gals. of gasoline, or 14 miles to the gallon. To July 10 the mileage made was 5,000.

As stated in our July issue, the C.N.R. management intends to convert 2 passenger cars into self-propelled cars of the storage battery type at the Niagara, St. Catharines & Toronto Ry. shops at St. Catharines, Ont., for use on Ontario District lines. They will each be fitted with a set of storage batteries and 4 motors, and all other electrical and control equipment will be applied at St. Catharines. The type of battery to be used has not been decided.

The self-propelled cars in C.N.R. service have been renumbered recently. The gasoline electric car which has been operating for some time between Transcona and Winnipeg, Man., is now no. 15,800; the storage battery car operating between Bathurst and Campbellton is now no. 15,801; the 2 storage battery cars to be built at St. Catharines will be nos. 15,802 and 15,803; the gasoline car operating in Prince Edward Island has been numbered 15,810; the first car built by Ledoux, Jennings, Ltd., now operating between Cross Creek and Stanley, N.B., is no. 15,811; the 2 gasoline cars ordered recently from the same builders, are nos. 15,812 and 15,813, and the gasoline motor car to be operated between Bathurst and Campbellton is no. 15,814.

Greater Winnipeg Water District Ry.—The gasoline motor car bought for this line, which extends from St. Boniface, Man., to Waugh, Shoal Lake, adjoining Lake of the Woods, 91.9 miles, was delivered in Winnipeg, June 23, and was placed in service July 3. It leaves St. Boniface, 5.3 miles from Winnipeg, on

The Diesel Electric Drive for Self-Propelled Cars.

Judging from the attention being given the matter in Canada, the United States and other countries, the self propelled car is rapidly establishing a field for itself in railway operation. An article on other pages of this issue deals fully with developments in self propelled car service on the Canadian National Rys. the Greater Winnipeg Water District Ry., the Quebec Central Ry., the Quebec, Montreal and Southern Ry., and on a Government railway in Australia, and in previous issues cars used on other lines have been described. While Canadian Railway and Marine World has not yet received complete records of operating and maintenance costs, it is evident that both the gasoline driven and the storage battery cars are reliable and economical. There is no doubt that the providing of steam train passenger service on the majority of branch railway lines is a losing proposition, and the introduction into branch line operation of any type of self propelled car which is reliable and much more economical than a steam train is certainly of value to the railways and the public.

There is one type of drive applicable to self propelled cars for railway service, which as far as we know, has not been tried in Canada, but from the results of operation elsewhere, it would seem that great advantages might be derived from its use. We refer to the Diesel electric motor cars used on certain Swedish railways, the first of these cars having been in service for over six years. Four different types of motor cars equipped with the Diesel-electric drive are in use, two having 75 h.p. engines and two having 120 h.p. engines, and a number of cars to be equipped with 160 and 250 h.p. engines are being built. The latter will be somewhat in the nature of locomotives, and will haul a limited number of trailers. The cars at present in use in Sweden are all operating on privately owned railways.

It is well known that the Diesel engine is superior to all other prime movers in efficiency as a heat engine. Whereas the ordinary internal combustion engine transforms from 20 to 22% of the thermal value of the fuel consumed into useful work, the Diesel engine will get from 30 to 35% out of it. In the operation of a Diesel engine, combustion is complete, and analysis of the exhaust gases shows them to consist of carbon dioxide, water vapor, and the nitrogen contained in the air of compression, so that the waste is negligible. High compression and complete combustion effect an economy not obtained by any other prime mover, and as ignition is caused solely by high air pressure, no special iginition devices, liable to get out of order, are required. With a large supply of cheap crude oil available for fuel, the economy in operating engines of this nature in self propelled cars is evident.

In the Swedish railway cars, the engines are started electrically, and the power created at the engine is transmitted electrically to the driving axles, through generator and motors. The engine and generator are mounted on a common frame, the generator being shunt-wound, and, in addition, provided with a separate series winding, the latter being connected to the circuit only when the generator is used as a motor driven from a storage battery included in the equipment. The two motors are standard series-wound railway motors, with commutating poles. Power is transmitted to the two inside axles by spur gearing.

We are informed by a Canadian railway officer, that two 50 ft. passenger cars could be equipped with a Diesel-electric outfit, to operate as a self propelled 2-car unit, for $25,000, this providing for the acquisition and installation of Diesel engine and all necessary electrical equipment in one car, and for equipping both cars with ball bearing trucks. The same officer informs us that maintenance costs have been demonstrated as exceedingly low, the electrical equipment particularly requiring but infrequent attention. Experience has shown that the cars require overhauling about every 50,000 miles.

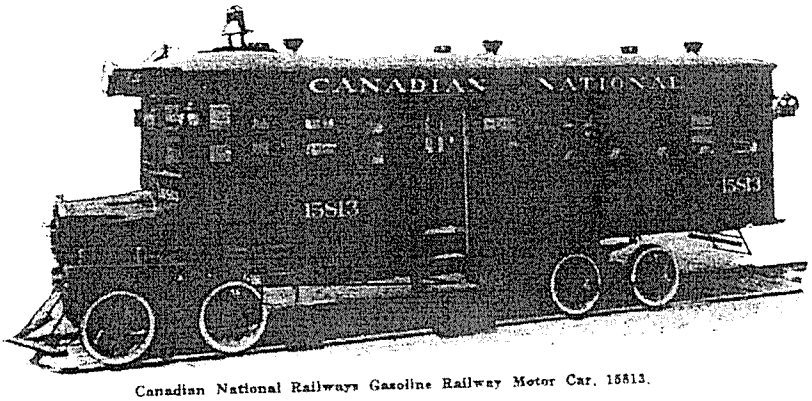
Reasonable first cost, low maintenance cost and low operating cost, together with simplicity in operation and reliability, indicate that cars of this type in suitable rail service would be a paying proposition. Actual experience with them in Sweden has demonstrated this. A trial of one of them on a Canadian railway might possibly lead the way to further progress in the task of decreasing railway operating expenses.

Sir Alfred Smithers, M.P., who, until May, 1921, was Chairman of the G.T.R. board of directors, is stated, in a press dispatch, to have voted in the British House of Commons recently against the motion to remove the embargo preventing Canadian live cattle from being admitted to Great Britain, the reason given for his action being that, among his other activities, he is a cattle breeder. If that was his reason, it will only tend to increase the contempt in which he has been held in Canada since the evidence before the arbitrators, on the value of G.T.R. shares taken over by the Dominion Government, showed his participation in the manipulation of the company's accounts for the apparent purpose of deceiving both the Government and the company's shareholders.

The Labor Congress, at its meeting in Montreal recently, passed resolutions urging that an adequate number of employes be engaged on railway maintenance of way work. There is not the slightest evidence that an inadequate number of employes are engaged in railway maintenance of way work on any of the principal Canadian railways, the management of which can safely be trusted to see that the tracks are maintained properly.

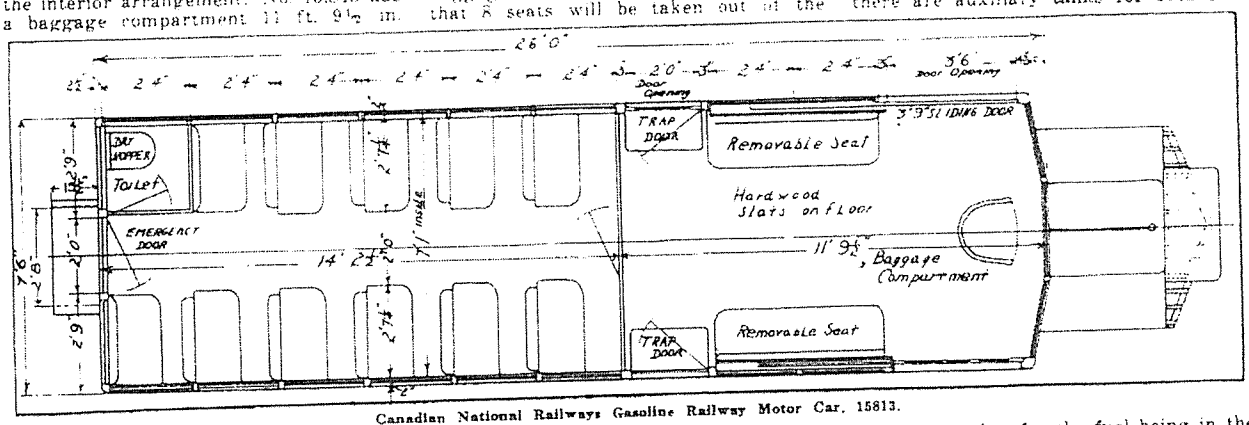
Self Propelled Cars on Steam Railways.

The Canadian National Rys. had 4 self propelled cars on exhibit at the Canadian National Exhibition, Toronto, from Aug. 26 to Sept. 9, viz., 15,803, storage battery car; 15,805, steam car; 15,813, gasoline car; and 15,814, gasoline car. The showing of these brought home to the public the possibilities in connection with self propelled car operation in short line and branch line service, and great public interest in them was evident. Car 15,814 was the service gasoline car, which has been thoroughly described and illustrated in preceding numbers of Canadian Railway and Marine World. Gasoline car 15,813, built by Ledoux, Jennings, Ltd., Montreal, has not been described and illustrated, but car 15,812, a car very similar to 15,813, and built by the same builders, has been. No. 15,813 is illustrated herewith and a floor plan is given. It is the same as 15,812 with the exception of the leading truck and the interior arrangement. No. 15,813 has a baggage compartment 11 ft. 9½ in. long, fitted with removable seats, while 15,812 has no baggage compartment. The leading truck of 15,813 is the same as the rear truck, with the exception of the side rods on the latter, while on 15,812 the front truck wheels are much smaller than those of the rear truck. With these exceptions, the description given in preceding numbers of Canadian Railway and Marine World for 15,812 is applicable to this gasoline motor car 15,813.



Canadian National Railways Gasoline Railway Motor Car, 15813.

Car 15,803, of the storage battery type, is one of two bought from the Cambria & Indiana Rd., in the U.S., and is illustrated herewith. It has a seating capacity of 36. The drive is by motors geared to axles, with current derived from storage batteries contained in the large battery holder seen below the car body and between the trucks, the batteries being charged between trips. The car is equipped with ball bearing trucks of the arch bar type, and is fitted with a snow plough arrangement as shown at the front. At the time of writing (Sept. 13) some changes remain to be made in the car, viz., renewal of storage battery, equipping of car with lavatory, baggage racks, coat hooks, locomotive type bell, and a smoking seat in the baggage compartment. This work will be done at the Niagara, St. Catharines & Toronto Ry. shops at St. Catharines, Ont. The other battery car bought from the Cambria & Indiana Rd., No. 15,802, is larger than 15,803, the seating capacity being 50. This car will also undergo some changes at the Niagara, St. Catharines & Toronto Ry. shops, among which will be the providing of a larger baggage compartment. It is probable that 8 seats will be taken out of the passenger compartment to provide for this. Renewal of the storage batteries will also be necessary before the car is placed in operation.



Canadian National Railways Gasoline Railway Motor Car, 15813.

Car 15,805, the steam car furnished by the Unit Railway Car Co., Boston, Mass., a plan and illustration of which are given herewith, has the following dimensions:

Length over bumpers	50 ft. 7 in.
of main passenger compartment	24 ft.
of operating compartment	8 ft.
of smoking and baggage compartment	12 ft. ⅞ in.
Width over side sills	8 ft. 6 in.
Width of aisle	1 ft. 9½ in.
Height from rail to top of roof	11 ft. 11½ in.
Truck centers	28 ft.
wheel base, motor	6 ft. 1 in.
wheel base, trailer	5 ft. 6 in.
Total seating capacity	42
Horsepower, normal	90
Weight, approximately	60,000 lb.
Steam pressure	700 to 1000 lb. per sq. in.

This car burns kerosene, or crude oil, as fuel, and as the name "unit car" implies, each car is a unit in itself, carrying its own fuel, water and other supplies. The car is propelled by a modified twin cylinder engine, mounted on, and forming a part of, the leading truck, power being transmitted direct to the axle by a spur gear, the engine and driving gear running in an oil bath in an oil tight case. The power developed is approximately 60 h.p., and when periods of emergency exist, such as when starting on heavy grades, or in deep snow, a maximum of 280 h.p. may be developed. An improved water tube boiler, mounted in the forward end of the car, supplies steam at a working pressure averaging 750 lb. In operation, oil is fed to the combustion chamber, under a constant pressure controlled by an automatic valve. The main burner and pilot are parts of the automatic control system used, and the water is also fed automatically to the boiler. The throttle valve is placed in the steam line where it leaves the boiler, and the throttle valve control lever, together with the reverse lever and air brake control equipment, are located in the operating compartment at the forward end of the car.

The water is fed from the auxiliary water tank to the boiler, by a double acting pump, and the automatic control feature is arranged so that if more water is being delivered than is required, the water is diverted back to the tank by an automatic movement of a valve. If the water supply to the boiler falls below a predetermined rate, resulting in the level getting dangerously low, the fuel oil supply to the burner is automatically cut off. The main water and oil tanks are below the car floor, but there are auxiliary tanks for both fuel and water, that for the fuel being in the baggage compartment, and that for the water at the front of the car. The oil is elevated to the auxiliary tank by air pressure, and then flows from the auxiliary tank to the burner, while the water is elevated to the auxiliary water tank by a lifting injector, and is forced from there to the boiler by a pump, as stated above. The steam is superheated in a 2 unit superheater. Simplicity is the outstanding feature of the control system.

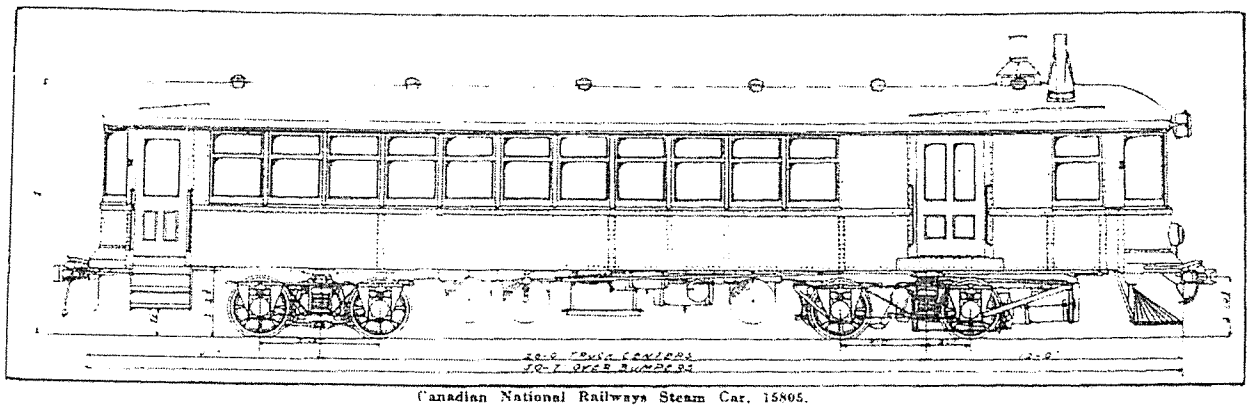
The trucks are of the arch bar type, and are equipped with roller bearings. The engine and front, or driving, truck being a unit, with the drive connecting to the leading axle of the truck, the

bolster is placed near the driving axle, to secure a proper weight on the driving wheels. The steam car is said to be capable of a speed of from 45 to 50 m.p.h. on level track, and of 14 m.p.h. on a 3% grade. It is claimed that it will operate at an average car-mile cost of 10 cents, and that from 2 to 4 miles, depending on conditions, will be obtained from one gallon of kerosene. The car is of semi-steel construction, with M.C.B. standards throughout, and is equipped with air brakes and electric lighting, the current being obtained from a steam driven generator. The interior arrangement is shown in the accompanying plan.

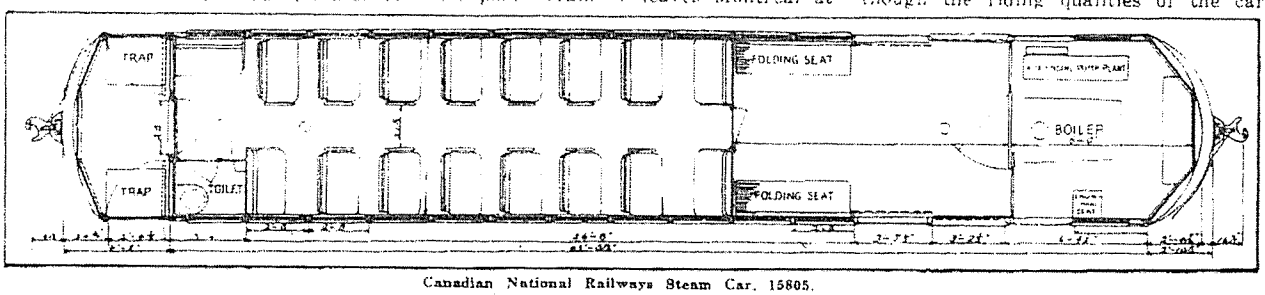
The C.N.R. has self propelled cars in operation, as follows:—Gasoline-electric car 15,800 between Winnipeg and Transona, Man., storage battery car 15,801 between Bathurst and Campbellton, N.B.; gasoline car 15,810 between Souris and Elmira, P.E.I., gasoline car 15,811 between Cross Creek and Stanley, N.B., and gasoline car 15,812 between Picton, Trenton Jct., and Napanee, Ont. It is probable that gasoline car 15,814 will be placed on the latter run also. A self propelled car service is to be established between Victoria and Sooke, B.C., on the Victoria Alberni lines, 22 miles, and it is likely that gasoline car 15,813 will be sent there. A self propelled car will also be placed in service between Brockville and Westport, Ont., 44.4 miles. A gasoline car was on that run for a short period some time ago, but was removed. A third additional self propelled car service is to be established between Toronto and Washago, Ont., 89 miles, and it is likely that a battery car will be sent there.

Quebec Central Ry.—As stated in Canadian Railway and Marine World for September, the Q.C.R. ordered two gasoline cars from Ledoux, Jennings, Ltd., Montreal, one of which had been delivered and loaned to the C.P.R. for use on its Lasalle Loop Division, Montreal Terminal Division, Quebec District, between Highlands and Cote St. Paul, 5.85 miles. We were officially advised that delivery of the second car was expected by Sept. 15, and that, on delivery, it would be placed in service between Levis and Scotts Jct., Que., 32 miles. As stated in our September issue, the Quebec Central Ry. cars are similar to Canadian National Rys. cars 15,812 and 15,813, but differ from both of them in that while they have the small leading truck like the 15,812, they also have a baggage compartment, similar to that provided in car 15,813.

Quebec, Montreal & Southern Ry.—An illustration is given herewith of the self propelled car built for this road, a Delaware & Hudson Co. subsidiary, by Ledoux, Jennings, Ltd., Montreal. It is similar to those ordered by the Quebec Central Ry., and, like them, is propelled by a Reo 6-cylinder 50 h.p. engine. It was placed in service Sept. 1, between Montreal and Sorel, Que., 44.51 miles, running on Sundays, Tuesdays, Thursdays and Saturdays, as trains 52, 53, 54 and 55, and between Montreal and Fortierville, Que. 109.69 miles, on Mondays, Wednesday and Fridays, as trains 50 and 51, the daily average mileage being in the neighborhood of 200. Train 52 leaves Montreal at 8 a.m. and arrives at Sorel at 10.15 a.m. Train 53 leaves Sorel at 10.50 a.m. and arrives at Montreal at 1.14 p.m. Train 54 leaves Montreal at 12.40 p.m. and arrives at Sorel at 3 p.m. Train 55 leaves Sorel at 4.10 p.m. and arrives at Montreal at 6.50 p.m. Train 50 leaves Montreal at 8 a.m. and arrives at Fortierville at 1 p.m. Train 51 leaves Fortierville 1.20 p.m. and arrives at Montreal at 6.50 p.m. Two men are used in operating this car. About 12 miles a gallon of gasoline have been secured. On the trial trips a speed of 48 m.p.h. was secured, but instructions limit the speed to 30 m.p.h. in operation.



Canadian National Railways Steam Car, 15805.



Canadian National Railways Steam Car, 15805.

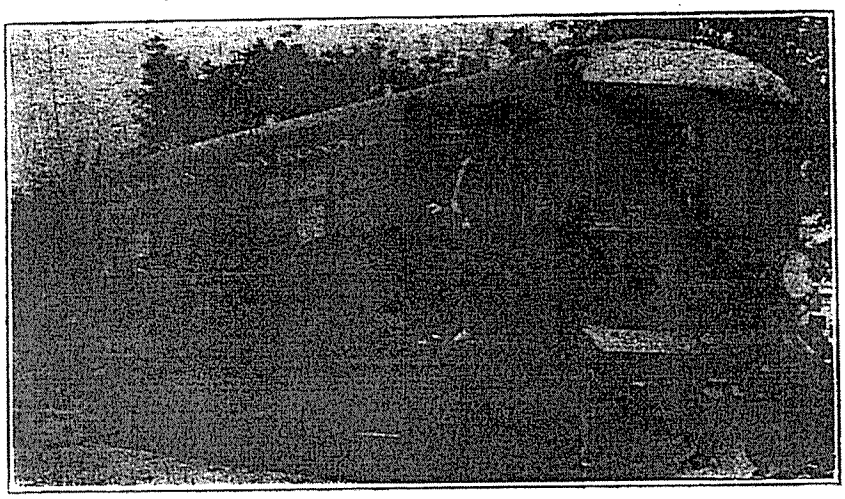
Results With Self Propelled Cars in the U.S.

J. W. Cain, Purchasing Agent, American Short Line Railroad Association, in a discussion at a recent meeting of the Society of Automotive Engineers, presented the experiences of some 500 short line railways located throughout the U.S. with self propelled cars. Regarding gasoline car costs, he said—"Operating costs vary from 10 to 25 cents a mile, and gasoline consumption from 5 to 10 miles a gallon. Maintenance costs have been found to be surprisingly low, averaging about $15 a month on smaller type cars and only slightly above this on the larger ones. By smaller type is meant those using a 2½ or 3 ton motor truck chassis, and by larger cars those using 5 ton chassis. The operating cost of 10 cents per car mile was, of course, confined to the former, which were being operated by one man. But some of the larger types, using two men, were being operated as low as 20 cents per car mile, as shown in the following table. The figures per mile in this table were made on a basis of $12,500 as the purchase price, and an operation of 100 miles a day."

Gasoline	3 c
Labor, 2 men at $125 monthly	8½
Depreciation at 12½%	4
Interest, insurance	2½
Maintenance	2
	20c

Summarizing his observations, Mr. Cain said: "The concensus of opinion by the short lines was that all cars should be equipped with a pivotal lead truck for safety, and that a single pair of drivers, with the proper weight distribution, gave satisfactory service, though the riding qualities of the car were naturally not as good as though a 4-wheel truck with swing bolster were employed. In our personal examination and inspection of the different cars available, it was found that the light 6-wheel type cars up to a length of 36 ft. and a weight of about 20,000 lb. could be operated successfully at a speed of 30 to 35 m.p.h., making from 5 to 6 miles per gallon of gasoline. Beyond this, there is too much vibration, and the single driving wheel arrangement makes the car ride uncomfortable, but for a capacity up to 35 passengers and about 2,000 lb. of baggage, we found this the most successful car of the

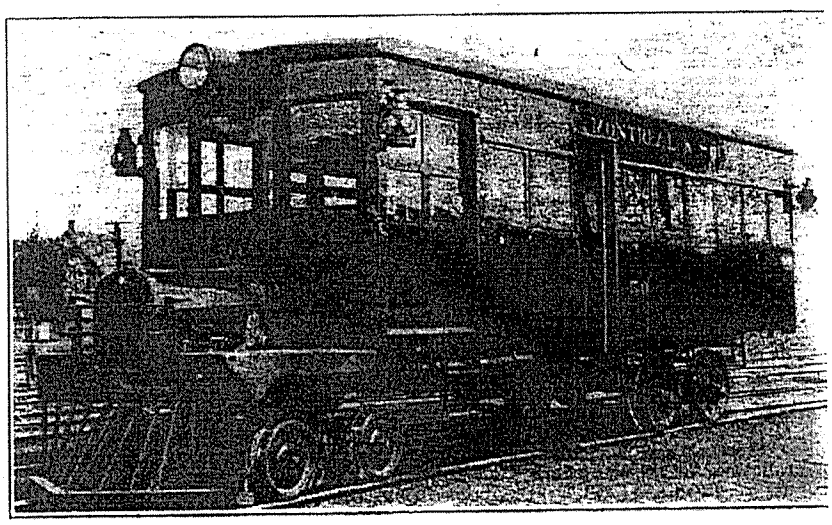
present time. Above this capacity, we examined a car 43 ft. in length, equipped with two 4-wheel pivotal trucks, which was capable of making a maximum speed of slightly better than 40 m.p.h., at which speed it rode very comfortably. The weight of this car was about 30,000 lb. I believe that these cars are going to prove the salvation of a great many short-line railways, as well as branch lines of the larger systems; and, as a great many of our member lines have stated, they have figures from red to black. While the cars of the type under consideration are absolutely successful and will faithfully perform the duties imposed on them, I feel that efforts should be expended toward the development of a higher powered engine, as the present equipment has none too much power. I do not mean to increase the bore of the cylinders, or go to the slow speed marine type of engine; but, instead, to increase the number of cylinders and adhere strictly to the successful and proved type of automobile engine."



Canadian National Railways Storage Battery Car, 15803.

Diesel-Electric Cars.—Swedish railways have been using self propelled cars, equipped with 75 and 120 h.p. Diesel engines, and electrical transmission, for many years, some of them having been in service since 1913, and more recently cars equipped with 160 and 250 h.p. engines have been placed in service. Four of these large units are in service between Gothenburg and cities south of that point. The complete power installation for these cars consists of the following apparatus: one Diesel engine of the 4 stroke cycle type, with 6, 8 or 12 cylinders, according to the capacity. (The size of generators and other electrical equipment is also increased with the engine capacity); one direct-coupled, direct-current generator of the 8-pole type, with commutating poles. The generator is shunt wound, but has a separate series winding, the latter being connected to the circuit only when the generator is driven from the storage battery in starting. The generator voltage can be varied within wide limits up to 550 volts. Two electric motors of standard series-wound railway type, with commutating poles. (Power is transmitted to the axles by spur gearing); one storage battery of alkaline type, suspended beneath car and supplying current for starting, lighting and working auxiliary apparatus. This is charged automatically when the car is in motion, and a special switch is provided for charging when the car is standing. In addition to the saving in operating costs claimed for these Diesel-electric cars, other advantages claimed are the saving in car heating from the engine cooling water, the independence of cooling and charging stations, and the elimination of waste of time in taking on water and fuel at stations, as the oil fuel suffices for a 600 mile run, and no cooling water is lost or evaporated.

Canadian Railway and Marine World has been advised that some of its readers have been under the impression that the rear trucks of the gasoline railway motor cars built by Ledoux, Jennings, Ltd., of Montreal, are fixed and rigid in relation to the car body, which has caused enquiries to be made as to how curvature is taken care of. We cannot understand how such an idea could have originated, as Canadian Railway and Marine World has published nothing to that effect.

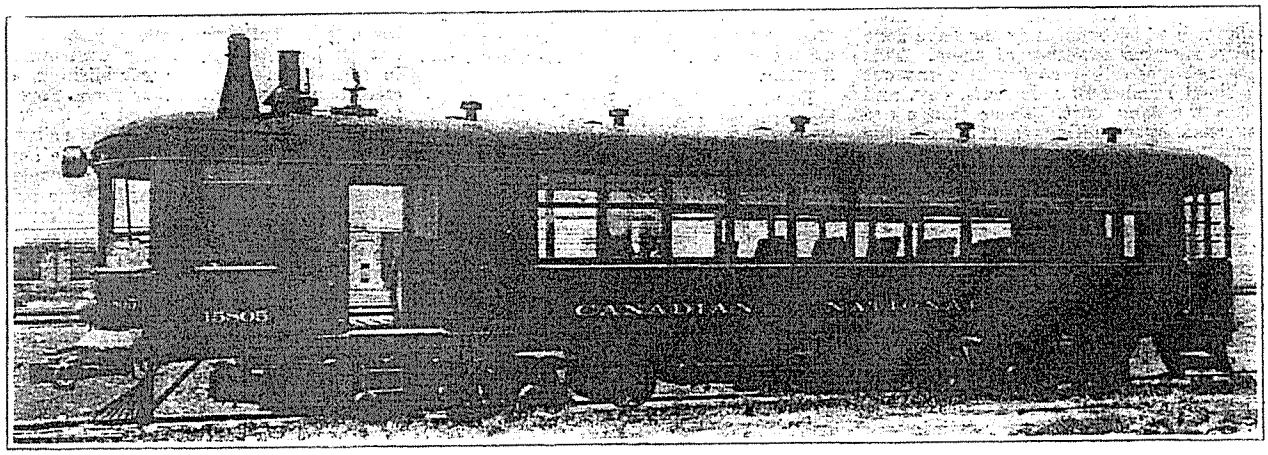


Quebec, Montreal & Southern Railway Gasoline Railway Motor Car.

Of course, proper curving and tracking would be impossible with the truck fixed, and the rear truck on these cars, like the front trucks, swivels on a center plate and side bearings as on any other railway car, the drive being taken care of by a ring universal joint and the telescoping.

Self Propelled Cars on Steam Railways.

Canadian National Railways' self propelled cars are, or very soon will be, assigned to service as follows: No. 15,800, the gasoline-electric car, which has been operating for some time between Winnipeg and Transcona, Man., will be withdrawn from service and remodelled, probably at the Transcona shop. Thorough overhauling of the motor is necessary. It will be replaced by storage battery car 15,802, one of those received from the Cambria and Indiana Rd. no. 15,801, the storage battery car which has been furnishing satisfactory service between Bathurst and Campbellton, on the Maritime District, is operating between Toronto and Beaverton, Ont., 64.3 miles, on the Muskoka Subdivision, Nipissing Division, Ontario District. The first trip was made Oct. 15. It was originally intended to give the service between Toronto and Washago, 89 miles, but in view of the latter place receiving adequate service without the car, the Toronto-Beaverton run was decided upon. The car handles a large milk traffic, in addition to local passenger traffic, and operates daily except Sunday, leaving Beaverton as train 316 at 8.30 a.m., and arriving at Toronto Union Station at 11.30 a.m., and leaving Toronto as train 315 at 3 p.m., and arriving at Beaverton at 6.05 p.m. Power for charging the batteries is available at both Toronto and Beaverton. Contrary to the original intention, car 15,802 will not be remodelled at the Niagara, St. Catharines & Toronto Ry. shops at St. Catharines, Ont., but at the Transcona shops, near Winnipeg. The baggage compartment will be fitted up as a smoking compartment and a few other small changes will be made. Storage battery car 15,803, also from the Cambria and Indiana Rd., is being rehabilitated at the Niagara, St. Catharines & Toronto shops at St. Catharines. New batteries are being put in, the car is being rewired, and equipped with locomotive bell, seats in the baggage compartment, standard headlights and marker lights, and a lavatory, and generally is being made to conform with the Board of Railway Commissioners' requirements. When hydro power becomes available, this car will run between Brockville and Westport, 44.4 miles, Brockville Subdivision, Ottawa Division, Ontario District. Steam car 15,805, described in Canadian Railway and Marine World for October, and illustrated herewith, has been placed on the Bathurst-Campbellton run, on the same schedule as the storage battery car operated there heretofore. Particulars of this schedule have been given in preceding numbers of Canadian Railway and Marine World. No. 15,810, the small gasoline car with the Winton engine, is still in operation between Souris and Elmira, on Prince Edward Island. Particulars of this run were given in Canadian Railway and Marine World for August, pg. 418. No. 15,811, the first gasoline car to be received from Ledoux, Jennings, Ltd., Montreal, is still in service between Cross Creek and Stanley, N.B., 5.74 miles, on the Nashwaak and Stanley Subdivisions, Edmundston Division, Maritime District. Gasoline car 15,812 is in service between Brockville and Westport, Ont., but will be replaced by car 15,803, as stated, after which it will be kept as a spare on the Trenton-Picton-Napanee run. Gasoline car 15,813 has been sent to the Pacific coast, where it will operate between Victoria and Sooke, some 22 miles out of Victoria, on the Victoria-Alberni line. Gasoline car 15,814 is in service on the Ottawa Division, Ontario District, between Picton and Trenton, 30.6 miles, on the Picton Subdivision; between Trenton and Trenton Jct., 1.6 miles, on the Maynooth Subdivision, and between Trenton and Napanee, 34.6 miles, on the Rideau Subdivision. Battery cars 15,801 and 15,802 are equipped with Edison storage batteries, which have proved satisfactory in every way. Battery car 15,803 will be equipped with ironclad exide batteries.



Self Propelled Steam Car, Canadian National Railways.

The Board of Railway Commissioners passed order 32,842 on Sept. 9, authorizing the operation of gasoline car 15,813, as follows: "The Board orders that the Canadian National Rys. be authorized to operate the passenger car known as the Ledoux, Jennings gas car, propelled by gasoline, and constructed according to the detail plans approved under order 32,224, March 25, 1922. The Board reserves the right, at any time hereafter, upon the report of its Chief Operating Officer or its Mechanical Appliance Specialist, to order any change or improvements in the said plans, or in any car constructed thereupon, which it may seem necessary for the safety and convenience of the public or the employes of the applicants; and the Board further reserves the right at any time to direct the discontinuance of the passenger service to be afforded by any car built according to the said plans, and the substitution therefor of other service."

We understand that the Canadian National Rys. are about to order an additional gasoline rail motor car from Ledoux, Jennings, Ltd.

Full details as to the operating costs of the various self-propelled cars are not available. It may be stated, however, that they have been running between 20c and 40c a car mile. In 1921, the average train mile operating expense on the Canadian railways as a whole was $4.02, but this of course, covered all items of expense. What the average cost per passenger train mile is, is impossible to determine, although from time to time some railway accountant announces that he has devised a method of segregating operating costs as between freight and passenger service. It is evident that such a distribution of expense would at best be but a scientific guess. At all events, while exact costs and savings are not yet available, it may be stated that the self-propelled cars on the Canadian National Rys. have demonstrated their ability to economically provide services that steam trains could not provide except at a large loss.

The two storage battery cars bought by the Canadian National Rys. from the Cambria & Indiana Rd. were in service formerly between Colver Heights and Nant-Y-Glo, Pa., 13.1 miles, making two round trips daily. It was decided by the Cambria & Indiana management to get rid of them, owing to the high cost of power, which was 5c per k.w.h. The cost of operating the cars was as follows: current, $490; attendant for storage battery charging plant, $110; and repairs, labor and materials, $115 monthly; making a total of $715 monthly. The cars were replaced by a service gasoline motor car.

We are informed that the Board of Railway Commissioners has decided to require air brakes on all self-propelled cars put in service in future. All of the Canadian National Rys. self-propelled cars are equipped with air brakes except 15,810; 15,811; 15,812 and 15,813.

Grand Trunk Ry. The National Steel Car Corporation, Hamilton, Ont., is preparing plans for a gasoline car for the G.T.R. The Boards of Trade of Kitchener, Galt, Doon and Waterloo, Ont., recently petitioned the Railways Department for a gasoline car service on the

G.T.R. Galt-Elmira branch. A Kitchener press report of Sept. 25 stated that the Department had decided to grant the request. As this is a matter which cannot conceivably be under the Department's jurisdiction, but is one for the railway management's determination, the press report is probably in error. We are officially advised that the car will be tried on several G.T.R. branch lines.

The Toronto Mail and Empire in referring recently to the proposal to operate a gasoline car on the G.T.R., said: "Why not put rubber tires on it and have a truck for road operation? It would probably be much more useful." The Mail and Empire, like many other daily papers, does not offer much encouragement to the men who are trying to reduce transportation costs, to the end that railway rates may be reduced. Besides, its remarks were silly.

Greater Winnipeg Water District Ry. gasoline motor car operation has shown the service gasoline car with which it is being carried on to be satisfactory, according to Chief Commissioner W. M. Scott. A Winnipeg press report quotes Mr. Scott as stating that, as the Commission had been given the option of using the car for 6 months by paying only the interest on its cost, with the right of returning it if unsatisfactory, and as the car had been satisfactory, he recommended that it be bought outright and that the first payment on its total cost of about $23,000 be made. This car was described and illustrated in Canadian Railway and Marine World for May, pg. 231.

Quebec Central Ry. gasoline railway motor car 1, which was loaned to the C.P.R. for operation between Highlands and Cote St. Paul, 5.85 miles, on the Lasalle Loop Subdivision, Montreal Terminal Division, Quebec District, was, at our last advice, still in the latter railway's possession. Car 2 was delivered by Ledoux, Jennings, Ltd., on C.P.R. tracks at Montreal on Sept. 20, and ran under its own power to Sherbrooke, the same day. It was placed in Q.C.R. service as trains 9 and 10 between Levis and St. George, on Sept. 24, and has been operating on that run since then. Train 10 leaves Levis at 2.45 p.m., arrives Scotts Jct. at 4.05 p.m.; leaves Scotts Jct. at 4.08 p.m., arrives Valley Jct. at 4.35 p.m.; leaves Valley Jct. at 5 p.m. and arrives at St. George at 6 p.m. Train 9 leaves St. George at 6.40 p.m., arrives at Valley Jct. at 7.45 p.m.; leaves Valley Jct. at 8.12 p.m., arrives at Scotts Jct. at 8.40 p.m.; leaves Scotts Jct. at 8.43 p.m. and arrives at Levis at 10.10 p.m. The distance between Levis and St. George is 66 miles. We are officially advised that, while it has not been decided whether the gasoline cars will operate on the Q.C.R. during the winter, it is not expected, in view of the severe winter conditions, that operation will continue after Dec. 15.

Quebec, Montreal & Southern Ry. The gasoline railway passenger car acquired by the Quebec, Montreal & Southern Ry. was described and illustrated in Canadian Railway and Marine World for October, pg. 527, and the schedule on which it is operating was given in full. Since that description and accompanying data were published, we have been officially advised that during September the car made 5,830 miles, the receipts being at the rate of 34.39c per train mile, the out-of-pocket cost of operating the car being 18.69c per train mile, and the earnings being 15.70c per train mile above out-of-pocket cost of operation. During the month, the car carried 2,206 pasengers, and passengers carried one mile totalled 56,127. The revenue per passenger was 90.89c, and the revenue per passenger mile 3.57c. The car operated satisfactorily and maintained schedule throughout.

Timiskaming & Northern Ontario Ry. —A recent Swastika, Ont., press report stated that mining and business men in Swastika and Kirkland Lake, as well as in the Cobalt district greatly desire self propelled car service on the T. & N.O.R., as an auxiliary to the steam train service, and that G. W. Lee, Chairman of the T. & N. O. R. Commission, had stated that money had been appropriated for purchasing a railway motor car, but that the actual purchase was deferred. We are officially advised that, while the Commission has been giving serious consideration to the self propelled car question, the necessary investigations have not been completed, and that pending their completion no decision will be made.

Self Propelled Cars on Steam Railways.

The Canadian National Rys. now have 11 self propelled cars, as follows: no. 15,800, formerly a gasoline electric car, operating between Winnipeg and Transcona, but now at the Niagara, St. Catharines & Toronto shops at St. Catharines, Ont., for conversion into a storage battery car; 15,801, storage battery car now operating between Toronto and Beaverton; 15,802, the larger of the two battery cars bought from Cambria & Indiana Rd., now being overhauled at St. Catharines, preparatory to being run between Bathurst and Campbellton, N.B.; 15,803, the other battery car bought from Cambria & Indiana Rd., now operating between Brockville and Westport, Ont.; 15,805, steam car which was operating between Trenton, Picton and Napanee, Ont., but not operating at the time of writing; 15,810, a small gasoline car, with Winton chassis and 6-cylinder engine, which was operating between Souris and Elmira, Prince Edward Island Ry., but which has been replaced by steam train service during the winter; 15,811, a small Ledoux, Jennings gasoline car, operating on the Stanley Branch, Maritime District; 15,812, Ledoux, Jennings gasoline car, operating between Victoria and Sooke, Vancouver Island; 15,813, Ledoux, Jennings gasoline car, also operating between Victoria and Sooke; 15,814, Service gasoline car operating between Trenton, Napanee and Picton, Ont., and 15,815, a Ledoux, Jennings gasoline car, similar to 15,814, acquired recently, and also operating between Trenton, Napanee and Picton.

In addition to the above, construction will soon be started at the Niagara, St. Catharines & Toronto shops of storage battery car 15,804, which will be very similar to car 15,801, which was described and illustrated in preceding numbers of Canadian Railway and Marine World. This car will be of all steel construction, about 60 ft. long, and with seating accommodation for about 60 passengers. It will be equipped with 260 A-12-H Edison batteries, and 4 General Electric 261-A motors. The trucks, to be supplied by Canadian Car & Foundry Co., will be of the ball bearing type. S.K.F. ball bearings will be used.

Car 15,800, which was heretofore of the gas electric type, is undergoing radical change in being converted into a storage battery car. Its dimensions were as follows:—

Length over couplers	58 ft. 11 in.
Length over end sills	53 ft. 5⅝ in.
Truck centers	40 ft. 7 in.
Width over all at eaves	10 ft. 3½ in.
Height, rail to top of roof	12 ft. 6 in.
Truck wheel base	6 ft.

As a gasoline electric car, it was equipped with a power plant, consisting of a G.E. gasoline engine, coupled with generator, the engine having 8 cylinders, and developing up to 175 h.p., and the dynamo being rated at 80 k.w. It had only 2 motors, the drive being to the leading truck axles. The motors were G.E. type 205B. The gasoline engine, generator and motors, are being taken out, and will be replaced by 250 Edison A-12-H storage batteries and four G.E. type G-261A ball bearing motors of 25 h.p. each. The car will be arranged for double end operation, with standard series parallel controller at each end, and the ends will be altered to form standard vestibules, with a compartment for the motorman, at each end. To provide for the addition of a rear vestibule, the sills will be extended at the back, and in addition, two new members in the form of sill extensions will be put in to secure added strength. The car is of all steel construction, with 4 sills of channel section; to secure additional strength and rigidity 5 transverse members of truss construction will be put in between the bolsters.

As a gas-electric car, the weight was about 44 tons, but it is anticipated that when the conversion into a storage battery car is completed, it will be only 35 tons. A large saving in weight will be introduced by replacing the old engine and generator set with batteries, while the 4 new motors will have an aggregate weight much less than the 2 old style motors. The new ball bearing trucks will be lighter than the trucks heretofore under the car. The car body will be arranged to have a seating capacity of nearly 100, and the interior will be in one compartment only. When the conversion is completed, the car will be returned to Winnipeg, to its run between Winnipeg and Transcona, 7.1 miles, on which it had been making 7 round trips daily. It is felt that the conversion into a storage battery car will introduce a large saving, as maintenance expenses were very heavy with the old equipment, and also because there is an abundance of cheap electrical power available.

Battery car 15,802, the overhaul of which at St. Catharines, preparatory to it being placed on the Bathurst-Campbellton run, is about completed, will be equipped with 277 Edison A-12-H batteries, 4 Westinghouse V65-A3 ball bearing motors of 25 h.p. each, and Brill 69E ball bearing trucks. The seating in this car, which was described in a preceding issue of Canadian Railway and Marine World, will be rearranged somewhat, and a smoking compartment and lavatory will be installed.

Battery car 15,803, now operating between Brockville and Westport, Ont., was overhauled at St. Catharines and turned out with 110 MVX Ironclad Exide batteries, 4 Westinghouse V65-A3 motors and Brill type 69E ball bearing trucks. The car is making 107 miles daily, the current being obtained from the hydro system at Brockville, and the batteries being charged during the night.

The gasoline car ordered by the G.T.R. from the National Steel Car Corporation will be numbered 15,816. It was described and illustrated in Canadian Railway and Marine World for February, pg. 49.

Hearing re Air Brakes for Self Propelled Cars.

Canadian Railway and Marine World for March contained a brief account of a hearing by the Board of Railway Commissioners on Feb. 7, at which railways were required to show cause why self-propelled cars should not be equipped with air brakes. At the hearing, C. E. Brooks, Chief of Motive Power, Canadian National Rys., in his evidence to show that hand brakes are safe and satisfactory on the smaller cars, said: "We know that, travelling at 30 m.p.h. under normal track conditions, we can stop, and have stopped, these cars in anywhere from 325 to 600 ft. We know there are cases where these cars have been tested on a descent of 1½%, the car weighing 20,000 lb. and with approximately 8,000 to 10,000 lb. weight of passengers, and the car has been stopped in between 600 and 700 ft., when the initial application was made at 30 m.p.h. We feel that under ordinary maximum speed conditions, we can expect, even under unusual rail conditions, to stop within 600 ft., or in approximately 25 seconds."

A. L. Currie, Superintendent, Quebec, Montreal & Southern Ry., which has been operating a Ledoux, Jennings gasoline car, said: "The Q. M. & S. objects to an order requiring air brakes, especially for cars weighing less than 35,000 lbs., and less than 37 ft. long, for the following reasons: 1. Cost of car would be increased by approximately $1,100. 2. Weight would be increased by 1,000 to 1,200 lb., or over 5%, and thus increase gasoline consumption and cost of operation. 3. It would require drivers with knowledge of air brakes and appurtenances, who would have to be paid higher. 4. Additional car failures would be caused by additional strain put on drive shaft and electric starter. 5. While automobile engine has been developed until it is now reasonably free from failure, introduction of air compressing apparatus would complicate it and introduce causes of failure. 6. The great need of these small cars is to furnish service on branch lines, where experts cannot be provided, except at needless expense, to look after air equipment. 7. Cars being terminused away from repair shops, any air brake defect would cause great expense and delay. 8. Power of car would be detracted from and repairs to driving gear would be difficult. 9. It would be difficult to maintain adjustment of air brakes so as to maintain proper braking power. 10. Maintenance costs would be greatly increased. 11. In general, the use of air brakes would inject into the operation an appliance difficult to maintain in proper shape, and expensive as to operation and maintenance. 12. Even if air brakes were installed, hand brakes would still be necessary. 13. The driver of the present Q. M. & S. car, not equipped with air brakes, states he would just as soon have hand brakes. 14. The hand brakes will stop the car more effectively than air brakes. The power from the hand brakes goes on gradually and is not so apt as the air brakes to skid the wheels and so lessen the braking power. 15. The hand brake is positive in action, whereas something might occur to the mechanism of an air brake which would render it inoperative when required. 16. From tests made, it is felt that with hand brakes, the car may be stopped more quickly than with air brakes.

W. A. Newman, Mechanical Engineer, C.P.R., in speaking of the Ledoux, Jennings gasoline car the C.P.R. is operating on its Lasalle Loop Subdivision, said: "We have made a number of tests with the hand brake . . . . it was snowing on both days and the weather was cold. Sand was used at all stops. The tests on the level were taken at a maximum speed, 36 m.p.h. We stopped in 397 ft., or 13 sec. from the time the signal was given. At 7 m.p.h. we had two tests; in one we stopped in 23 ft. and in the other 19 ft., the time being 2½ and 3 sec. I have one test classified as an ordinary stop running at 35 m.p.h.; we stopped in 13 sec. in 468 ft. We had an emergency stop going at 36 m.p.h. and stopped in 9 sec. in 359 ft. We demonstrated to our own satisfaction that with our hand brakes we are accomplishing everything that can be accomplished with an air brake."

From the evidence quoted above it appears that the hand brake is a satis-

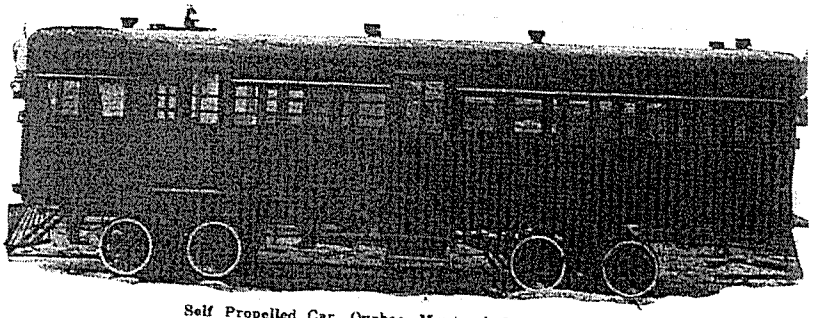
factory device for the lighter self propelled cars. Canadian National Rys. cars not equipped with air brake are nos. 15,810; 15,811; 15,812, and 15,813, all of which are of light construction.

T-6 motor of 50 h.p. The second car, no. 52, was expected to be delivered about April 12.

Car 51, together with the gasoline car delivered to the Q. M. & S. in 1922 by the same builders, is being operated as train 50, St. Lambert to Fortierville, Que., 109.69 miles; as train 51, Fortierville to St. Lambert, on Mondays, Wednesdays and Fridays, and as train 52, St. Lambert to Nicolet, 76 miles, and train 53, Nicolet to St. Lambert, on Tuesdays, Thursdays and Saturdays. Car 52 will be operated as train 60, Sorel to Noyan Jct., 86.04 miles, daily, except Sunday; train 61, Noyan Jct. to Sorel, daily, except Saturday and Sunday, and train 63, Noyan Jct. to Sorel, Saturdays only.

Self Propelled Cars on Steam Railways.

The Quebec, Montreal & Southern Ry. received on April 4 from Ledoux, Jennings, Ltd., Montreal, car 51, one of two self-propelled gasoline driven passenger cars ordered recently, an illustration of which is given herewith. This car is approximately 32 ft. long, 8½ ft. wide



Self Propelled Car, Quebec, Montreal & Southern Ry.

and 10¼ ft. extreme height. The underframing is of the same type as that of the car previously delivered to the Q. M. & S. Ry. by the same builders, as described in Canadian Railway and Marine World for Oct. 1922, and the truck and drive arrangement are also similar. Illustrations of the latter, as applied to a car built for the Canadian National Rys., were given in Canadian Railway and Marine World for Aug. 1922.

The car is equipped with a small platform at the back, providing easy access to the marker lamps. The car body is of all steel construction, the sheathing being 1/16 in. thick. The windows are of the ordinary drop type, sliding upward about 8 in., and are provided with standard railway curtains. Provision has been made for the application of storm windows for cold weather use. The seating capacity is 34, and the baggage compartment, 14 ft. long, will accommodate additional passengers if necessary. Entrance to, and exit from, the passenger compartment is by the central doors at each side, and there is an emergency door at the rear, for use in case of accident. The baggage compartment doors are of the sliding type. The equipment includes electric lighting, overhead ventilators, 2-compartment water cooler, dry hopper closet, locomotive bell, Stromboss horn, sanding apparatus and locomotive type pilot. The wheels are 36 in. in diam., and side rods are used on the rear or driving truck. The car has a Reo

Some Recent Developments of the Railway Motor Coach.

By C. E. Brooks, Chief of Motive Power, Canadian National Railways.

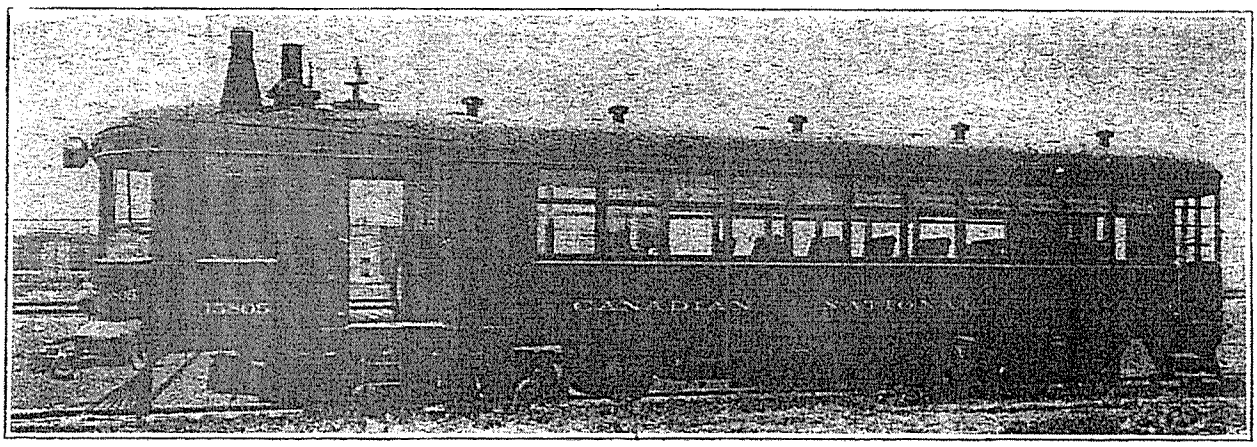
In commencing this paper the writer must ask for lenient consideration, as the subject named is not only in the early stages of development, but also covers such a large field and variety of equipment that it is necessary to curtail descriptive matter as far as possible and to make a certain number of rather bald statements unadorned by detail.

The motor coach is not a new departure in railway work, but is instead a branch of the work which on most railways had sunk back, from a promising start 15 years ago, into obscurity, due essentially to high maintenance and operating costs, and to the general idea that the motor car was a toy only. During the past three years the subject has been actively revived as a result of: Firstly: The ever increasing encroachment of the motor bus on railway earnings. Secondly: To the improvement in the design of the motor and its appurtenances. Thirdly: To the idea which the automobile is gradually giving the public, namely, that it is not necessary to sit on a plush seat in order to travel short distances.

In order to enter into a discussion of present day developments, it will be necessary to briefly outline the service requirements, and in doing so the writer must be pardoned if he presents the motor coach as a "unit car," and not a train of cars, or a driving car hauling a trailer. The latter conditions may be possible on small interurban, or suburban, lines, but as a practical railway condition it is not being considered by many large railways. The reason for this is that up to the present time it has not generally been found to be economical to replace a necessary train service with a motor coach hauling one or more trailers, on account of motor capacity limitations.

On the other hand, high train mile costs for small returns have forced railway officers to turn to the motor coach for relief in the following classes of service: (1) To give a frequent passenger service on sparsely settled branch lines, or parts of main line adjacent to market towns or junction points. (2) To connect junction points, on important main lines, with the town or small city situated within a few miles of the main line. (3) To give a group of towns, situated on a main line or important branch lines, a frequent connecting service over and above through main line trains. (4) To connect small summer resorts, golf clubs, etc., to branch line or through main line service. (5) To handle milk of a limited amount to a distributing or connecting point. (6) To provide connections to small suburbs.

Among the first real developments of the motor coach was the gas-electric car, the use of which spread rapidly fifteen years ago, but which, unfortunately, did not solve these problems successfully, on account of the high maintenance cost of the heavy duty gasoline motor driving the generator, the very uncertain service, the complications of the equipment, and the great weight of the motor coach itself. Indications are that the gas-electric system, with a modern gas engine generating plant, is making another bid for this class of work, and a brief description of such a unit is given farther on in this paper. About the same time steam units, having very considerable weight, and all the complications of the locomotive, appeared, but were discarded for much the same reasons as the gas-electric car. Present day developments are generally to provide for traffic requirements, which, for the purpose of discussion, are sub-divided as follows:



Self-propelled Steam Passenger Car, Canadian National Railways.

Class A—A seating capacity of from 24 to 40 persons, and provision for approximately 100 sq. ft. of baggage space. (Note: In some classes of service the baggage space is given up and seating accommodation substituted.) The light weight of such a car to be from 18,000 to 30,000 maximum, or in other words, not to exceed 750 lb. per single seat (with baggage space) or 500 lb. per seat if no baggage space is allowed. Smaller cars have been made, and are in daily use, but the rapid development of traffic, after cars are put into service, indicates that the above mentioned sizes are reasonable limits.

Class B—Units seating from 40 to 60 passengers, and providing for baggage space, minimum 100 sq. ft., maximum 200. While the trend of construction has resulted in this class of car weighing from 800 to 1,200 lb. per single seat, it is thought that the weight must be kept down to the same limits as prescribed in class A above, in order to get any fuel economy and keep maintenance costs at a reasonable figure.

Speed Requirements.—Schedule speeds of 15 to 25 miles per hour, including stops. Consider a 5 mile run between stops, 1 minute for stops, acceleration from 0 to 30 m.p.h. in 2 minutes on level track; 30 to 35 m.p.h. at end of third minute, an average speed of 35 m.p.h. for the next 3¾ miles, and half minute to travel 0.21 mile, and come to a stop, means that in order to run 5 miles and make one stop, the elapsed time is 10.9 minutes, or an average schedule speed, including stops, of 27½ m.p.h. This allows nothing for loss of time on gradients, slow orders, etc.

Generally speaking, class A units have been gasoline driven, and the experience of many railways points to this class of equipment being an economical and lasting development, which will be improved to the point of high grade automobile reliability within a very short time. Already, in many places, these cars have retrieved business which had been lost to bus lines on the highways, and also to the private owned car, and it has been the usual thing to find passenger traffic develop to a marked extent after a service has been instituted. The failures have been rather heavy, due to conditions described later in this paper, to the over-exacting requirements of timetables, and to non-realization of the limitations of the gasoline motor. For the purpose of description class B units may generally be sub-divided as follows: (1) Storage battery; (2) H.p. steam, oil fired boiler; (3) Heavy duty gas engines; (4) Gas-electric.

Class A Cars—The Gasoline Engine Driven Motor Coach.—For cars described as class A, weighing approximately 30,000 lb. light weight, the general practice has been the use of the high grade truck engine—4 cylinder—and running at a maximum speed of approximately 1,600 r.p.m., developing a maximum of 70 h.p. Wherever this type of engine has been used, it has transmitted its power through clutches, transmissions and universals, to gears, most of which are of standard truck or even heavier design.

A general description of a typical power plant, such as mentioned above, is as follows: Engine, 4-cylinder 4¾ x 6 in.; pressure oiling system; pump water cooling system; primary and secondary transmission; primary ratio first speed, 4 to 1, third speed, 1 to 1. Secondary increases the ratio from 26 m.p.h. for

normal engine speed, to 35 m.p.h. The first provides for ruling grade, and the second for level track conditions.

To a much less extent, the automobile type six-cylinder engine of the following general description has been experimented with: Engine, 6-cylinder 3¾ x 5 in.; pressure oiling system; gear ratio 4.7 to 1 between engine and wheel; nominal engine speed at 30 m.p.h., 1,450 r.p.m.; horse power developed, 50 at 2,200 r.p.m.; maximum speed, 2,200; pump, water cooling system. In general its power has been transferred through standard automobile clutches, transmissions, etc., which are used with the same type of engine in automobile service.

In so far as the actual power plant is concerned, it is the opinion of many that the automobile engine has, in almost every way, demonstrated its superiority over the truck engine for class A cars, and for general service, as described in the first part of this paper, due to the following main reasons: (1) Ability to run over rated speed without serious loss of balance and consequent excessive vibration; (2) Economy under light load conditions. Number 1 undoubtedly embraces conditions which are vital to the successful maintenance of any machine or engine, and it is the writer's intention to attempt to explain this from the everyday point of view, derived from experience, rather than from the dynamics of the problem.

Practically any high grade automobile engine designed for a rated engine speed of approximately 1,450 at 30 m.p.h. with a gear ratio between 4 to 1, and 5 to 1, may be driven at engine speeds of 2,200 and car speeds from 50 to 60 m.p.h., without any noticeable serious vibration. Experience indicates that a relative flexibility cannot be expected from the truck engines, for any length of time, without serious engine trouble, possibly resulting in a complete break down of the service. When a motor coach is being operated on a railway where there are schedule connections to make, and where there are meeting points, designated by train orders, and by the time card, it is certain that, regardless of the framing of a schedule, which should not develop an engine speed over that coinciding with the rated speed of 35 m.p.h., the operator will frequently exceed this by 15 or 20 m.p.h., in order to meet the operating requirements of the service after a delay of any kind. No such parallel exists in highway work, with either the automobile or the truck, but is such an accepted fact on a railway, that the only safe course is to provide the type of power plant which will meet this condition daily without breaking down; in other words, the power plant must be moved out of the sphere of ordinary usage, and into what might be called the outer edge of racing conditions. Railway gradients even accentuate this condition, as there is little, if any, opportunity for letting the engine cool off, as there is on the highway. The automobile engine has been designed, not only for easy and economical low engine speed conditions, but also for those outlined in the last paragraph above, and the experience of several railways in this country, with a number of cars operating under extremely different conditions, seems to bear this out, which leads to the conclusion that the light weight high speed gas engine is a satisfactory power plant for the light weight cars described as class A.

Class B Cars—(1) The Storage Battery Car.—The general dimensions and description of a typical unit are as follows: Car: Interior arrangement, to suit purchaser; weight, 60,000 lb.; length, 53 ft.; trucks, 2-4 wheel standard M.C.B. axles, except that journals are fitted with roller or ball bearings; electric motors, etc., 4-25 h.p. 250/300 volt, mounted with a gear ratio of 16 to 91. Standard series, and parallel controller and circuit breaker, installed at each end, and in baggage compartment; there are voltmeter, amp. hr. meter, underload circuit breaker and switches for control of air compressor and lighting. Storage batteries, 250 cell, capacity 450 a.h. amp. hrs. at 300 v. or 135 k.w.h.; (Note 580 a.h. have been obtained with a minimum of 150 volts). Charging, d.c. 250 or 500 volts may be used for charging and the car is equipped with switches for arranging the battery cells in either series or parallel. Normal rate of charge 90 amps. Time required for a normal full charge 5 to 7 hours. Higher rate of charging may be followed provided temperature of battery does not exceed 115° F. Radius of operation, maximum of 140 miles, on a full charge, figuring on level or rolling grade. Recommended not to exceed 100 miles, or to get a boosting charge. Consumption of power 35 watt hrs. per ton mile. Acceleration ½ m.p.h. per second. Maximum speed, 45 m.p.h. on level track. As the car weighs approximately 60,000 lb. the figure of 35 watt hours per ton mile gives a consumption of 1.05 k.w.h. per car mile—level track and normal conditions.

General—Within the before mentioned radius of operation this car has been extremely satisfactory, and is being operated successfully, under low temperature conditions, with no appreciable trouble. The tractive effort of 2,400 lb. makes it possible to use a trailer, if necessary. Cost per car mile, including all maintenance and transportation charges, power, etc., 17c. The maintenance has been extremely light, and all indications are that the life of the batteries will be 8 to 10 years at least.

(2) Steam Cars.—The steam power plant was probably one of the first tried, of any kind of power, for self-propelled cars, but unfortunately its development has not kept pace with requirements. Medium pressure boiler plants of 300-400 boiler pressure, with comparatively low superheat (100° F.) were introduced to a considerable extent in continental practice several years ago, but the use of this type of car has not developed, due principally to excessive weight of the equipment, the inefficiency of the boiler plant, and the general complications of the equipment. Recent developments indicate that while the seriousness of these defects has been noted, and improved, they have not yet been overcome to the point which may make steam power the most satisfactory unit car power, and it may be well to consider these defects more in detail, as they appear to exist in modern equipment.

(1) Insufficient boiler capacity is a defect directly coupled with excessive weight of equipment. Boiler plants of approximately 70 boiler h.p. nominal rating have been applied to cars with a total net weight in running order of from 50,000 lb. to 60,000 lb., providing for 100 sq. ft. of baggage space. The total live load will bring this equipment up to a gross weight of approximately 65,000 lb. or a load of 650 lb. per boiler h.p. Experience indicates that for a boiler of this capacity the weight should be reduced by approximately 15,000 lb. and the writer has no hesitation in saying that this should be possible, as the entire power plant may be carried on the leading (driving) truck and the rest of the body lightened proportionately. Total absence of vibration should be a very great advantage in lightening the car equipment. Practically all the first cars of continental make indicated that high pressure and high superheat were necessary, in order to provide for a gear ratio sufficient for starting, and at the same time for a piston speed of 800 ft. per minute at 40 m.p.h. The engine developed to meet these conditions has no doubt been a great mechanical success, but the boiler plant supplying it has not yet been developed to the point where it can exceed the schedule previously outlined, even under the most favorable conditions. The causes of this deficiency appear to be due to: (1) Insufficient header volume, resulting in carrying over an emulsion into the superheater units, with a consequent total loss of superheat and excessive water consumption, and (2) Unequal distribution of heat to all generating units, resulting in steam pockets, thereby destroying both circulation and evaporative qualities.

The problem of providing sufficient surface condenser for hot weather conditions, coupled with protective appliances which will be operated by thermostat in cold weather, has not been solved, with the result that under maximum conditions the water loss is as high as 45 lb. per car mile, necessitating replenishing at frequent intervals, with subsequent loss of time.

The automatic control of the oil flame has been highly developed, but is not yet perfected. Generally speaking, this automatic feature must have two distinct functions: (1) To cut off or reduce fuel supply when maximum h.p. is reached, and (2) To cut off fuel under low water conditions. The first named is undoubtedly perfectly developed, but the second

Gasoline Motor Passenger Car, Canadian National Railways.

is not due to the varying quality of the steam coincident with the conditions (maximum load) which most often causes low water.

The least considered of all conditions in connection with the steam car is probably the comfort of the operator, and in this respect this type of equipment is unpopular, on account of the extreme heat, which may be overcome, and also the noise of the oil flame. The latter is by far the most serious, and is apparently impossible to control when using high velocity jets of steam for atomizing.

Space does not permit a further study of the steam plant, but the following general data of a steam car now being tested may be of interest:—

Space required for boiler plant	640 sq. ft.
Heating surface	direct 385-s.b. 44
Gross weight of car	60,000 lb.
Net weight of complete power plant without oil and water	13,000 lb.
Quantity of water supply	200 U.S. gall.
" oil "	180 U.S. gall.
Oil rate per car mile average	1.0 gall.
Boiler pressure	800 lb.
Superheat (average)	200° F.
Engine dimensions	6½ bore 8 in. stroke
Gear ratio between crank shaft and axle	1 to 1.46

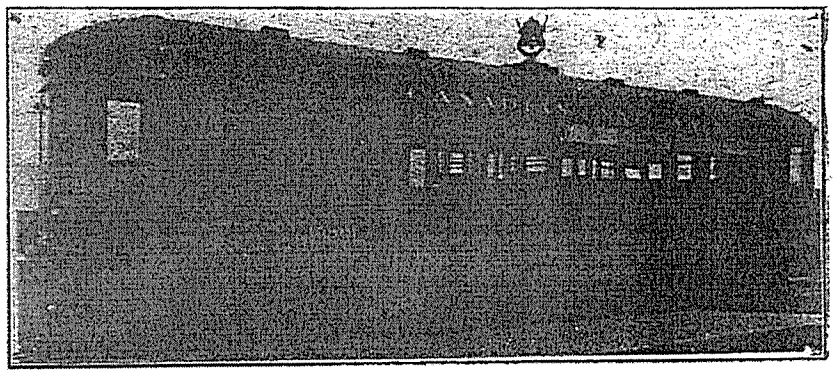
(3) The Heavy Duty Gas Car.—Dimensions and description: Length, 55 ft.; weight, 60,000 lb. loaded; engine dimensions. 6-cylinder—6¾ in. stroke; power, 116 h.p., at 800 r.p.m.; 225 h.p. at 1,600 r.p.m. Transmission, 4 speeds forward, 3 reverse. Geared to give 56 m.p.h. forward at 1,400 r.p.m. in high, and 37 in third speed. This class of car has not been tested to the point where any accurate data may be given, but it is evident that gas consumption will be at least twice that of a class A car per car mile.

The problem of handling through transmission and clutch the mechanical drive from a heavy duty gas engine of possibly 200 horse power has not yet been solved, unless it is through the medium of the oil transmission, so successfully used in navy work. The extreme complication of this transmission or magnetic control makes it doubtful at the present time whether gas power plants will successfully exceed 70 horse power.

(4) The Gas Electric Car.—Earlier in this paper mention has been made of the gas-electric car, which came into prominence about fifteen years ago, and which has been practically discarded, for reasons mentioned, namely, unreliable power plant and general complication of equipment. The first mentioned cause of failure has undoubtedly been overcome, and reliable constant speed units are in general use for generating purposes. If it were possible to eliminate the starting troubles when using types of engines suited for low grade and cheap fuels, there would be no doubt about the general use of this type of equipment, on account of unit power costs. The difficulties mentioned are such an important factor in the successful operation of a motor coach in certain localities that we must necessarily turn to the gasoline engine for generating power.

The gas-electric system provides double ended control, and an efficient starting torque, but still retains all the complications of a dual power plant. The general data pertaining to a modern gas-electric plant is as follows: Size of car, 55 ft. length, 10 ft. width; seating capacity, 54, with 100 sq. ft. of baggage space; weight, loaded, 65,000 lb.; engine, 6-cylinder, governor controlled, bore 7 in., stroke 8 in., developing 150 b.h.p. at 900 r.p.m., driving a 100 k.w. 700 volt generator, which in turn drives two motors on forward truck. Fuel consumption, estimated, 0.25 gall. per mile. It is thought that there may be a possibility of a smaller capacity constant speed gasoline engine (the equal of average running power consumption approximating 25 horse power for cars weighing 60,000 lb. loaded) driving a generator charging a limited battery capacity. Theoretically this might provide the starting torque desired, and at the same time eliminate the undesirable features of the large power plant, but it could not be an economic consideration where cheap power could be purchased.

The Ball and Roller Bearing.—As it is impossible, in the space of a paragraph or two, to even partially cover the question of low friction bearings, it is the intention to briefly indicate why the ball or roller bearing has been one of the most important factors in the development of the motor coach and may possibly be a greater factor in future railway developments in other equipment. Exhaustive tests indicate that the ball bearing has reduced starting friction, under summer conditions, to approximately 15% of that of plain bearings, or in other words has reduced friction of approximately 20 lb. per ton to 3 lb. per ton. At the same time average rolling friction at speeds up to 30 miles per hour has been reduced by approximately 40%, or from 3.6 lb. per ton to 2.2 lb. per ton.



Electric Storage Battery, Passenger Car, Canadian National Railways.

Experience in this country indicates that the ball bearing is suitable for class A cars, but that designed areas and sizes for industrial work should be at least doubled for railway work, due to excessive shocks and side thrusts. It is not possible at this time to say whether side thrusts or vertical rail shocks are more destructive, but it is certain that for poor rail conditions the bearings should have a side thrust capacity of 100% of vertical load. For class B equipment, it may be necessary to use the roller bearings for vertical loads, with special bearings for side thrusts.

Transmission and Type of Drive for class A gas driven and class B (heavy duty gas driven).—While it has been advocated in this paper that the automobile engine is most suitable for the light motor coach, it is also admitted that experience indicates that standard automobile transmission, clutches, universal connections and driving gears are entirely inadequate for motor coach service, and are the cause of probably 75% of the breakdowns. In this respect, the appliances which have been developed as counter parts of the truck engine are generally much superior, due to greater size and strength per h.p. transmitted than automobile parts. The argument has been advanced that the parts are designed for the engine, and will handle all the power developed by same, but such are not sound, on account of the greater inertia to be overcome at starting, requiring a momentary torque much in excess of anything experienced in automobile work. There is also the condition in this country, and the northern states, of having to operate cars in snow storms, resulting in clutch slippage, and shocks to transmission, much in excess of that experienced in automobile service.

The method of transmitting the power to the wheels has been generally as follows:—

(1) Through a standard transmission to one driving axle, which supports the entire two-wheel rear truck, and which can move in a vertical plane only. While this is the simplest method of driving, it is not the opinion that it will ever be generally acceptable to the railways, as railway experience indicates that safety and good riding qualities are almost proportionate to the number of wheels in the trucks. This is particularly applicable to cars operating on cheaply maintained lines.

(2) To both axles of front four-wheel truck, by gearing and universal connections, from a transmission located behind the truck. Experience on some railways is showing that this method of transmitting the drive is very successful, and although the number of universal connections is not reduced, the shafts are all short, and the entire driving forces are removed from the passenger carrying part of the cars, thereby reducing vibration.

(3) To a transmission located about the center of the car, and from there to nearest axle of each four-wheel truck, or to both axles of two-wheel trucks. The advantage claimed for this method of drive is that the entire weight of the car is available to give good adhesion (where the trucks are two-wheel type), but general experience indicates that this is not necessary, and is harder on the engine than an arrangement where part of the momentum of rotating parts may be taken up by slippage. Where four-wheel trucks are used this method gives better adhesive qualities than connecting to both axles of one truck, but seemingly not sufficient to warrant the extra complication of transmission.

(4) To the leading axle of rear four-wheel truck. The chief advantage of the drive to the rear truck is that the engine may be aligned in such a manner as to have its shaft center line pass through the center line of main driving axle, thus reducing wear on universals and friction to a minimum. The disadvantage is that it necessitates the use of one or more supplementary bearings, between the engine and the point where

the drive shaft is coupled to the front universal. The maximum lateral motion of a truck of 48 in. wheel centers and 18 ft. truck centers on an 80 ft. radius curve is shown by road check to average ¾ in. at a radius from center of 24 in., so that is is apparent that the swing of the truck has but little effect on the universals. The torque arms supporting the housings of such an arrangement should have both vertical and lateral swing. Only when the load on main axle is not sufficient for adhesion it may be conceived that driving power acts on the second axle. Under ordinary conditions transmitting power to the second axle generates no more friction than that due to the weight of rotating parts.

Methods of transmitting power from the front axle to the rear axle of rear truck may be sub-divided as follows:

(a) Chain drive has the advantage of rapid wear, noise, and the complication of shields and covers, which more than overcome the advantage of the straight drive to the rear truck.

(b) Gear drives to the second axle no doubt appear the best mechanical means of transmitting power, but it has with it all the disadvantages of rapid wear, due to difficulty of adjustment of contact, and the maintenance of extra universals.

(c) Side rods and cranked wheels, in similar manner as locomotive driving wheels. Side rod drive to the second axle, while with many other locomotive developments is said to be crude and inefficient, in actual practice is a thoroughly reliable and easily adjusted and inspected arrangement, and is operating successfully at high and low speeds, and with no appreciable friction.

(5) Miscellaneous, including oil transmissions still being experimented with.

Summary.—In summarizing, the writer realizes that in dealing with such a subject there is no doubt a very great difference of opinion amongst railway men regarding what will fulfil the requirements of the service best. It is apparent to any engineer that there will be important developments in railway motor cars, both in so far as design and field of service are concerned, and therefore the conclusions which we may note here may be considered as preliminary only.

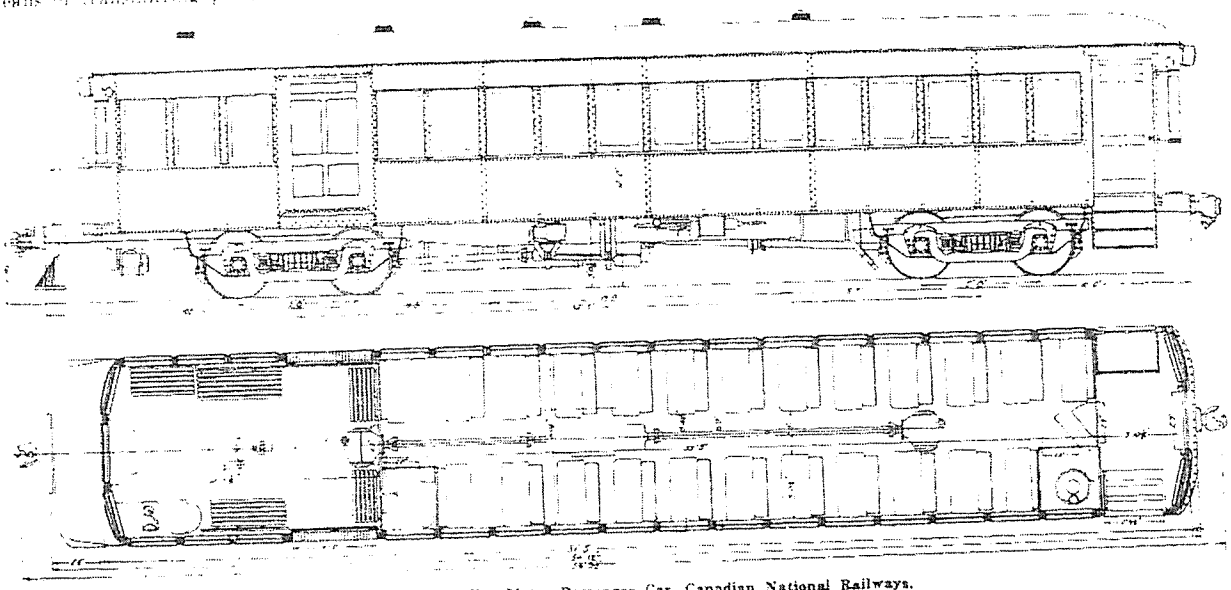
Class A cars (30,000 lb. maximum light weight) gas engine driven by automobile type engine 6-cylinders with the following general characteristics and limiting conditions:—1.6 h.p. per 1,000 lb. light weight of car at engine speed of 2100 r.p.m., giving a car speed of 35 to 40 m.p.h. Rolling friction 2.2 per ton weight on rail, and wind resistance of 5 lb. per square foot cross sectional area of car at 40 m.p.h. Weight of car per passenger seat maximum 750 lb. Weight of car per maximum h.p. 600 lb. Gear ratio between engine and wheel for ruling grades not exceeding 1.25%, 4.7 to 1. (In hard operating conditions this may be increased to 5.5 to 1).

Class B cars—It is difficult to come to a general conclusion with regard to this class of equipment, as it appears that only one class of car has actually passed out of the experimental stage. One of the Canadian railways has found the battery car to be a thoroughly reliable and economical unit to operate, provided that the schedule will permit of charging time. Severe weather conditions have had but little effect on the operation and the simplicity of the power controlling devices eliminates any chance of opposition from the operators.

The chief obstacles in the development of this type of units is first cost, and in some regions high power costs, but it is felt that the great advantage of double ended operation, without complication, more than offsets any serious disadvantages.

In conclusion it seems safe to say that there is a fairly large field for the motor coach in railway work, and that it will not be developed from without, but rather from within, slowly, conservatively, by motor manufacturers and railway engineers, as the travelling public will never tolerate from the railway companies the difficulties and disappointments which have been visited on them personally by the automobile manufacturers. The railway engineer, to do his part in this problem, must be familiar, not only with operating conditions, but also with the labor problems which are sure to arise in such a development, making it necessary and advisable to give consideration to the employe operating this equipment, and to the public using it.

The foregoing paper was read before the American Society of Mechanical Engineers at its railway session in Montreal recently.

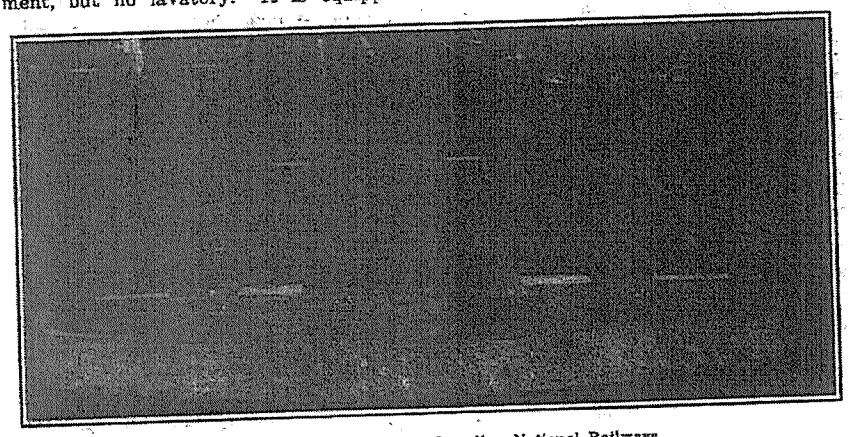


Heavy Duty, Gasoline Motor Passenger Car, Canadian National Railways.

believed would be as high as 40c or 50c a bushel. He favored the development of a route via Vancouver. H. Holgate was in favor of improving the St. Lawrence navigation route so that large grain boats from the upper lakes could reach Montreal. G. H. Duggan said that every dollar that had been expended by the Government on the Hudson Bay Ry. and on the proposed terminals at Port Nelson had been wasted, and the sooner the whole thing was dropped and forgotten the better it would be for Canada.

Self Propelled Cars on Steam Railways.

Canadian National Railways. — The accompanying illustration shows the storage battery car converted from a gas-electric car at the Niagara, St. Catharines & Toronto shops at St. Catharines, Ont., as described in Canadian Railway and Marine World for October. The car, as rebuilt, is 57½ ft. long and seats 96 passengers. It has a smoking compartment, but no lavatory. It is equipped with 250 Edison A-12-H storage batteries, and 4 G.E. type G-261 ball bearing motors of 25 h.p. each. On completion of the conversion, the car was returned to Winnipeg in a freight train, with gears disconnected, and placed in service between Winnipeg and Transcona, where it was operated formerly as a gas-electric car.



Storage Battery Car Frame, Canadian National Railways.

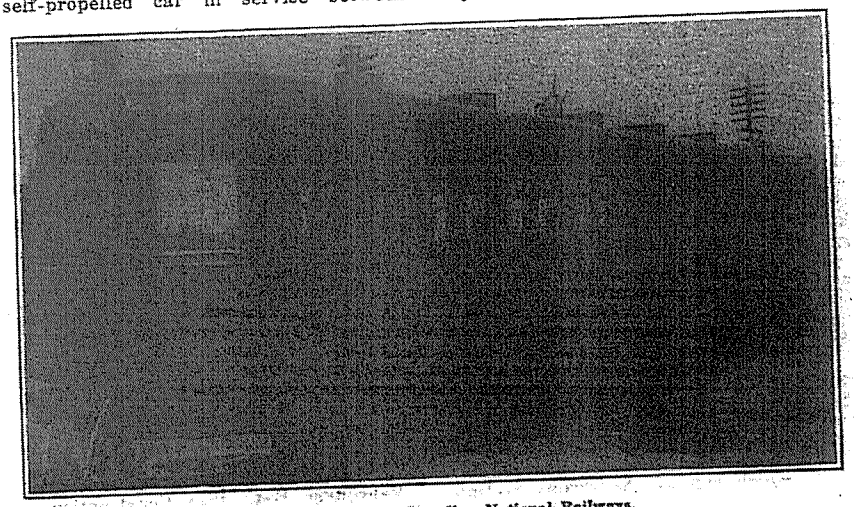
As stated in our October issue, the Canadian National Rys. are having another battery car built at the N., St. C. & T. R. shops at St. Catharines. An illustration of its frame is given herewith. C.N.R. mechanical officials are developing plans for a standard frame for all future battery cars to be acquired, and it is expected that the frame to be adopted as standard will be somewhat similar to that shown herewith. It has side sills of 6 in. channels, center sills of 6 in. I-beams, platform sills of 5 in. I-beams, alternated with open truss supports as shown. The car for which this frame was built will be 58 ft. long and 9 ft. wide, and will be equipped with 260 A-12-H Edison batteries and 4 G.E. G-261 motors of 25 h.p. each. It will have a baggage compartment at the front, a smoking compartment to seat 20 passengers in the central portion, and a main compartment seating 40 passengers. Good progress is being made with construction.

In addition to the cars mentioned above, the Canadian National Rys. have invited tenders, in alternative form, for 6 more storage battery cars. In view of the success which the C.N.R. have had with storage battery cars during the two years they have been operated, which is emphasized by the management's intention to augment considerably the number now on the lines, it is evident that this type of car has definitely established a place for itself in self-propelled car service on steam railways. The absence of complicated mechanical features, making for minimum maintenance cost, is a most desirable feature, and in districts where electrical power is cheap, operating costs are low.

We are advised that the Canadian National Rys. management is considering the possibility of placing a storage battery car in service between Toronto union station and Weston, 8.41 miles northwest of Toronto, to operate on the original G.T.R. line from Weston to Parkdale and Toronto union station, making morning and evening trips.

The Peterborough, Ont., City Council asked Sir Henry Thornton, President, C.N.R., recently, to put on gasoline or electric self-propelled cars in that district. He replied that they would not give better service than is being supplied by steam trains, and that their operation would not be economical, as it would be necessary to run steam trains to serve places in the territory not contemplated in the self-propelled cars' operation.

We are officially advised that the Canadian National Rys. management is considering placing an electrically operated self-propelled car in service between Quebec and Loretteville, Que., 8.6 miles, on the Batiscan Subdivision, Saguenay Division, Quebec District, Central Region.



Storage Battey Car, Canadian National Railways.

The Pacific Great Eastern Ry. is adding a gasoline motor car to its rolling stock. The engine and trucks will be supplied by the Four-Wheel Drive Auto Co., Kitchener, Ont., and the body and furnishings will be made at Vancouver. The car will be equipped with standard railway appliances to comply with the British Columbia Railway Act. It will have seating accommodation for 25, and also baggage and express space. It will be capable of hauling cars of freight, and will also be suitable for use in switching service. It is intended to run it during this winter between Williams Lake and Quesnel. Williams Lake is 277.8 miles from Squamish dock, and the distance from Williams Lake to Quesnel is 70.7 miles. We are advised that the car will be suitable for service on the North Shore Branch, should traffic conditions warrant it, and it is believed that this type of car will enable the railway to give a service where the traffic is light without subjecting the public to a reduced train service.

Foreign.—A remarkable increase has taken place lately in the use of Diesel-electric self-propelled cars in Sweden. Since 1913, several Swedish railways have been operating cars of this type, with engines rated at from 75 to 120 h.p., but several cars have been introduced recently which are equipped with engines of 160 and 250 h.p. Some of these high-powered cars are more in the nature of locomotives, being fitted with only a baggage space, the passengers being carried in trailers. The complete power installation for these cars, which have Diesel engines with electrical transmission to the driving wheels, is as follows, the apparatus being of similar nature for all sizes: one Diesel engine of the 4-stroke cycle type, with 6, 8 or 12 cylinders, according to capacity. The size of generators and other electrical equipment is also increased to accord with increased engine capacity. They have one direct-coupled direct-current generator of the 8-pole type, with commutating poles. The generator is shunt wound, but has a separate series winding, the latter being connected to the circuit only when the generator is driven from the storage battery in starting. The generator voltage can be varied, within wide limits, up to 550 volts. They have two electric motors of standard series-wound railway type, with commutating poles. Power is transmitted to the axles by spur gearing. A storage battery of alkaline Jungner type, suspended beneath the car, furnishes current for starting, lighting and auxiliary apparatus. It is charged automatically while the car is in motion, and a special switch is provided for charging when the car is standing.

in acknowledging receipt of this information, have indicated that they will bring forward for consideration certain changes in schedule rules which they consider advisable, and have also indicated that they think the present time inopportune to ask for higher wages.

Shop Staff Reductions.—C.P.R. shops throughout western Canada were closed during the last three days of October, which resulted in vigorous protest from the shopmen's leaders, who alleged that the action was a violation of the agreement providing for a working week of 40 hours. Two hundred men were laid off at the Canadian National Rys. Transcona shops during the last week in October, in conformity with the policy of putting into effect a cut of about 10% in the staff at all shops, and the Great War Veterans Association, provincial command, communicated with Sir Henry Thornton, President, Canadian National, asking that they be reinstated. He replied that while he appreciated the spirit in which the request was made, the C.N.R. must be operated with business intelligence and with due regard for earnings, and that therefore the request had to be refused.

Sir Henry Thornton, President, Canadian National Rys., in addressing the Toronto Board of Trade on Nov. 16, said: "As far as the Canadian National is concerned, we cannot go on indefinitely increasing wages and decreasing rates, if we are to maintain any sort of efficiency or solvency. I would be the last one to advocate anything other than a living wage for those who work upon the railways, but I want to make it quite clear—and in saying this I am violating no principles of economics, and I manifest no lack of sympathy to the working class—we cannot go on increasing wages if we are going to eliminate our deficit. Likewise, until we reach a more settled financial condition, we cannot endorse any wholesale reduction in rates and fares. If anyone can show me how 2 and 2 make 6, I will be much obliged to him. It can't be done, and unless within a reasonably short time the burden which the C.N.R. system imposes in the form of deficits on the taxpayer is not reduced we are all going to be in a very bad way. This is what I am fighting for and this is what I am trying to achieve."

U.S. Situation.—As stated in Canadian Railway and Marine World for November, the U.S. Railroad Labor Board, in a decision effective Oct. 16, granted small wage increases to members of the International Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employes on some 30 railways, as follows: Storekeepers, assistant storekeepers, chief clerks, foremen, and other clerical supervisory employes, 2c an hour; clerks with over one year's experience, 2c an hour; clerks with less than one year's experience, 1c an hour (clerks without experience on entering the service to be paid $2.35 a day for first 6 months and $2.75 a day for second 6 months); callers, assistant station masters, train announcers, gatemen, baggage and parcel room employes, 2c an hour; janitors and watchmen, 1c an hour; common laborers in stations and warehouses, 2c an hour; freight handlers, 1c an hour; sealers, scalers and fruit inspectors to be paid 1c an hour over truckers' rates, and stowers and coopers 2c an hour over truckers' rates.

The Brotherhood of Railroad Signalmen, which, as stated in our November issue, had been refused a wage increase by the Labor Board, has asked the Board to withdraw its decision and remand the dispute to the individual railways interested for settlement locally. It does not seem reasonable to suppose that the Board will accede to this request, as it would appear to be establishing a dangerous precedent, and to be robbing the Board's decisions of any finality.

Train service employes on U.S. railways have not met with any great degree of encouragement in their effort to get higher wages. Practically all carriers asked for wages increases have refused to grant them, but on the contrary have suggested elimination of several rules favorable to the employes. The outlook is that the negotiations between U.S. railways and their train service employes on wage contracts which expire on Dec. 1 will result in disagreement, and that the matter will go before the Labor Board.

A Philadelphia press report states that system federation no. 90, representing shopmen on the Pennsylvania System, has brought suit in the Federal District court against the Pennsylvania Rd. for $15,000,000, alleged due to make up underpayments which resulted from the Pennsylvania's refusal to abide by the U.S. Railroad Labor Board's rules.

Self Propelled Cars on Steam Railways.

The Canadian National Rys. management has ordered 6 storage battery cars from International Equipment Co., Montreal, Canadian agents for Edison Storage Battery Co., and the Railway Storage Battery Car Co. They will be built at the Canadian Car & Foundry Co.'s Montreal plant, and are expected to be delivered in 6 months. They will resemble very closely car no. 15,801, now in service between Toronto and Beaverton, which was described and illustrated in preceding issues of Canadian Railway and Marine World. Equipment will consist of 4 G.E. 261-A. motors and 250 A-12-H Edison storage batteries.

The storage battery car reported in our November issue as being built at the Niagara, St. Catharines & Toronto Ry. shops in St. Catharines, Ont., for the Canadian National Rys., and of the frame of which an illustration was given, has been completed, and will be put on exhibition at St. Catharines in connection with an exhibit of home products which will be held there shortly, before going into operation.

The large gasoline motor car ordered by the G.T.R. from the National Steel Car Corporation, Hamilton, before the consolidation, has been completed, and the expectation at the time of writing (Nov. 22) is that it will be tested between Wyoming and Petrolia, 5.74 miles, on the Petrolia Subdivision, London Division, Southwestern Ontario District, Central Region, in the near future, and go into operation there. This car was described and plan and elevation given in Canadian Railway and Marine World for February, pg. 49. A London paper, in speaking of the proposed introduction of self propelled cars on the London Division, referred recently to the steam car which the Canadian National Rys. once had in operation, which, it said, "was run by steam power, developed under gasoline and kerosene pressure." (Sic.)

The Pacific Great Eastern Ry., as stated in Canadian Railway and Marine World for November, is having a gasoline car built, for operation between Williams Lake, 277.8 miles from Squamish dock, and Quesnel, 70.7 miles. The engine and trucks will be supplied by the Four-Wheel Drive Auto Co., Kitchener, Ont., and the body is being built to the order of the Westminster Iron Works, New Westminster, B.C. The car will, in addition to providing passenger service, be used for switching freight cars, and occasionally for hauling one freight car on the main line. The chassis complete will weigh 11,000 lb., and the car will be 25 ft. 5½ in. over couplers; the body will be 22 ft. 2 in. over all, and 8 ft. 10 in. wide outside; width of frame will be 36 in. and wheelbase 15 ft. 5 in. The car will be equipped with a Wisconsin 62 h.p. motor, 4 cycle, 6 cylinder, with the following chief characteristics: bore, 5.1 in.; stroke, 5.5 in.; piston displacement, 672 cu. in.; no. of crankshaft bearings, 4; diam., 2⅜ in.; length of connecting rods, 12 in.; lubrication, forced feed; cooling system, centrifugal pump; radiator, tubular, 3 point suspension. There will be an Eisemann high tension magneto with impulse starter, Stromberg carburetor, a 50 gall. gasoline tank mounted at side of chassis, with Stewart vacuum feed, and Hele Shaw multiple disc clutch with clutch brake. The transmission will be of the jaw clutch type, the gears always being in mesh. Four speeds forward and 4 reverse will be provided. The reverse gear mechanism will be mounted in the sub-transmission, and will contain a differential, permitting the power to be transmitted in either forward or reverse motion. This mechanism will be controlled by a hand lever located near the driver, similar to the reverse lever on a locomotive, and will permit the use of all 4 speeds in either direction. The mechanism will be mounted on ball bearings throughout, will be housed in an oil-tight, dust-proof case, and will run in an oil bath. Power will be transmitted from the reverse gear differential to the axles, through propeller shafts, each containing universal joints, these to have hardened steel bushings running upon hardened steel pins. Both front and rear axles will be rigid, like the rear axle of a truck, and will be of the full floating type. Each axle will contain a differential, through which the power will be transmitted to each driving wheel. The axle differentials will be completely housed in oil-tight, dust-proof casings, and these casings, and not the driving axles, will take the weight of the car. The car will be equipped with a pilot at the front end, an air brake system, with brake shoes applying on all wheels, a 10 cu. ft. per min. compressor controlled by automatic governor, 2-unit starting and lighting system, exhaust gas heating system and locomotive type warning bell. The wheels will be steel tired, 35 in. diam.

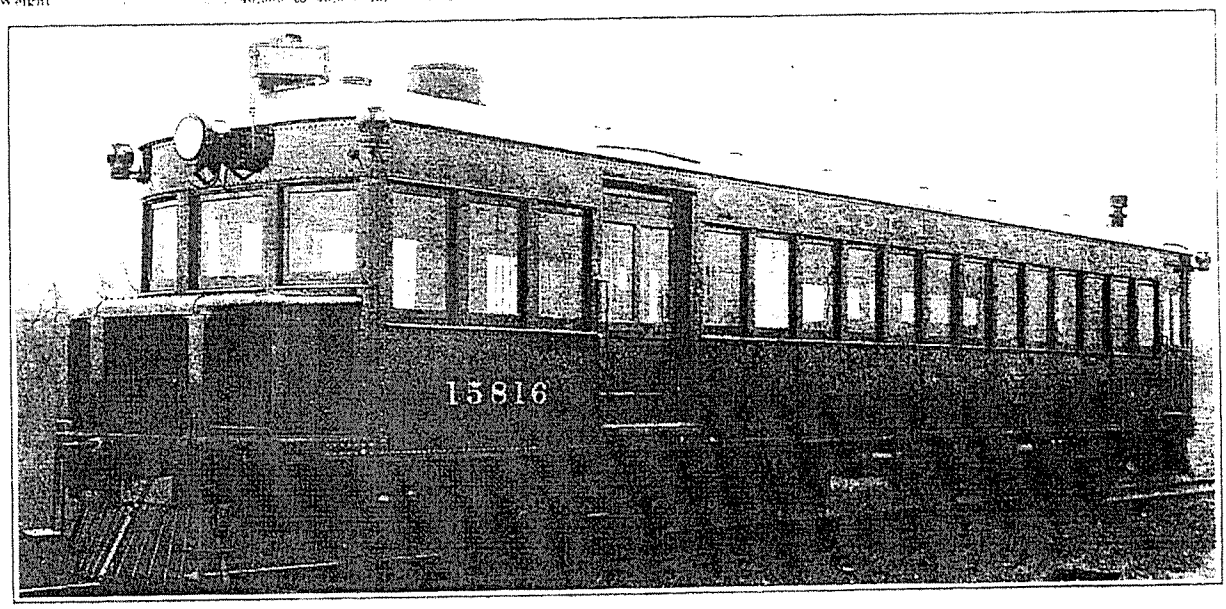
Mechanical Convention at Atlantic City.—The American Railway Association's Mechanical Division, general committee, decided at a meeting in New York on Nov. 8, to hold a convention with exhibits at Atlantic City, N.J., on June 11, 1924. The Railway Supply Manufacturers' Association also voted in New York on the same day to hold exhibits on the same dates.

Canadian Railway Club.—C. W. Parker, Signal Engineer, C.P.R., read a paper on Railway Signalling, which was illustrated by stereoptical views and blackboard sketches, at the Club's monthly meeting, Nov. 13.

Self Propelled Cars on Steam Railways.

Canadian National.—The gasoline motor passenger car ordered by the Grand Trunk from the National Steel Car Corporation, before the co-ordination, was delivered to the C.N.R. in Nov., 1923, and after tests, was placed in service between Toronto and Hamilton. It was described, with plan and elevation, in Canadian Railway and Marine World for Feb., 1923. Exterior and interior views are given herewith, the interior view being of a portion of the front compartment, which shows the rectangular steel case enclosing the upper portion of the engine, and the asbestos-covered sheet metal pipe of large diameter which conveys the escaping gases of combustion to the atmosphere, via the roof. The car has the following general dimensions:—

Length over all	55 ft. 9½ in.
Length over end sills	54 ft. 1½ in.
Width over side sheathing	8 ft. 9 in.
Height, top of rail to floor	3 ft. 9⅝ in.
Height, top of rail to roof	12 ft. 0 in.
Center to center of bolsters	32 ft. 3 in.
Truck wheel base	5 ft. 8 in.
Weight	40,000 to 45,000 lb.



Self-Propelled Gasoline Car, Canadian National Railways.

As all details of the underframing, side framing, roof, floor, etc., were given in our previous description, these will be dealt with here only to the extent of saying that the car is of all steel construction, with arch type roof, with ½ in. poplar roof boards, covered with canvas well bedded in white lead, the carlines being of flat steel bars. The interior is divided into 2 compartments, the rear or main one being for passengers, and the front one being primarily for baggage, but fitted with folding slat seats so that passengers may be accommodated on occasion. The main compartment seats 44 passengers, the seats, non-reversible and with metal frames, being arranged transversely on each side of the central aisle, and upholstered in green plush. The baggage compartment is provided with seats for 12 passengers. The compartments are divided by a partition matching the interior finish and fitted with a door with plate glass panel. The interior is finished in cherry, and presents a very ment has a carline finish. The passenger compartment has a lavatory, drinking water tank and cup vendor, and all the refinements of the modern passenger car. The windows are equipped with storm sash, and there are 5 ventilators in the car roof, adjustable from the interior.

The car is heated by a hot water heater, which, together with the coal box, is in a separate compartment in the passenger portion. Hot water pipes are located along each side of the car, under the seats. The lighting includes two 50-watt lamps in the front compartment and seven in the passenger compartment, and 2 rear vestibule lamps. The current is supplied by a U.S.L. generator, chain driven from the engine, and there is also a 250 ampere-hour storage battery underneath the car near the center.

The trucks are of the pedestal type, with swing motion bolster, the frames being of 6 in. structural channels, and the pedestals and equalizer spring caps of cast steel. The trucks are equipped with 36 in. diam. steel tired wheels, with spoke centers, and the journal bearings are of the Stafford roller type, with roller end thrust. Each truck is equipped with 2 triple elliptic bolster springs and 4 helical equalizing springs.

Each end of the car is equipped with a type D coupler, the rear coupler being connected to the frame by spring draft gear, and the front one supported by a steel casting attached to the end sill, and arranged so that it can be easily taken out in case it is desired to take the engine out of the car. The engine is carried on a sub frame, which is supported from the car frame by 3-point suspension, and is built in so that it can be easily taken out, by removing the front coupler and radiator. It is a Sterling, Dolphin type 6-cylinder gasoline engine, with cylinders 5¾ in. bore and 6¾ in. stroke, with power rating as follows: 800 r.p.m., 116 h.p.; 1,000 r.p.m., 144 h.p.; 1,200 r.p.m., 180 h.p.; 1,400 r.p.m., 205 h.p.; 1,600 r.p.m., 225 h.p.

The car is operating between Toronto union station, and Hamilton, 38.71 miles, as trains 73 and 74, train 73 leaving Toronto at 9.30 p.m. daily except Sunday, and arriving at Hamilton at 10.45 p.m., and train 74 leaving Hamilton daily except Sunday at 6.30 a.m. and arriving at Toronto at 7.35 a.m.

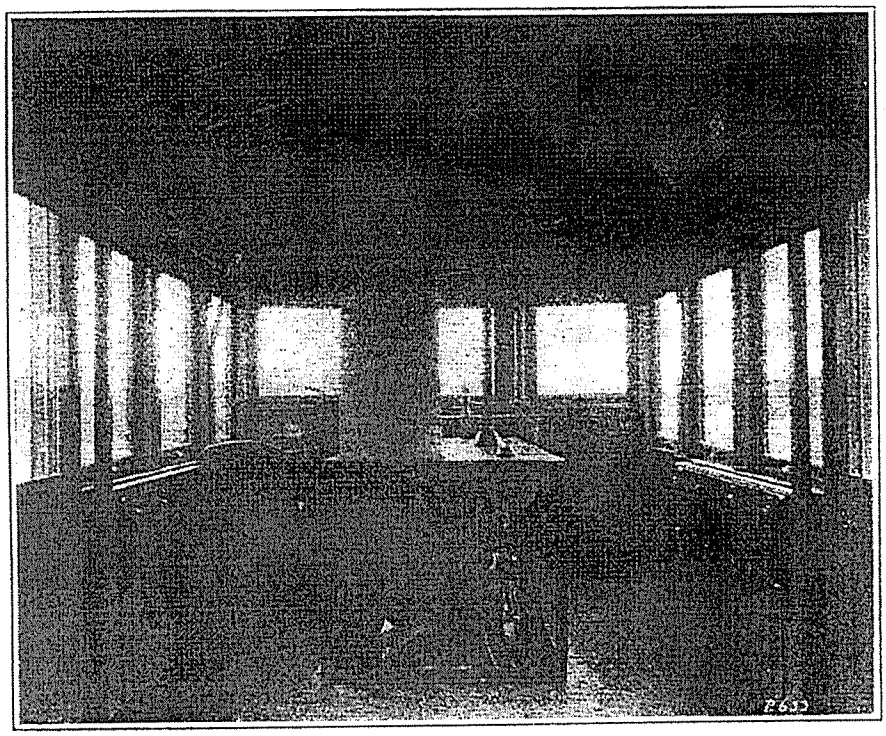
Storage Battery Cars.—As stated in Canadian Railway and Marine World for Dec. 1923, the Canadian National has ordered 6 storage battery cars, to be built by Canadian Car and Foundry Co. They will have steel underframes, steel superstructure, and wooden roof construction, with covering of canvas embedded in white lead. The general dimensions will be as follows:

Length over platform end sills	53 ft. 2 in.
Width over posts	8 ft. 9 in.
Width inside	8 ft. 4⅝ in.
Height from rail to top of roof	12 ft. 3½ in.
Truck centers	35 ft. 10 in.
Truck wheel base	5 ft. 6 in.

The underframing will include channel center sills, angle side sills, channel end sills, and channel floor beams. The

posts, and angle side and end plate. The flooring will be composed of 2 layers of tongued and grooved flooring, with double thickness of building paper between, the lower floor, of yellow pine, to be laid diagonally, and the upper floor, of maple, to be laid longitudinally. The roof, which, as stated above, will be wood and canvas, will be of arch design and supported on 1½ x ⅜ in. carlines. The cars will be of the 3 compartment type, the main compartment for passengers, and the other 2 for smoking and baggage, respectively. The main compartment will be equipped with 13 Walkover type seats, and 4 stationary seats, making seating capacity for 34, while the smoker will have 4 Walkover and 4 stationary seats, making seating capacity for 16, and thus making the total seating capacity 50. The passenger compartment will contain a lavatory. The interior finish in the passenger and smoking compartments will be in birch, stained either cherry or mahogany. The sides, ends and ceiling of the baggage compartment will be sheathed with t. and g. B.C. fir, painted to conform to railway standard. The cars will be heated by forced draught system, with the heating stove in the baggage room, and the ducts will also be arranged to heat the battery boxes.

The main body lighting, tail lights, marker lights and number lamps will all be electric, the current to be supplied from 10 Edison batteries, A-12-H type. As the cars will be arranged for double end operation, each end will be equipped with a Golden Glow headlight, fitted with dimmers. The main battery equipment will consist of 240 Edison A-12-H cells, and the 4 motors will be G.E. 25 h.p. units, type 261-A, the drive applying to all 4 axles. The trucks will be of the arch bar type, with railway standard semi-steel center and steel tired wheels, and SKF. self-aligning roller bearings. The cars will be equipped with Westinghouse type AMM brake equipment for double end operation, and Ackley staff type hand brakes with drop handle. Other couplers, with 5 x 7 in shank; steel locomotive type pilots on each end; Dayton air gong with foot control, and basket, coat and hat racks. It is expected that the battery equipment, 240 A-12-H cells, will enable the car to run 125 miles on one charging.



Front End Compartment, Self-Propelled Gasoline Car, Canadian National Railways.

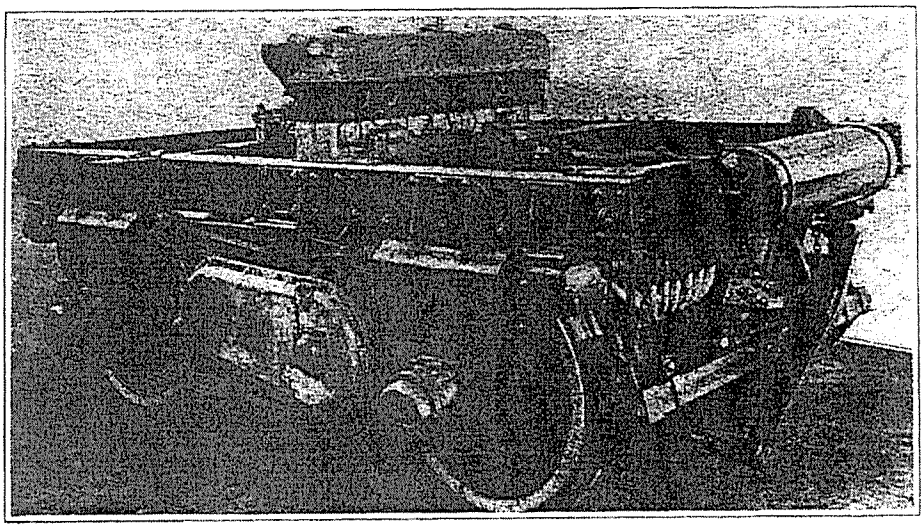
Investigation of Diesel Engines. — C. E. Brooks, Chief of Motive Power, C. N.R., left Montreal on Dec. 27, and E. W. Oliver, Manager Niagara St. Catharines and Toronto, Toronto Eastern and Toronto Suburban Rys., and R. J. Needham, Mechanical and Electrical Engineer, Central Region, C.N.R., left Toronto on the same date, for New York, and sailed for England on the s.s. Scythia on Dec. 29, to study the application of the Diesel engine to rail transportation for both locomotives and self-propelled cars, as developed in Scotland and on the Swedish State Railways. From London they will make trips to Glasgow and Stockholm. They expect to be away about a month. A description of the application of Diesel engines to self-propelled car operation was given in Canadian Railway and Marine World for Nov. 1923, pg. 531. Since 1913, several Swedish railways have been operating cars equipped with engines of from 75 to 120 h.p., but more recently cars have been introduced which have engines of 160 and 250 h.p. Some of these high-powered cars are really more in the nature of locomotives, being fitted with only a baggage space, the passengers being carried in trailers. The engines are of the 4-stroke cycle type, with 6, 8 or 12 cylinders, according to capacity, with capacity of electrical generator and other electrical equipment to suit, the power transmission to the driving wheels being electrical.

by an overhead camshaft. The main bearings for the crankshaft, which is counterbalanced and case-hardened, are 4 in. diam. The engine has large bearing areas and unusually large factors of safety, and two complete and separate magneto systems and a battery system are installed to guard against ignition trouble. The engine delivers 120 h.p. at 1,200 r.p.m. and is designed to maintain this output indefinitely.

The main clutch is mounted at one end of the engine crank case, and at the other end a train of gears, leading from a pinion on the crankshaft, is used to drive an air compressor. The main driving gears are housed in a casing outside of, and parallel to, the truck side frame, and from these gears a flexible shaft leads to the transmission gear case, which is supported by two brasses on the driving axle, and by a flexible link suspended from the truck bolster. The transmission drives through a pinion to a large spur gear on the driving axle. The entire transmission can be easily removed and replaced as a unit. Forced feed lubrication is employed.

Control of the power truck involves opening and closing the engine throttle, adjusting the spark, clutching and declutching and shifting the gears. There are four speed ratios provided for operation in each direction. The clutch must also be actuated as a function of the gear shift, and in addition to the main clutch between the engine and speed change gears, there is an auxiliary clutch located between these gears and the driving pinion. When the main clutch is disengaged the auxiliary clutch is also disengaged, so that the speed change and reversing gears are isolated from both the engine and driving wheels. This facilitates shifting the gears, as they are subject to no external pressure in the position described. For adjusting the spark and throttle, two electric motors are mounted on the truck frame immediately in front of the engine. One of these motors governs the position of the throttle through a small worm gear, and the other advances or retards the spark through a similar gear, according to the direction in which the motor is run. The throttle and spark levers placed in the plicated, as there are clutch movements to be taken into consideration, and a definite position of the gears must result from any movement of the controller. Movement of the gears and clutches is secured by a number of pistons in air cylinders, to which the admission of compressed air is controlled by magnet valves. The same air pressure is used for this purpose as for the air brake system with which the car is equipped, and the pistons are proportioned properly to overcome the inertia of resistance to shifting the gears and throwing the clutches out.

The car under which this power truck is in service is equipped with control apparatus at both ends, and has a baggage compartment, in a corner of which, partitioned off, is the radiator. This partition also encloses the engine exhaust, which is carried through the roof. The car was tested on the Pennsylvania Rd., near Philadelphia, before being placed in operation.



Power Truck for Self Propelled Gasoline Car.

Self Propelled Cars on Steam Railways.

Canadian National.—The large gasoline motor passenger car, 15,816, placed in operation recently between Toronto and Hamilton, Ont., was described as concerns structural details, dimensions, exterior and interior fittings, etc., in Canadian Railway and Marine World for January, pg. 19, and interior and exterior views were given. A plan and elevation were given in our Feb. 1923 issue, together with a preliminary description. This is the highest powered gasoline self propelled car yet placed in service on Canadian railways, and its power plant and driving mechanism are of special interest. The engine, of Dolphin type, Sterling make, with 6 cylinders of 5¾ in. diam. and 6¾ in. stroke, has the following power rating: at 800 r.p.m., 116 h.p.; at 1,000 r.p.m., 144 h.p.; at 1,200 r.p.m., 180 h.p.; at 1,400 r.p.m., 205 h.p.; at 1,600 r.p.m., 225 h.p. The cylinders are of the overhead valve type, with detachable heads, and are made of high tensile strength special cylinder iron. The water jacket extends to the base flange, affording uniform cooling, and the cylinder wall is skirted into the upper base, so as to give the piston guidance the full length of its stroke. The lower base extends the full length of the engine, enclosing the flywheel, and the flywheel housing clears the inside of the foundation. The pistons are of aluminum, the piston pins of steel, and the connecting rods, of I beam section, are of special steel, drop forged and double heat treated. The intermediate and end main bearings are unusually large, and all bearings are line reamed and worked in by hand. The crankshaft is a drop forging of chrome nickel steel, equipped with counterbalance weights opposite the throws, and has a tensile strength of 115,000 lb. The rocker arms are drop forged, the push rods, enclosed, are of steel, fitted with large roller for cam action, the camshafts are drop forgings, the pushrod guides are of bronze, and removable, the crankshaft and camshaft gears are steel drop forgings and are helical, and the other timing gears are of phosphor bronze. An oil circulating pump of gear type, driven from the camshaft through spiral gears, is provided, as is also an oil supply pump of the plunger type, attached to the top of the base and driven through worm gearing on the camshaft. Lubrication is by pressure feed through the camshaft, the pump taking oil from the tank in the lower base casting. The oil is returned to the supply tank by 2 scavenging pumps, which pick it up through strainers from either end of the engine.

The engine and clutch are mounted on a frame hung between the center sills, with 3 point suspension, arranged so that the frame, with engine and clutch, can be easily taken out through the front end of the car by unbolting the front striking plate. The clutch is of the multiple disc type, running in oil, and the universals are such that all angles are reduced to less than 5 degrees on 23 degree curves. The transmission provides for 4 speeds forward and 3 reverse, and is of the sliding gear type, with a special arrangement to cut off the load when changing gears. The rear truck is direct connected without gears in high speed. The drive is through the leading axle of the rear truck and the trailing axle of the front truck, power being transmitted to the latter through a jack-shaft, which may be thrown out of engagement when little tractive power is needed. The gear ratios are as follows: low, 5.19 to 1; 2nd., 2.7 to 1; 3rd., 1.67 to 1; high, 1 to 1. The accompanying illustration, fig. 1, shows the general arrangement of the transmission.

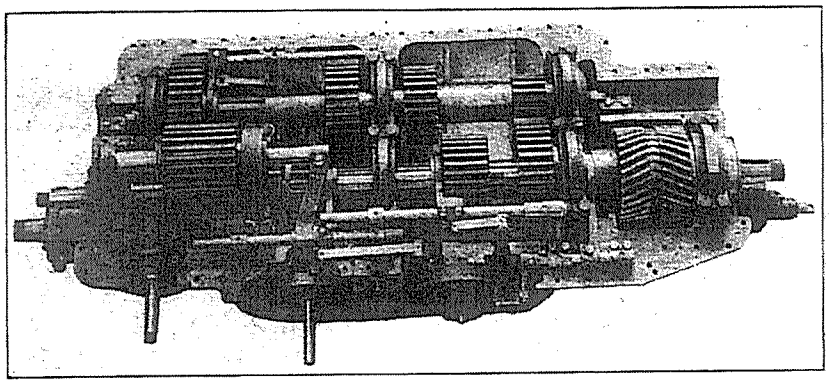


Fig. 1. Transmission, with Top Cover Removed, Canadian National Gasoline Car 15,816.

The drive is through spiral bevel gearing pressed on the driving axles, the gearing being enclosed in cast steel 2-part housings, with ball bearings on the axles, all parts running in oil or grease. The lower view in fig. 2 shows the set-up of the gearing and the housing construction. The ratio of the gearing is approximately 3 to 1, giving a speed of 36 m.p.n. at 1,000 r.p.m. of the engine. To relieve the shock of starting and stopping, the gear housings are fitted with cast steel torque arms, as shown at the back of the gear housing in the top view in fig. 2, these arms being rubber cushioned, and suspended to the truck equalizer bars. With the gear ratios as indicated above, the following speeds are obtainable:

R.p.m.	Miles per hour.			
of motor	High.	3rd speed.	2nd speed.	Low.
1800	63	37.8	23.4	12.15
1400	49	29.4	18.2	9.45
1200	42	25.2	15.6	8.10
1000	35	21	13	6.75
800	28	16.8	10.4	5.40
400	14	8.4	5.2	2.70

Gasoline Car with Engine in Truck.—A novel development in gasoline self-propelled car construction was effected recently, when the Pennsylvania Rd. tested a gasoline motor car equipped with trucks in one of which the engine is mounted. The "power truck", built for the car by the International Motor Co., is arranged with remote control, applied in such a way that the engine is controlled electro-pneumatically by the motorman, from his compartment at either the front or back of the car. As a matter of fact, both of the trucks under the car could, if desired, be fitted with a gasoline engine, and both engines would be subject to synchronous control as certain and accurate as that for the one mounted on the driving truck of the car now in operation. An illustration of the car's power truck is given herewith. The engine, a 6-cylindered one, is mounted between the truck's side frames, parallel to the bolster. The truck is equipped with tapered roller bearings and semi-elliptic springs. On the end of the truck at which the drive is transmitted, the engine crank case is supported at two points by a casting, with lips extending over the truck side frame, while the other end of crank case is suspended from the truck side frame by a flexible link, the effect of this arrangement being to provide a 3-point suspension.

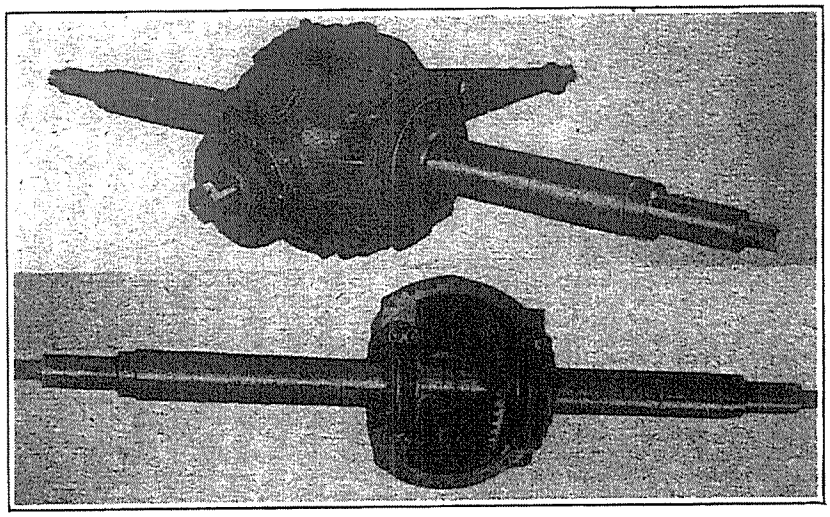


Fig. 2. Arrangement of Driving Axle, Bevel Gearing, Housing and Torque Arm, Canadian National Gasoline Car 15,816.

The engine cylinders are 5½ in. diam. and 7 in. stroke, there being two exhaust and one inlet valve per cylinder, actuated

Self Propelled Cars on Steam Railways.

Canadian National Ry. — Information as to additional oil electric cars placed in operation recently is given elsewhere in this issue, under "Oil Electric Cars, C.N.R."

Canadian Pacific Ry. — The gasoline car built by Ottawa Car Mfg. Co., described and illustrated in Canadian Railway and Marine World for July 1924, pg. 337, and which was placed in operation between St. Thomas and Woodstock, Ont., on the schedule given in our Nov. 1925 issue, pg. 565, continues on that run, and is giving satisfactory service. The battery car described and illustrated in our June 1924 issue, pg. 265, which has been in operation between Galt and Hamilton, Ont., has also been giving very satisfactory service on that run. Recently, its running time on the trip has been extended slightly, and the Sunday operation has been discontinued.

Great Northern Ry. is operating a gas electric self propelled car built by Electro-Motive Co., Cleveland, between Marcus, Wash., and Nelson, B.C. It is 59 ft. 7 in. long over coupler faces, 57⅓ ft. long over framing, 9 ft. 9⅝ in. wide, and the distance between truck centers is 40 ft. 10 in. Truck wheel base is 6½ ft., and total wheel base 47⅓ ft. The rolled steel wheels are 33 in. diam., and journals are 4¼ x 8 in. Each end is equipped with a Priest snow flanger. The underframe is of steel, and bolsters are of built-up type. It is equipped with Westinghouse air brakes, with 12 in. brake cylinder; spring draft gear; G. E. Co. C.P.-127-A air compressor; 6-cylinder gasoline engine with cylinders 7 in.

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Self Propelled Cars on Steam Railways.

Canadian National Ry.—Canadian Railway and Marine World for Nov. 1925, stated that the C.N.R. had ordered a Brill model 55 gasoline car from Ottawa Car Mfg. Co., for use on Vancouver Island lines, to replace the smaller gasoline car formerly in use there, which would be retained as a spare. The car was completed towards the end of 1925, and was delivered by barge from Vancouver to Victoria on Jan. 14, after which it went into service immediately between Victoria and Cowichan Lake, 72.9 miles, on the Cowichan Subdivision. Leaving Victoria at 9 a.m. daily except Sunday as train 351, the car reaches Cowichan Lake at 12.10 p.m., and leaving there at 12.30 p.m. daily except Sunday as train 352, arrives at Victoria at 3.40 p.m. A similar car acquired by the Canadian National was described and illustrated in Canadian Railway and Marine World for Aug. 1925, pg. 388.

Another 60 ft. oil electric car has been turned out of the Point St. Charles shops, Montreal, and has been numbered 15,825. It has been placed on the Ottawa-Pembroke run in place of no. 15,822, which is being held pending assignment to a new run. This makes 5 of these cars completed to the time of writing, viz., 15,819 to 15,822, both inclusive, and 15,825. Nos. 15,823 and 15,824 are nearing completion at the shops. Details of the runs on which the cars turned out previously were placed were given in preceding issues.

Gasoline Electric Cars.—The Reading Co. placed in service recently an all steel gasoline electric car, with body interior divided into engine, baggage and passenger compartments. It is 60 ft. long over end sills, 9½ ft. wide over the posts, 7 ft. 10 in. high inside, and 12 ft. 3½ in. high over all. The engine room, 10 ft. 8 in. long, contains the gasoline engine, generator, and control equipment. The baggage room is 11 ft. long, and the passenger compartment 35 ft. 10 in. long, with seats for 50 passengers. Distance between truck centers is 44½ ft., and truck wheelbase is 6½ ft. The wheels are 33 in. diam. The engine, a 6-cylindered one, with cylinders 7¼ in. bore. x 8 in. stroke, is of the valve-in-head type, with 2 exhaust and 2 intake valves for each cylinder, has removable liners and dual heads, and delivers 250 h.p. at 1,100 r.p.m. Two complete ignition systems are provided, by 2 high tension magnetos with impulse starters, used with 2 complete sets of spark plugs. A centrifugal pump is used for circulating the cooling water. Two motors are used for engine starting. The engine and generator are mounted as a unit on a common bedplate, being connected by a flexible disc coupling with 4 16-in. discs. An exciter, mounted directly on the shaft of the main machine, is used for exciting the main shunt field winding, and also for supplying power at a low voltage for car lighting circuits and for charging the storage battery. The shunt field of the exciter receives its excitation from a 32 volt battery. Each machine has 6 poles. The main machine operates at 600 volts, with normal load at 1,100 r.p.m., and the exciter at voltages up to 60. The generator supplies current to 2 Westinghouse 140 h.p. traction motors mounted on leading truck, axle hung, and driving through helical gears having a 16:61 ratio. These gears are completely enclosed in grease. The control is exceedingly simple. Two unit switches are used for connecting the motors to the generator, and also a reverser for changing the direction of current flow through the motor fields, and hence the direction of car movement. These are of the electromagnetic type, and their operation is governed by a master controller. Car speed varies with generator voltage, regulated by governing the engine speed, i.e., the engine throttle setting. There is a sequence drum with a cam on the generator, with push rods to the throttle. The position of the cam determines the throttle setting and hence the engine speed. The movement of the drum is regulated by the same master controller which operates the unit switches and reverser. The operator, therefore, has only one control to use for operating the car. The first movement of the master controller closes the unit switches and also a relay which energizes the exciter field. Further movement of the master controller only causes further rotation of the sequence drum, i.e., opening of the engine throttle. All the control apparatus, including a number of knife switches for the motors, generator fields and battery circuits, is located on a rack and panel on the generator. This car, operating on a branch line, where it replaced 2 steam locomotives, is said to be capable of speeds up to 51 m.p.h., and also handles a standard passenger or baggage car as a trailer. Westinghouse Electric and Manufacturing Co. reports that orders have been placed for similar cars for Boston and Maine Rd., New York, Ontario and Western Rd., Great Northern Ry., and the Pennsylvania, the New York, New Haven and Hartford, and the Erie Rds.

February 1926

Self Propelled Cars on Steam Railways.

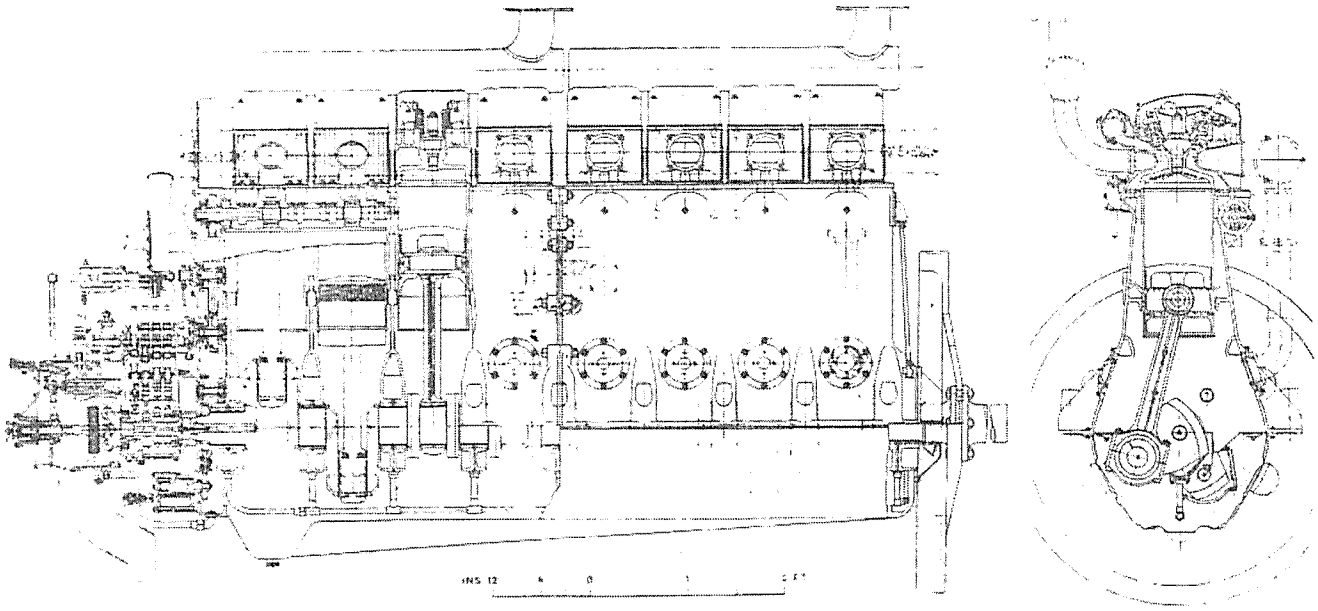
Oil Engines, Canadian National Cars.—An elevation and cross sectional view are given herewith of the Beardmore 8-cylinder engine, built in England, used in the Canadian National Ry. articulated oil electric cars described in preceding issues. The cylinders are 8¼ x 12 in. The whole frame is of cast steel, and is of cellular form, a square cell for each cylinder, these being separated by transverse walls continuing down to the crankshaft bearings, and carrying directly the stresses due to combustion pressure. Within the cells are supported liners of thin steel tubes, and the pistons and cylinder covers are of aluminum alloy. To complete the crankcase a light sheet steel pan closes off the lower side of the engine, and serves as a drain receptacle for the force-feed lubricating system. The engine, which weighs 5,040 lb., or 12.6 lb. per b.h.p., is rated to deliver 400 h.p. at 750 r.p.m., and operates at from 250 to 750 r.p.m., according to operating requirements. Owing to the relatively high piston speed employed it would have been difficult to accommodate inlet and exhaust valves of the ordinary type, and dual valves were placed on either side of the combustion space, the latter taking on a gabled shape, with the fuel injection device located at the apex.

The fundamental requirements in atomization of fuel in an oil engine may be stated as follows: definite injection period in continuous service; precise measurements of fuel over long periods; instantaneous cut-off action; fine division, to give sufficiently good rapid combustion; discharge into all the air possible, with avoidance of wall contact. In order to accomplish efficient injection and atomization, a device of novel character, designed to afford sharper and better defined individual injections of fuel than theretofore obtainable, was employed, wherein, based on the realization that it is practically impossible to stop and start a direct-injection fuel pump plunger rapidly enough to give the required well-defined character to the injection, only the central portion of the normal pump plunger travel is utilized for the delivery of the fuel. The early and latter parts of the oil delivered by the pump plunger are by-passed into a tank without producing any discharge from the atomizer. The by-pass outlet from the plunger chamber is crossed by a small piston valve with a narrow land capable of being moved across the by-pass opening at a high rate of speed. For the brief instant during which the rapidly moving piston valve blocks off the by-pass port, fuel is delivered to the atomizer in a sharp injection with quick and well-defined start and termination.

Canadian National Ry. Services.—Effective with the May 2 change of time, the C.N.R.'s gasoline, gas-electric, storage battery and oil electric self propelled cars were assigned to run as follows:—

Atlantic Region.—Battery car 15,798 between Lunenburg and Mahone Bay, on Lunenburg Subdivision, Halifax Division, 7 miles, giving all passenger service; battery car 15,792 between Bathurst and Campbellton, on Bathurst Subdivision, Campbellton Division, 62.97 miles, as trains 329 and 330; battery car 15,793 between New Glasgow and Pictou, on Mulgrave and Pictou Subdivision, New Glasgow Division, 12.24 miles, as trains 264, 265, 266 and 267; battery car 15,799 between Fredericton and St. John, on Centreville Subdivision, Edmundston Division, 83.16 miles, as trains 53 and 54; gasoline car 15,811 between Cross Creek and Stanley, on Nashwaak and Stanley Subdivisions, Edmundston Division, 5.73 miles, giving all passenger service; gasoline car 15828 between Stellarton and Sunny Brae, Mulgrave and Sunny Brae Subdivisions, New Glasgow Division, 16.17 miles, as trains 231, 232, 233 and 234; 60 ft. oil electric car 15,821 between Truro and Sackville, Springhill Subdivision, Montcon Division, 86.67 miles, as train 17, between Sackville and Oxford Jct., on same subdivision, 39.92 miles, as train 18, and between Oxford Jct. and Truro, same subdivision, 46.75 miles, as train 296; 60 ft. oil electric car 15,823 between Tignish and Charlottetown, on Tignish and Kensington Subdivisions, Island Division, 115.17 miles, as trains 205 and 206; battery car 15,802 between Halifax and Windsor Jct., on Bedford Subdivision, Halifax Division, 15.87 miles, as trains 173-178 inclusive.

Central Region.—60 ft. oil electric car 15,824 between Montreal and Waterloo, Granby Subdivision, St. Lawrence Division, and Montreal Terminals Division, Montreal District, 66.96 miles, as trains 303 and 304; multiple unit cars 15,903 and 15,904 between Montreal and St. Eustache, Mount Royal and L'Orignal Subdivisions, Montreal Division, Quebec District, 17 miles, giving all local passenger service; multiple unit cars 15,903 and 15,904 between Montreal and Cartierville, Mount Royal and L'Orignal Subdivisions, Montreal Division, Quebec District, 8.2 miles, giving all local passenger service; 60 ft. oil electric car 15,825 between Ottawa and Pembroke, Hurdman and Beachburg Subdivisions, Ottawa and Capreol Divisions, Northern Ontario District, 86.7 miles, giving all local passenger service; gasoline car 15,827 between Brockville and Westport, Westport Subdivision, Ottawa Division, Northern Ontario District, 40.3 miles, as trains 311, 312, 313 and 314; gasoline cars 15,814 and 15,826 between Picton, Trenton and Trenton Jct., on Picton Subdivision, Ottawa Division, Northern Ontario District, 30.6 miles, as trains 301, 304, 305 308, 309 and 310; battery car 15,801 between Toronto and Beaverton, Bala Subdivision, Nipissing Division, Northern Ontario District, and Toronto Terminals Division, Southwestern Ontario District, 64.3 miles, as trains 315 and 316; gasoline car 15,816 between Parry Sound and Capreol, Sudbury Subdivision, Capreol Division, Northern Ontario District, 127 miles, as trains 317 and 318; battery car 15,804 between Toronto and Weston, Brampton Subdivision, Stratford Division, Southwestern Ontario District, and Toronto Terminals Division, Southwestern Ontario District, 8.41 miles, giving all local passenger service; battery car 15,804 between Toronto and Oakville, Oakville Subdivision, London Division, and Toronto Terminals Division, Southwestern Ontario District, 21.14 miles, as trains 619 and 620; articulated oil electric car 15,818 between Palmerston and Kincardine, Newton and Kincardine Subdivisions, Stratford Division, Southwestern Ontario District, 75.37 miles, giving all passenger service; articulated oil electric car 15,817 between Palmerston and Southampton, Southampton Subdivision, Stratford Division, Southwestern Ontario District, 58.94 miles, giving all passenger service; articulated oil



Eight Cylinder Oil Engine for Self Propelled Car.

Self-Propelled Cars on Steam Railways.

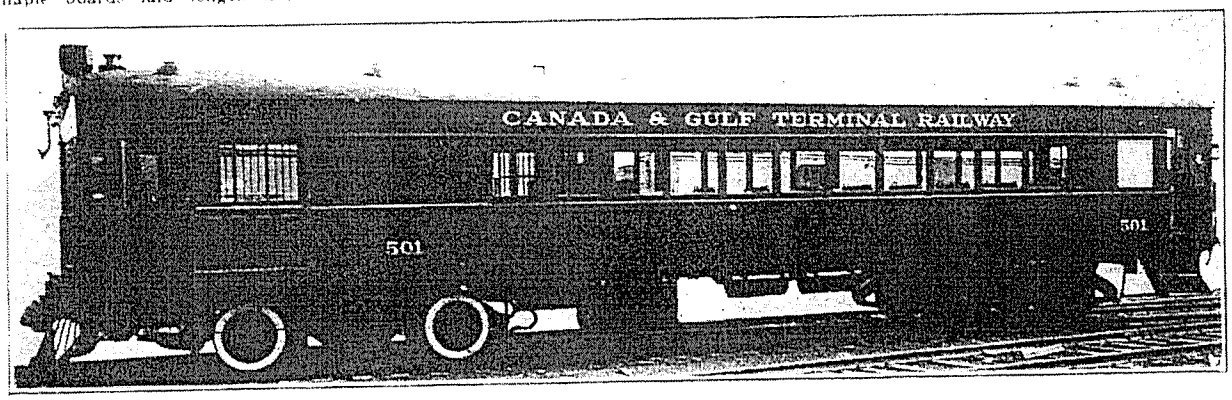
The Canada and Gulf Terminal Ry's model 75, gasoline self-propelled car, built by Ottawa Car Manufacturing Co., delivery of which was mentioned in Canadian Railway and Marine World for July, and an illustration of which is given herewith, has the following chief dimensions: length over end sills, 55 ft.; width over posts, 9 ½ ft.; length of baggage compartment inside, 16 ¼ ft.; truck centers, 32 ft.; motor truck wheel base, 8 ft. 4 in.; trailer truck wheel base, 7 ft.; height rail to top of roof, 12 ft., 3 ½ in. Seating capacity in main room is 50, and in baggage compartment, 6. The underframe is of steel construction throughout, the centre sills being 10 in. rolled steel channels, continuous from end sill to end sill, the side sills rolled steel angles, the end sills and cross members rolled steel channels, and the bolsters of the built up type. The body framing is also of steel throughout. The flooring is double, the top floor being 5/8 in. t. and g. maple boards laid lengthwise, and the lower floor 5/8 in. t. and g. yellow pine boards laid transversely. The rear end of the body has a bulkhead of steel construction, with swing type door, and a single swing type door is provided at each rear platform opening. Sliding doors at each side of the baggage space provide 4 ft. opening. The engine is a 6-cylinder 4-cycle valve-in-head heavy duty type, with cylinders 6 in. bore and 7 in. stroke. It is equipped with 32 volt starting motor, and ignition is dual, there being 2 separate independent high tension magnetos with impulse couplings. The transmission, providing 5 speeds, is mounted in a cast steel swing bolster on the front truck. The trucks are both 4-wheel, and the truck frames are of the built up type. The axles are of heat treated alloy steel, and the journal bearings are of the Timken tapered roller type, packed in grease. The drive is to both axles of the leading truck, the rear truck being an idler. Westinghouse air brakes are applied. The light weight of car is 53,000 lb.

This car is being operated between Mont Joli and Matane, Que., 36 miles, on the following schedule, daily except Sunday: leave Mont Joli as train 2, at 7.20 a.m., arrive Matane at 8.32 a.m.; leave Matane at 9.30 a.m., as train 3, arrive at Mont Joli at 10.42 a.m.; leave Mont Joli at 5 p.m., as train 4, arrive Matane at 6.12 p.m.; leave Matane at 7.30 p.m. as train 5, arrive at Mont Joli at 8.42 p.m. Connection is made at Mont Joli by train 2 with the Canadian National Ry. Ocean Limited, from Montreal, arriving at Mont Joli at 6.20 a.m., and with the Maritime Express, from Halifax, arriving at Mont Joli at 6.30 a.m. Train 5 connects at Mont Joli with the Ocean Limited for Montreal, leaving there at 10.05 p.m. Connections are made at Matane with Heppell Navigation Co. boats for all points on the north shore, and connections are also made at Matane with the bus service to Ste. Anne des Monts and intermediate points. Train 4 connects with the Canadian National local from Levis, arriving at Mont Joli at 4.40 p.m., and train 3 connects with the C.N.R. local for Levis leaving Mont Joli at 12.25 p.m. We are advised officially that the car's operation has been satisfactory, and that the improved service rendered is receiving public approval and support.

Canadian National Ry.—As stated in these columns previously, the C.N.Ry. was converting 2 storage battery cars, nos. 15,794 and 15,797, into gas-electric cars. This work has been completed at Point St. Charles shops, Montreal. Car 15,794 operated previously between Toronto and Oakville, Ont., and car 15,797 between Kitchener, Galt and Elmira, Ont. In the conversion, both cars were equipped with a Winton engine, type 124, supplied by Electro Motive Co. These engines are 4 cylinder, with cylinders 6 in. bore and 7 in. stroke, and, operating at 1,000 r.p.m., develop 125 h.b.p. The generator and control equipment installed is the standard developed by General Electric Co. for gas-electric cars. The original motors were retained.

Newfoundland Government Ry.—The steam self-propelled car, one of those described and illustrated in Canadian Railway and Marine World for July, 1925, pg. 335, which, as stated in our July issue, pg. 363, has been operating between St. John's and Bowring Park, began giving, in addition, a service between St. John's and Kelligrews, on July 5. It leaves St. John's at 6.30 p.m. Tuesdays, Thursdays and Fridays, and at 10.15 p.m. Wednesdays, Saturdays and Sundays. Returning, it leaves Kelligrews at 7.10 a.m. daily except Sunday, when it leaves at 9 a.m. This car gave a similar service last year.

Timiskaming and Northern Ontario Ry. has ordered from Ottawa Car Manufacturing Co. a gasoline-electric car to weigh about 120,000 lb. It will be 73 ft. long, 9 ft. 10 in. wide over posts, and of all steel construction throughout. The interior will be finished in solid mahogany, and divided into main room seating 57 passengers, smoking compartment seating 20, and baggage compartment 16 ft. long, in addition to the engine compartment, 11 ft. 2 in. long. The rear vestibule will be 6 ft. 5¾ in. long. The power plant will be a gasoline engine with cylinders 7 ¼ in. bore x 8 in. stroke, developing 250 h.p. at 1,100 r.p.m., driving a Westinghouse type 176 1,100 r.p.m. 160 kw. self-ventilated railway generator, with normal, or one hour, rating 500 volts, continuous capacity on stand, total capacity 600 volts. An auxiliary generator mounted on brackets will be used to excite the field winding and supply auxiliary power to other circuits. The current for propelling the car will be supplied to 2 Westinghouse 557-A-8 140 h.p. railway motors. The control equipment will be operated through a throttle, at the right of the operator, and connected mechanically to the engine. Moving of the throttle from the "off" position will open the carburetor, thereby increasing engine speed, and also operate the control circuit. The car may be geared to run 60 m.p.h., or, with a different gear ratio, to pull a 150,000 lb. trailer on level tangent track at 30 m.p.h.



Self Propelled Gasoline Car, Canada and Gulf Terminal Railway.

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Cars

lower floor 5/8 in. t. and g. yellow pine boards laid transversely. The rear end of the body has a bulkhead of steel construction, with swing type door, and a single swing type door is provided at each rear platform opening. Sliding doors at each side of the baggage space provide 4 ft. opening. The engine is a 6-cylinder 4-cycle valve-in-head heavy duty type, with cylinders 6 in. bore and 7 in. stroke. It is equipped with 32 volt starting motor, and ignition is dual, there being 2 separate independent high tension magnetos with impulse couplings. The transmission, providing 5 speeds, is mounted in a cast steel swing bolster on the front truck. The trucks are both 4-wheel, and the truck frames are of the built up type. The axles are of heat treated alloy steel, and the journal bearings are of the Timken tapered roller type, packed in grease. The drive is to both axles of the leading truck, the rear truck being an idler. Westinghouse air brakes are applied. The light weight of car is 53,000 lb.

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August 1926

Self-Propelled Cars on Steam Railways.

Canadian National Ry. As stated in Canadian Railway and Marine World for April, pg. 188, the Canadian National Ry. management proposed to add 5 oil electric cars to its equipment. Unofficial information is that these cars have now been ordered, that they will be non-articulated, and intermediate in size between the articulated and 60 ft. oil electric cars now in service, described and illustrated in Canadian Railway and Marine World for Nov., 1925, pg. 537, and that they will be equipped with Beardmore 6-cylinder oil engines and Westinghouse electrical equipment. They will, it is stated, be about 73 ft. long, weigh about 65 tons, and have single end control. The engine, of 300 b.h.p., will, it is said, have some changes in design from those now in service, one involving an increase in circulating water pressure, and another an improved location of atomizers. The generator will, it is said, be 300 h.p., about 210 k.w., and two 150 h.p. motors will drive through the axles of the leading truck, which will carry 60 or 65% of the car weight. The engine starting arrangement will be the same as on the oil electric cars now in service, viz., operation of the generator as a motor with current from a storage battery.

Newfoundland Government Ry.—The self propelled steam car in service between St. John's and Bowring Park, has been so well patronized that it has been taxed to capacity to handle the traffic offering. This car, described and illustrated in Canadian Railway and Marine World for July, 1925, pg. 335, also runs between St. John's and Kelligrews, 19.26 miles, on the schedule mentioned in our August issue, pg. 423. A covered platform has been built in Bowring Park recently, for the convenience of passengers using the car operating between St. John's and the park. The railway has another of these cars in service, between Humbermouth and Soper's Crossing, 6.78 miles, used chiefly by workmen in the Humber area.

Distillate for Fuel.—What is said to be an improvement on the gasoline-electric car is reported to have been developed by Electro-Motive Co., Cleveland, in designing an engine for its cars which operates on low grade fuel oil, such as distillate, effecting a large saving, practically 50% compared with the cost of gasoline. Our information, from an unofficial but reliable source, is that several of this builder's gasoline-electric cars previously in service on various roads in the U.S. have been converted to burn this distillate, with the result that the saving in fuel cost has been remarkable. We are advised that the engine is started on gasoline, the feed being changed over to the distillate as soon as the engine is speeded up. The engines in the cars now being built are designed to burn the distillate as a regular fuel, but they can burn gasoline equally as well, all that is necessary to change from one fuel to the other being the changing of the carburetor and manifold. The Boston and Maine Rd. has, it is reported, bought 10 cars, with power plant furnished by Electro-Motive Co. and bodies built by Osgood-Bradley Car Co., Worcester, Mass., and with the engines fitted to burn distillate. The engines develop 275 h.p. at 1,000 r.p.m., and have $7\frac{1}{2} \times 8\frac{1}{2}$ in cylinders. They are of Winton manufacture and drive a General Electric Co. gen-

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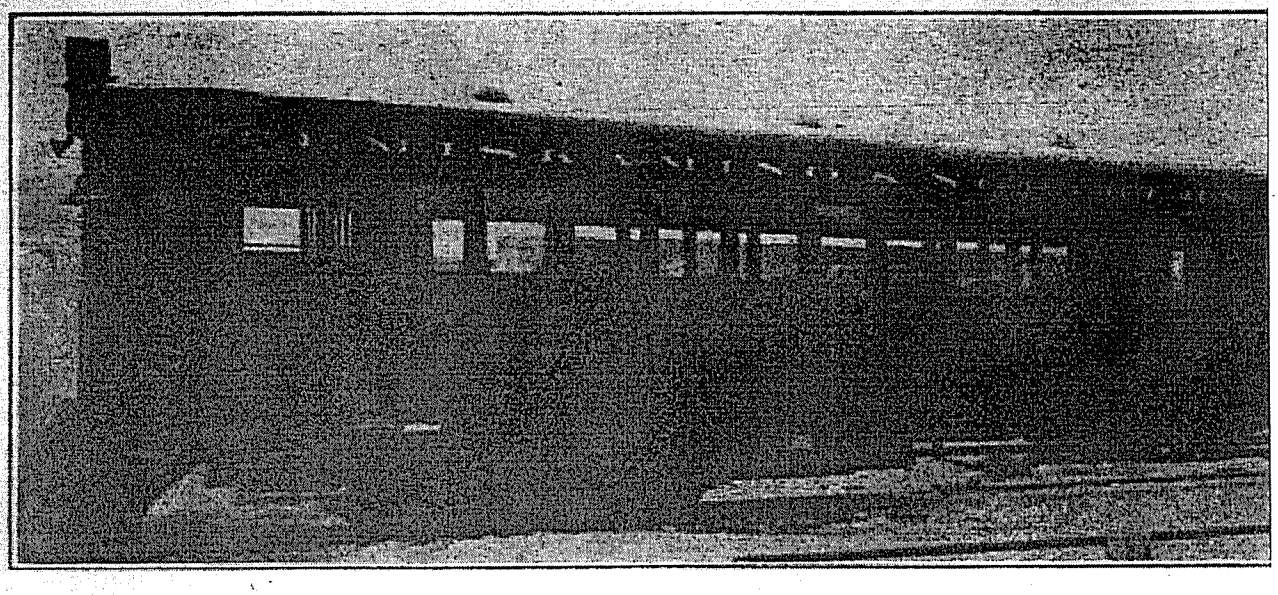
and St. Martins subdivisions, Atlantic finished in Pullman green, with gold



Gasoline-electric Self-Propelled Car, Timiskaming and Northern Ont

Region, where it is operating on the schedules of trains 131 and 136, between St. John and Hampton, and also, during the winter, as trains 49 and 50, between St. John and Moncton, on Sundays only, as follows:—lv. St. John 9.30 a.m., arr. Moncton 1 p.m.; lv. Moncton 4.45 p.m., arr. St. John 8 p.m.

A Montreal dispatch quotes Canadian National passenger department officials as stating that the railway is operating 30 self-propelled car services, with approximate annual mileage of 1,540,084, that placing in operation of additional cars now being built will increase this to about 1,935,220 miles a year, and that by the use of self-propelled cars, loss of short haul passenger traffic to buses and automobiles has been curbed considerably.

Premier Coates, of New Zealand, while in Montreal, on Jan. 12, displayed considerable interest in one of the Canadian National oil-electric cars which he saw at the Bonaventure station. Construction and operation details were explained to him by R. G. Gage, Electrical Engineer, and he made a trip with Mr. Gage to the railway's shops at Point St. Charles, where other oil-electric cars are being built.

Timiskaming and Northern Ontario Ry. has received from Ottawa Car Manufacturing Co. the gas-electric self-propelled car mentioned in Canadian Railway and Marine World for Aug. 1926, pg. 423, as having been ordered. It weighs about 120,000 lb., is 73 ft. long, 9 ft. 10 in. wide over posts, and is divided into main room seating 57 passengers, smoking compartment seating 20, baggage compartment and engine compartment. It is equipped with a rear vestibule 6 ft. 5¾ in. long. The lettering.

The car was given a trial trip between Ottawa and Renfrew, leaving Ottawa at 10.15 a.m. and returning at 4.20 p.m., a maximum speed of 62 m.p.h. and an average speed over long intervals of 45 m.p.h. being reported. Among the party on the trip were S. B. Clement, Chief Engineer, T. and N.O.R.; W. H. McIntyre, Vice President and General Manager; L. D. Byce, Superintendent of Works; F. S. Beattie, Superintendent, Car Department, and J. R. Allan, of Sales Department, Ottawa Car Mfg. Co.; W. J. Warnick, Superintendent, Toronto, Hamilton and Buffalo Ry.; F. M. Donegan, Superintendent, Algoma Eastern Ry., and representatives of the Canadian National and Canadian Pacific Rys. Lt. Col. L. T. Martin, T. and N.O. Ry. Commissioner, and Mrs. Martin, accompanied the party on the return trip from Renfrew to Ottawa.

The car was delivered at North Bay, Ont., on Dec. 31, 1926, and on Jan. 3 left there under its own power for the T. and N.O.R. Larder Lake branch, which runs easterly from Swastika, 165.8 miles north of North Bay, to Cheminis, on the Ontario-Quebec boundary, serving the Kirkland Lake gold mining area. It is operating on this branch, between Swastika, Kirkland Lake, Larder Lake and Cheminis.

February 1927

Six-Cylinder Oil-Electric Cars, Canadian National Railway.

The Canadian National Ry. management, as stated in Canadian Railway and Marine World for Oct. 1926, pg. 535, decided to add to its fleet of oil-electric self-propelled cars, which then consisted of 7 single body cars 60 ft. long, and 2 articulated cars 102 ft. long, and which had been described and illustrated in Canadian Railway and Marine World for Nov. 1925, on pg. 537. It ordered from Canadian Car and Foundry Co. steel frames for 5 single body cars, intermediate in size between the 60 ft. and articulated cars. The frames have been delivered, and the cars are being finished in the railway's Point St. Charles shops, Montreal. The 60-ft. cars were equipped with 4-cylinder engines, and the articulated cars with 8-cylinder ones; the additional cars are being equipped with 6-cylinder engines. The power plant, located at the front end of the car, consists of an oil-engine direct connected to a d.c generator. The cars are driven by standard railway type motors mounted on the trucks. The chief dimensions of these intermediate size cars are as follows:-

Length over end sills	73 ft. 9 in
Width over side sills	10 ft.
" inside	9 ft. 6¼ in.
Height from rail to top of roof	12 ft. 7 in.
" inside from floor to ceiling	8 ft.
" over all	14 ft.
Distance between truck centers	53 ft. 3 in.
Total wheel base	60 ft. 9 in.
Truck wheel base	8 ft. and 7 ft.
Length of engine room inside	16 ft. 6 in
" baggage compartment	27 ft. 2 in.
	21 ft. 7 in.
" smoking compartment	5 ft. 7 in
" passenger compartment	22 ft. 7 in
Weight, with equipment but without live load	133,000 lb. est.

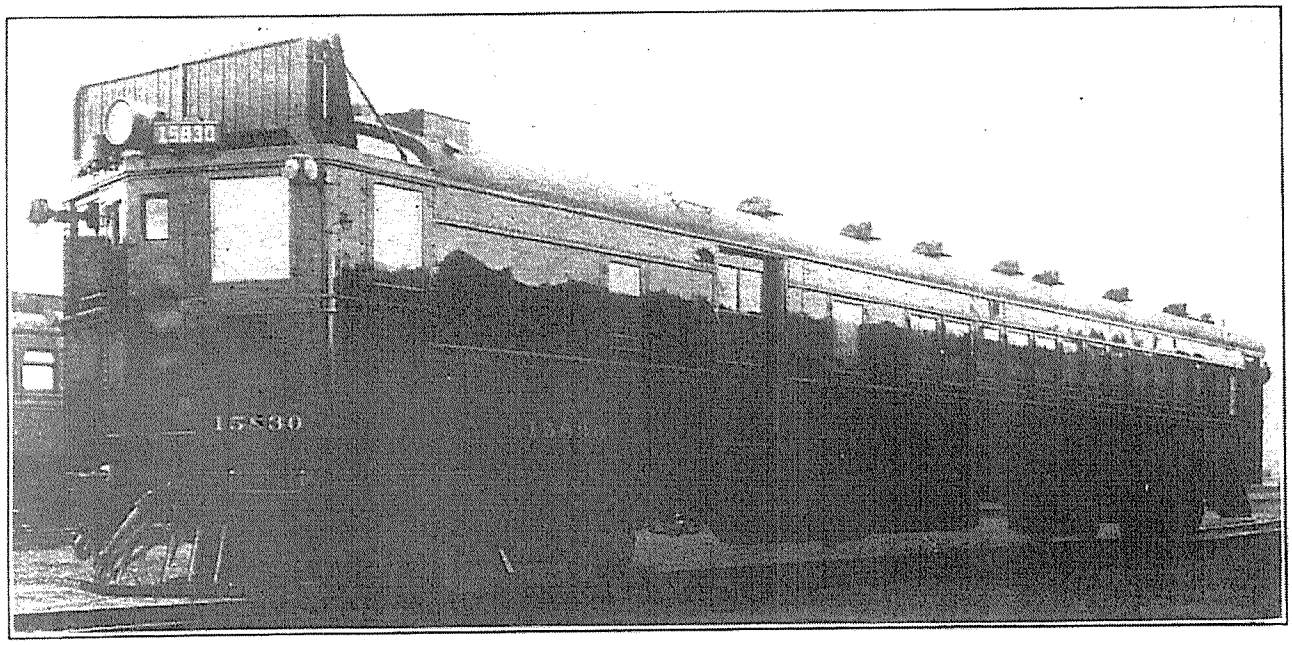
The body construction includes 12-in. 30-lb. channel center sills, spaced 25 in. apart; 3/16 x 31 in. center sill cover plates; 5 x 4 x ¾ in. angle side sills; channel end sills cast with bolsters; 3 x 2½ x ¼ in. angle side plates, 3 x 2½ x ¼ in. angle end plates; ⅛ in. sheathing; 4½ x ¾ in. belt rail; 2½ x 2 x 3/16 in. angle carlines; 3 x 2½ x 3/16 and 3 x 2½ x ⅛ in. side posts; and channel platform sills cast with bolsters. The end steps are Canadian National standard 4-tread all-steel type, with Edwards trap doors. The couplers are Van Dorn 5 x 5 in. shank, and class G 8 x 8 in. draft springs are used, a single spring on the front end of the car, and tandem springs on the rear end. The partitions between the engine room and baggage room are of steel, so constructed that they can be removed if necessary, to facilitate working on the power unit.

The interior finish is birch stained mahogany, with 3/16 in. Haskelite ceiling, painted cream color. Double floors are applied throughout, except in the engine room, where a single floor, 1¼ in. thick, is used, and covered with checkered aluminum floor plates. On all other parts of the cars, the floor consists of one layer of 13/16 in. white pine, with a top floor of ⅝ in. B.C. fir, with one layer of J.M. no. 50 asbestos and asphalt waterproof felt between. The side lining below the windows is 3/16 in. Haskelite, painted to match the interior finish. The windows, single, of cherry. Canadian National standard size, are fitted with curtains, and storm sashes are provided for winter. Parcel racks are applied the full length of the passenger compartment, on both sides. Insulation is 3-ply Salamander. The roof is 5/16 in. Haskelite, with no. 6 canvas laid in white lead. The outside finish is Canadian National standard coach color, dark green, with lettering and numbering in gold leaf.

The seats, arranged to accommodate 3 people on one side of the aisle and 2 on the other, provide a total seating capacity of 37, are of Heywood Wakefield type, spaced at 2 ft. 10 in. centers, and upholstered in mohair. Electric lighting is provided from storage batteries at 32 volts, and conduits for the lighting circuits are carried over the side plates and let into wooden carlines. The lighting fixtures are placed on the center line of the car. Conduit is also used throughout for the power and control circuits. Ventilation is provided for by exhaust type ventilators in the roof. The cars are heated by Smith hot water heaters, type C.C. 2A, in the baggage room, with wrought iron heating pipes. One car is equipped with Vulcan tubing.

The trucks are all of the 4-wheel type, with equalizer springs. Both front and rear truck have 36-in. rolled steel wheels, S.K.F. boxes and bearings, and cast steel frames and bolsters. The front truck carries 2 motors and has 5½ x 10 in. journals; the trailing truck has no motors and has 5 x 9 in. journals.

The brake equipment is Westinghouse schedule A.M.F. The air pressure is supplied from one D.H.-20 compressor controlled by S-6-A governor. The braking ratios are based on 50-lb. cylinder pressure, being 83% on the front truck and 75% on the rear truck. The front truck is equipped with A.S.F. suburban type Simplex clasp brake, and the rear truck is fitted with single type brake of C.N.R. design. Both trucks are equipped with Universal Draft Gear Attachment Co. hand brake booster and vertical operating ratchet handle.



Six-cylinder Oil-electric Car, Canadian National Railway.

The engines for these cars, manufactured by William Beardmore and Co., Glasgow and London, conform to a modified Diesel cycle of the solid injection 4-stroke cycle type, and are arranged with 6 cylinders in line. The cylinders are 8¼ in. bore by 12 in. stroke, and develop 300 b.h.p. at 750 r.p.m. The engine with flywheel weighs approximately 6,900 lb. One of the principal features of the engine is its very low weight per h.p., which has been obtained entirely by a scientific use of materials. The thicknesses of the materials have been reduced to a minimum consistent with the required strength, using high tensile steels and special alloys throughout. The crank case is cast steel, the cylinder liners forged steel, the cylinder heads cast aluminum, the valve seats alloy steel, the pistons forged aluminum, the crankshaft special forged alloy steel, the sump cover sheet steel, and the connecting rods special forged steel. The pistons are fitted with 5 cast iron rings and one oil scraper ring. The exhaust from each cylinder is carried vertically up through the roof.

The fuel oil is carried in a 150-gall. tank mounted in the engine room, from which the fuel for the engine is drawn, and an

additional supply is carried in a 150-gall. tank suspended beneath the car, from which the oil is forced up into the engine room tank by air pressure. The fuel circuit is from the engine room tank by gravity to an Auto-Klean filter, then to the gear pressure pump, from which it is delivered at about 30 lb. pressure to the distributing plunger pumps, of which there is one for each pair of cylinders. This pump delivers the oil to the atomizers at from 8,000 to 10,000 lb. per sq. in.

In lubricating the engine, the oil is forced under pressure to all working bearings, including the camshaft ones. Oil is drawn from the well in the sump at the gear case end of the engine, and is then forced at 40 lb. pressure through a filter to the bearing, from which it drains back to the sump, latter acting as the lubricating oil storage, in which the oil is air cooled.

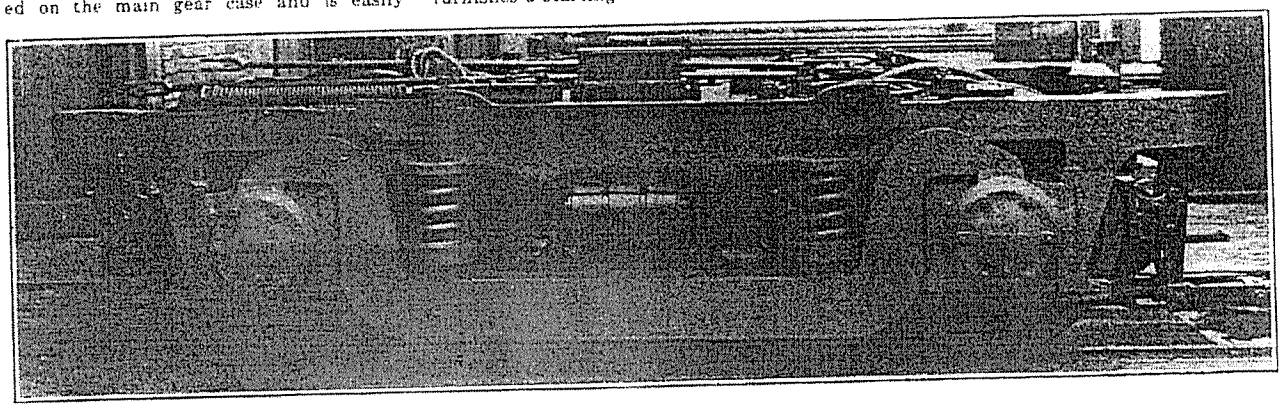
A centrifugal pump to circulate the cooling water through the engine is mounted on the main gear case and is easily detached for examination. A flow indicator is provided in the cooling water circuit, which indicates a stoppage of flow by extinguishing a lamp in front of the operator.

A centrifugal type governor, driven off the crank shaft, is coupled to the fuel pump controls, and arranged so as to increase or decrease the oil supply to the fuel distributing system. It is fitted with an emergency device to cut the fuel pumps out of action, should the engine speed, for any reason, increase above the desired point.

The electrical equipment was manufactured by Canadian Westinghouse Co. The generator is a 198-k.w. 300-volt d.c. 600-amp. compound wound machine, mounted on the same bedplate with, and rigidly connected to, the engine. Liners are placed between the bedplate and the car sills to absorb the vibration. On the same shaft with the generator is mounted a 5.6-k.w. 64-volt auxiliary generator. The balance of the electrical equipment consists of two 569-C. 4,600-volt, 215-h.p. railway motors, mounted on the leading truck and connected through helical gears at a 20:59 ratio; the controller, at the front end, which connects motors and generator and governs direction, engine starting and manual throttle control of engine speed, and the control switches. An 84-volt M.V.A. 17 Exide Ironclad battery is carried under the rear half of the car, suspended from the floor in a steel battery box on each side of the car. This battery furnishes a starting current for driving the generator as a motor, and is charged from the auxiliary generator when its voltage is higher than the battery voltage.

The standard train air communicating signal system is used. Twelve inch Golden Glow headlights are mounted on the roof at the front end, together with C.N.R. standard number lamp and Strombos horn. Brackets and electrical connections are provided for marker and classification lamps. There is a light pilot on the front end, made of angle iron, and well braced. A locomotive type bronze bell is suspended from the center sills under the baggage compartment, and is operated by an internal quick acting bell ringer made by Transportation Devices Corporation. Miniere window cleaners are used on front windows, near operator. Hanlon sanders provide sand to the front of the front truck wheels, and to the rear of the rear wheels of the front truck. The sand boxes, in the engine room, are filled through holes in the roof. Car replacers are carried in equipment boxes under the car. Modine radiators are mounted on the car roof at the front end for cooling water. Steps are let into the left-hand side of the car ahead of the baggage door, with grab handles on the roof to provide ready access to radiators and other equipment mounted on the roof. The tanks for water and fuel oil are made of copper bearing steel plate. The water tank, with 80 Imp. gall. capacity, is located in the engine room. The piping is wrought iron, while in a few places copper is used.

The first of these cars to be completed was on display in Montreal during the American Railway Association Mechanical Division meetings early in June.



Truck of Six-cylinder Oil-electric Car, Canadian National Railway.

Canadian Railway and Marine World is indebted to C. E. Brooks, Chief of Motive Power, Canadian National Ry., for the information on which the foregoing article is based.

We are advised that it is the management's intention to operate one of the six-cylinder cars between Toronto, Hamilton and London. It will leave Hamilton in the morning, hauling a trailer, proceed to Toronto, and thence to London, via Stratford, and in the afternoon will run

July 1927

from London to Hamilton.

The two articulated 8-cylinder oil electric cars and the seven 60 ft. 4-cylinder ones, mentioned above, the routes and schedules of which were given in these columns as they were placed in service, made a total of 451,991 miles during 1926, for 238,676 miles of which trailers were hauled. Any mechanical troubles experienced were due more to the auxiliary equipment than to the oil engines themselves. While some trouble with the radiators in the engine cooling systems was experienced during the first winter that any of the cars were in operation, there was practically no such trouble in the winter of 1926-27. Engine cylinder bushing wear to date has been insignificant, and no trouble with bearings has been experienced. As was to be expected, a large problem in connection with these cars was that of adopting them into the railway organization, but this, by educational instruction and by training of men at the terminals into which the cars run, in regard to both mechanical and electrical details, has been largely solved.

Revenue earned by the 9 cars in 1926 is reported as $337,041.45, and operating expenses, including repairs and an allowance for mechanical department supervision, $127,421.73, leaving net earnings of $209,619.72. It is said that in the service between Edmonton, Alta., and Saskatoon, Sask., where 2 of the cars operated, the oil-electric operating cost as determined by selected accounts was 23c a train mile, compared with $1.01 a train mile for steam operation, the saving in operating expense as compared with steam train operation on the 120,087 miles operated on this run being given as $93,677. The oil-electric cars replaced 4 steam locomotives, the interest and depreciation on which alone was practically equal to that on the oil-electric cars. Operating revenues, expenses and statistics for the 9 cars, for 1926, are given in the table on the preceding page.

Hudson Bay Railway Surveys for Water Terminal.

The survey party sent last winter by the

Self-Propelled Cars on Steam Railways.

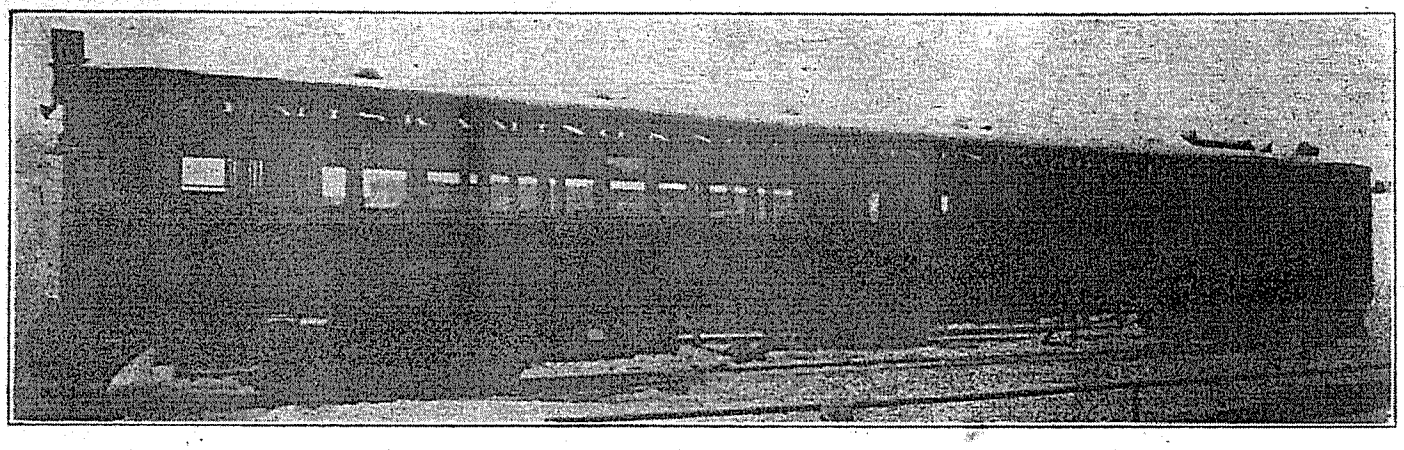
Great Northern Ry., U.S.A.—A Fernie, B.C., press dispatch states that the Great Northern Ry., in connection with the handling of passenger traffic over its Rexford Branch to Elko, and thence into Fernie over Canadian Pacific Ry. tracks, has placed in operation, as an experiment, a large gas-electric car with main passenger compartment and baggage room, and that if trials are successful, it will be retained in operation there permanently, displacing steam train equipment consisting of light locomotive and 2 cars.

Canadian National Ry.—A St. John, N.B., paper stated early in January that the C.N.R. management had placed in operation, between St. John and Hampton, a "new oil burning Diesel locomotive." Canadian Railway and Marine World's enquiry elicited official advice that the management had transferred oil-electric car 15,823, which had been in service on Prince Edward Island lines, to the Sussex and St. Martins subdivisions, Atlantic Region, where it is operating on the schedules of trains 131 and 136, between St. John and Hampton, and also, during the winter, as trains 49 and 50, between St. John and Moncton, on Sundays only, as follows:—lv. St. John 9.30 a.m., arr. Moncton 1 p.m.; lv. Moncton 4.45 p.m., arr. St. John 8 p.m.

A Montreal dispatch quotes Canadian National passenger department officials as stating that the railway is operating 30 self-propelled car services, with approximate annual mileage of 1,540,084, that placing in operation of additional cars now being built will increase this to about 1,935,220 miles a year, and that by the use of self-propelled cars, loss of short haul passenger traffic to buses and automobiles has been curbed considerably.

Premier Coates, of New Zealand, while in Montreal, on Jan. 12, displayed considerable interest in one of the Canadian

interior is finished in mahogany. The power plant consists of a gasoline engine, with cylinders 7¼ in. bore by 8 in. stroke, developing 250 h.p. at 1,100 r.p.m., direct connected to a Westinghouse type 176 160 k.w. self-ventilated generator with normal rating 500 volts. This supplies current to 2 Westinghouse 557-A-8 140 h.p. railway motors mounted on the leading truck. An auxiliary generator mounted on brackets is used to excite the field winding and supply auxiliary power to other circuits. Control is by manual operation of throttle lever, at each end of car. There are 16 windows on each side of car, having double sash. Seats are upholstered in Pantasote, and are reversible. On one side of the aisle, the seats hold 3 passengers each, and on the other side 2 each. All side windows are fitted with curtains. Interior lighting is provided by 39 lights with standard glass shades. A plow is attached at each end of car. The car exterior is finished in Pullman green, with gold lettering.



Gasoline-electric Self-Propelled Car, Timiskaming and Northern Ontario Railway.

The car was given a trial trip between Ottawa and Renfrew, leaving Ottawa at 10.15 a.m. and returning at 4.20 p.m., a maximum speed of 62 m.p.h. and an average speed over long intervals of 45 m.p.h. being reported. Among the party on the trip were S. B. Clement, Chief Engineer, T. and N.O.R.; W. H. McIntyre, Vice President and General Manager; L. D. Byce, Superintendent of Works; F. S. Beattie, Superintendent, Car Department, and J. R. Allan, of Sales Department, Ottawa Car Mfg. Co.; W. J. Warnick, Superintendent, Toronto, Hamilton and Buffalo Ry.; F. M. Donegan, Superintendent, Algoma Eastern Ry., and representatives of the Canadian National and Canadian Pacific Rys. Lt. Col. L. T. Martin, T. and N.O. Ry. Commissioner, and Mrs. Martin, accompanied the party on the return trip from Renfrew to Ott...

February 1927

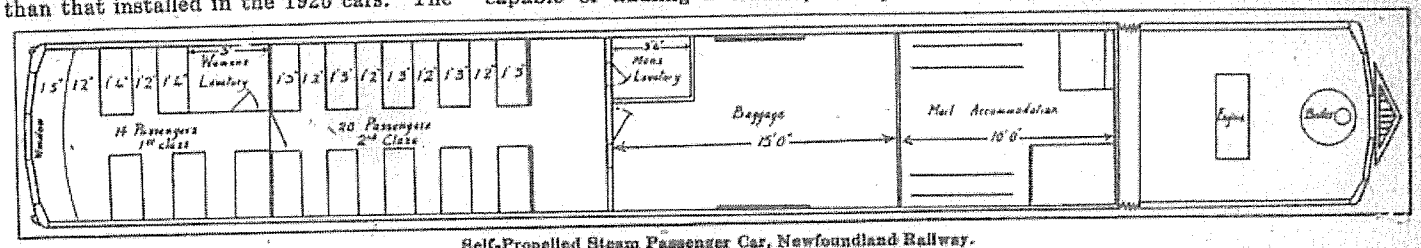
Self-Propelled Cars on Steam Railways.

Newfoundland Ry.—Canadian Railway and Marine World for July 1925, contained on pg. 335 an illustrated description of two Sentinel-Cammell steam driven self-propelled cars obtained in England for the Newfoundland Government Ry., now the Newfoundland Ry., the car body and running gear being built by Cammell, Laird and Co., Nottingham, and the power plant and control apparatus by Sentinel Wagon Works, London. The railway has, we are advised officially, placed an order recently with the Sentinel Wagon Works for 3 Sentinel-Cammell passenger cars to be used in branch line service. There will be numerous improvements in the new cars, and many features not included in those got in 1925. The new cars will be of the geared type, which includes a main frame with buffers mounted on two standard railway trucks, one of which is driven through a bevel gearing and flexible shaft by a 6-cylinder, single acting, horizontal engine. This engine consumes 18 lb. of steam per b.h.p. hr., and the boiler to supply the engine has 40% more capacity than that installed in the 1925 cars. The engine is supported in the underframe, and is much more accessible than those in the cars now in operation. As there will be no articulated joint between the power unit and the passenger unit of the car, all controls will be straight. Superior riding qualities are claimed for the new type of car.

The new cars will have the following dimensions:—length over all, 64 ft. 7 in.; wheelbase, 54 ft.; clear space between seats, 1 ft. 2 in.; width of baggage compartment doors, 4 ft. There will be a door at each side of the baggage compartment, and also a door at each side for passengers. The baggage compartment will be fitted for the carriage of both mails and baggage. The passenger space will be entirely cut off from the engine unit, but there will be complete access from the passenger space to the mail and baggage space, through doors in the centers of the partitions. The Two sets of firebars will be furnished with each car, one with ¾ in. and the other with 7/8 in. spacing. Coal and water capacity of the engine unit will be made as large as possible. Compared with the cars now in operation, the axle bearing size will be increased, and the spring buckles will be changed to make them more rigid. Edison batteries will be used on the new cars, reinforcing plates will be attached to the frames for use in jacking up the car bodies when necessary, and the equipment will probably include pop type safety valve and steam operated sanding apparatus. The cars will, in all probability, be given test runs on the London and North Eastern Ry., as soon as completed. While the builders think that delivery will not be possible before June, the railway management is endeavoring to have the cars delivered and in operation in the early spring.

Roberval and Saguenay Ry.—We are advised officially that the management has under consideration the acquirement of a 250 h.p. gas-electric self-propelled car, capable of hauling 2 trailers, to replace steam trains, with the object of improving service by providing more frequent trips between Arvida and Port Alfred, Que., 19 miles, making connection with all Canadian National Ry. (Jonquiere Subdivision, Saguenay Division, Quebec District) trains, and also for the convenience of persons travelling locally. The Roberval and Saguenay connects with the Canadian National at Arvida and Chicoutimi, which places are 6.4 miles apart on the Canadian National line.

Toronto, Hamilton and Buffalo Ry. received early in Dec. 1927 the 60 ft. steel self-propelled car, the order for which was dealt with in Canadian Railway and Marine World for Aug. 1927, pg. 472. It has capacity for 50 passengers, and is fitted with a 16 ft. baggage compartment. It was built by Canadian Car and Foundry Co., and the motive power consists of the Electro-Motive Co. 175 h.p. gas-electric instal-



Self-Propelled Steam Passenger Car, Newfoundland Railway.

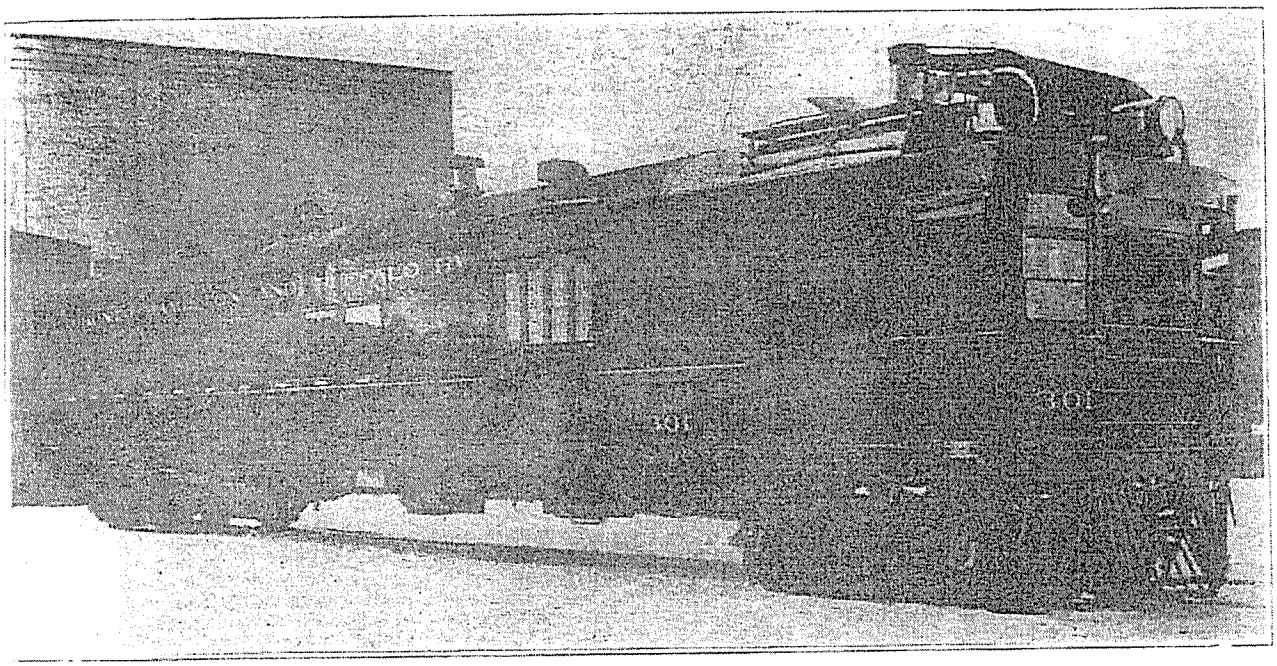
Canadian National Railway New Station for Hamilton.

A. E. Warren, General Manager, and T. T. Irving, Chief Engineer, Central Region, Canadian National Ry., had a conference with the Mayor of Hamilton, Ont., Dec. 13, 1927, in connection with the proposal to build an up-to-date station there and submitted plans and details. The Mayor is reported to have stated subsequently that the proposition made was the fulfilment of the promise given by Sir Henry Thornton that in the construction of stations in Ontario, Hamilton would have the first place. There will be many engineering problems to be worked out, but the railway engineers were prepared to meet the city's engineers and expected to have things straightened out so that a start could be made early in January. The new station will be built near the present one and will be on the east side of James St., extending easterly to John St., and southerly to near the Murray St. line. It will be on the street level, but the 8 tracks which will enter it will be maintained at their present level. The plans call for the closing of Stuart St. at James St., but the railway will open a road south of the station near Murray St. which will run from James St. to John St. The closing up of McNab, Hughson and Catharine Streets, or Mary St. as an alternative to the latter, is asked for. The railway has secured most of the land required and expropriation proceedings in respect to the remainder have been started.

Freight Car Condition and Supply.—The Railway Association of Canada reports that on Dec. 1, 1927, there were 201,884 freight cars on Canadian lines, compared with 200,238 on Nov. 1, 1927, of which 12,204, or 6.1%, were in bad order, compared with 12,576, or 6.2%, on Nov. 1, 1927, and that there were 5,354 surplus cars on hand, compared with 6,850. The American Railway Association's Car Service Division reports that on Nov. 15, 1927, there were 2,269,062 freight cars on U.S.A. class 1 lines, of which 137,374, or

Gas-Electric Self Propelled Car, Toronto, Hamilton & Buffalo Railway.

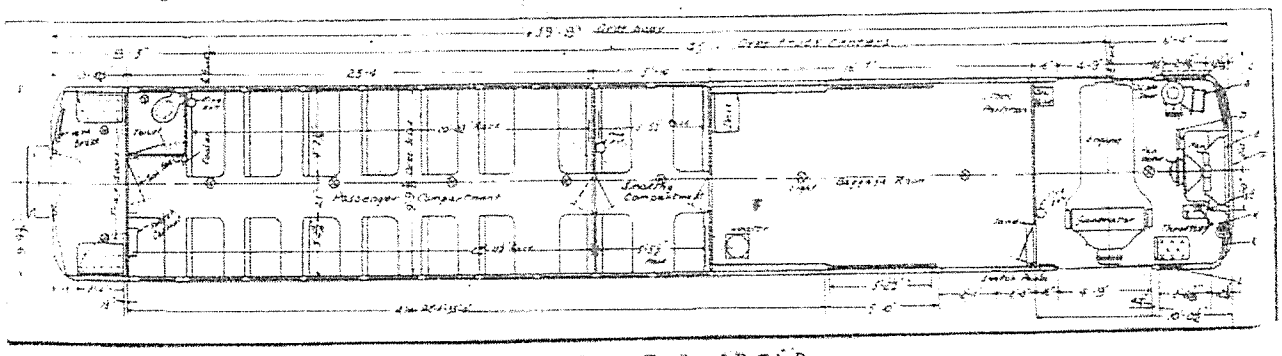
Toronto, Hamilton & Buffalo Ry. has added to its rolling stock a gas-electric self-propelled car, preliminary particulars of which were given in Canadian Railway and Marine World for January, and an illustration and floor plan of which are given herewith. It is 59 ft. 8 in. long over body, the distance between truck centers is 43 ft. 1 in., width over body, 9 ft. 9⅝ in., width over side sills 9 ft. 9⅜ in., and height of floor above rail 4 ft. 2½ in. The engine room and operating compartment, at the front, is 10 ft. 0½ in. long, the baggage compartment 16 ft. 7 in. long, the smoking compartment 5 ft. 10 in. long, and the main passenger room 23 ft. 4 in. long. The seating capacity is 37 in the main room and 10 in the smoking room, a total of 47, the transverse seats on one side of the aisle accommodating 3 passengers each, and those on the opposite side 2 each.



Gas Electric Car, Toronto, Hamilton & Buffalo Railway.

The car underframe is built up of 6 in. Z-bar center sills, 5 x 3 in. angle side sills, ¼ in. pressed steel diaphragm end sills with ¼ in. top cover and 5/16 in. bottom cover plates, and built up body bolsters. The side framing includes pressed steel side posts, 7 in. channel steel end posts, 2½ x 2¼ angle vestibule corner posts, 4 x ½ in. steel bar belt rail, and sheathing of blue annealed roller levelled copper bearing steel. The roof is of the plain arched design; over the passenger and baggage compartments it is of ½ in. x 2¼ in. face t. and g. poplar, canvas covered, and over the engine compartment it is of steel.

The power is supplied by a Winton 6 cylinder 275 h.p. gasoline engine, with cylinders 7½ x 8½ in. It turns over at 1,050 r.p.m. The electrical equipment consists of a General Electric Co. DT-507-B2 180 kw. generator with differential winding on the exciter, driven by the gasoline engine, 2 G.E.-292 450 v. motors, a CP-127 400-v. air compressor, with 25 cu. ft. displacement at 500 v., and a CY-99-B 7½ h.p. radiator fan motor. The generator has a continuous rating of 420 amps. at 440 v., based on 65 degrees C. rise by resistance. The exciter has approximately 4 kw. capacity at 60 v. The electrical equipment operates in a manner similar to that on the Canadian National Ry. 60 ft. oil-electric cars, except for the location of the differential field. The engine is started by 2 Leece-Neville Bendix starting motors, in addition to which there is compressed air starting mechanism, the air being supplied from the braking system main reservoir. The power plant is mounted crosswise of the car, with the generator directly behind the operator. The radiator cooling system is mounted at the front of the car, as on the gas-electric car acquired by the Grand Trunk Western Ry. a couple of years ago and described in Canadian Railway and Marine World at the time. The radiator fan motor, turning over at 1,800 r.p.m., built in behind the radiator, draws air through it and passes it upward and toward the rear of the car. The two traction motors have 52:19 gearing, and are rated at 150 h.p. each. The gearing is suitable for maximum operating speed of 60 m.p.h. The motors are self-ventilated. The hourly rating is 275 amps. at 450 volts, and continuous rating on shunt field is 210 amps. at 450 v. The motors weigh, complete with accessories, 4,600 lb. each. These motors are single turn machines with spring nose suspension. The air compressor and fan motor operate directly from the main generator voltage supply.



Gas Electric Car, Toronto, Hamilton & Buffalo Ry.

The letters on plan refer to equipment as follows: A, oil-cooling radiator under window; B, compressor; C, drop-sash window; D, hand brake, E, radiator; F, radiator shields; G, controller; H, brake valve; K, 3-piece windshield; L, slide and drop windows.

The leading truck, upon which the

Gas-Electric Car, Manitoba Power Co.

The Manitoba Power Co., a Winnipeg Electric Co. subsidiary, placed in operation this spring a Mack gas-electric car on its Winnipeg River Ry., between Lac du Bonnet and Great Falls, to provide for the rapidly increasing traffic between Lac du Bonnet and the electric plant at Great Falls, and the through traffic between Winnipeg and the Central Manitoba mining area. This car, known as type AS, has the following general dimensions:

Length, over body end sills	52 ft.
" smoking compartment	7 ft. 9 in.
" main passenger compartment	23 ft. 3 in.
" baggage compartment	10 ft.
" engine room	5 ft. 5 in.
Height, rail to roof	12 ft. 1 1/8 in.
" rail to floor	4 ft. 2 in.
" floor to ceiling	7 ft. 9 3/8 in.
Width, over eaves	10 ft.
" inside, over posts	9 ft. 10 in.
Weight, light	54,000 lb.
Distance between truck centers	35 ft. 6 in.
Power truck wheelbase	6 ft.
Idle truck wheelbase	6 ft.

The engine room is at the front of the car, followed by the baggage room, which contains folding seats for 6 passengers, baggageman's desk and rack, lockers, heater and coal box. Next is the smoking compartment, with 15 seats, then the main passenger compartment at the rear with 44 seats. The seats in the smoking and main passenger compartments are arranged transversely on each side of the central aisle, 3 on one side and 2 on the other.

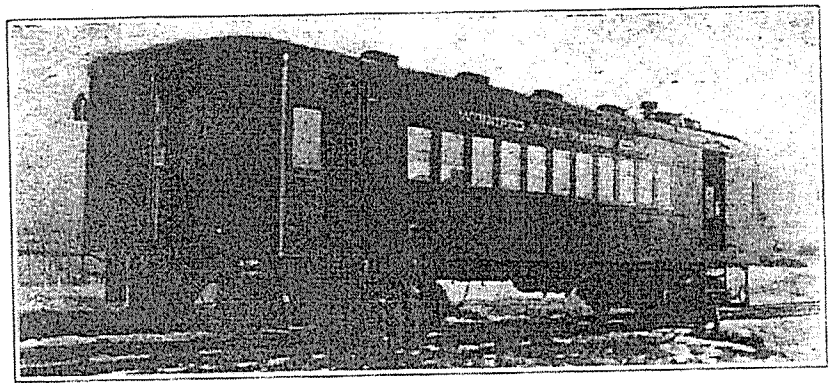
The leading truck, the power one, is equipped with 2 motors. The rear truck is an idler. The gasoline engine is a Mack model AP, 6 cylinders, 5 in. bore and 6 in. stroke, and piston displacement is 707 cu. in. It develops 120 h.p. at 1,350 r.p.m., the governed speed. Lubrication is by both splash and pressure systems. The pistons are of aluminum alloy, the wrist pins are 1 7/16 in. diam. and 4 1/2 in. long, the tubular connecting rods are drop forged and machined throughout, the crankshaft is 3 1/4 in. diam., drop forged, case-hardened and counterbalanced, there are 4 main bearings, with a total length of 11 15/16 in., and 4 camshaft bearings; the connecting rod bearings are 2 11/16 in. diam. and 3 in. long. The camshaft is forged and case-hardened, and has a valve lift of 7/16 in. Ignition is by high-tension standard magneto, and the lighting generator is 750-watt, 32-volt engine driven. The engine drives the air compressor, which has capacity of 12 cu. ft. free air per minute. The electric generator, driven by the engine, and generating electric current to supply the motors, is of 15-k.w. capacity, operating voltage being 650 and amperage 145. It is of the self-ventilated type, mounted on a bed plate common with the engine. The traction motors are of 60-h.p. capacity each.

The trucks are of the built-up type, as light as possible consistent with strength. Full elliptical springs are used on the swinging bolster and coil springs on the equalizer. The one-wear steel wheels are 30 in. diam., and turned to standard flange and tread. The motors on the power truck, inside hung, are suspended by patented Mack rubber shock insulators which eliminate the usual coil springs. Journals are 4 1/4 x 8 in. Brakes are inside hung M.C.B. standard.

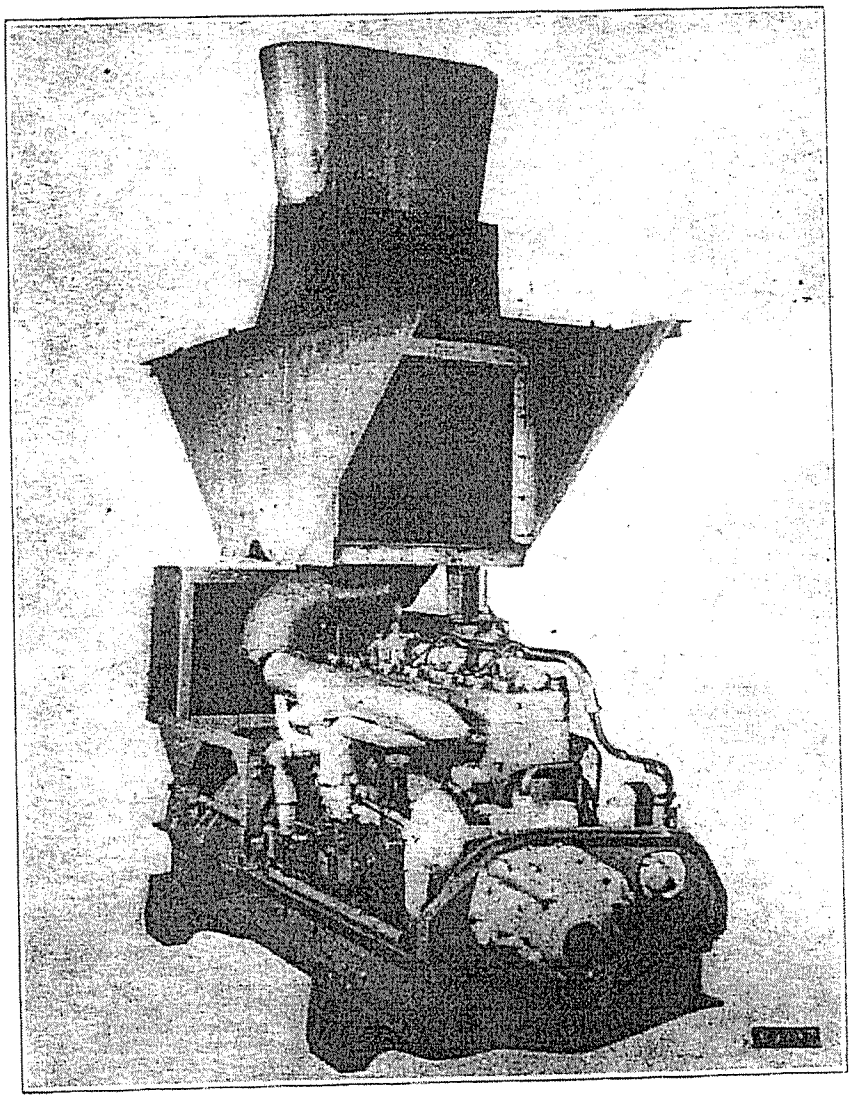
In the body construction, aluminum has been used freely wherever possible, to secure lightness by employing it without sacrifice of strength. All windows are provided with curtains, seats in the smoking compartment are of imitation leather and in the main passenger compartment are plush covered. There are two lavatories in the rear vestibule. Gasoline tankage is 175 gall.

Equipment includes locomotive type bell, air whistle, air signal whistle, conductor's valve, 250-watt headlight, oil and electric marker lamps, A.R.A. couplers, air sanders, hot water heating system, and hand brake at both ends. The car will operate on curves with minimum radius 200 ft.

The operator's position is on the right side of the car, with the brake valve on his right and the locomotive type controller on his left. The controller is for engine



Gasoline-electric self-propelled car, Manitoba Power Co's Winnipeg River Ry.



Power plant, gasoline-electric self-propelled car, including engine, generator, control, cooling system, etc.

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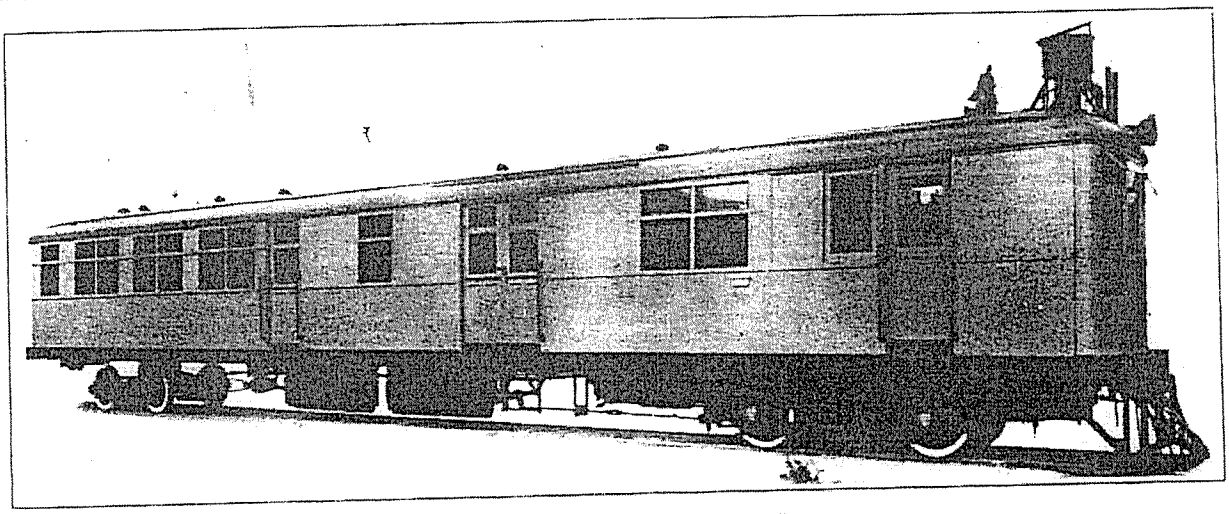
World for August, pg. 477. One of the cars was given a test run on Aug. 29 on the Trepassey Branch, from St. John's to Trepassey and return, the one way distance being 106.63 miles. The car left St. John's at 7.27 a.m., and arrived at Trepassey at 1.32 p.m. the elapsed time being 6 hours 5 mins. The lost time, not including station stops, was 47 minutes, and station stops took 19 minutes, making the running time 5 hours and the average speed 21 m.p.h. On the return trip, Trepassey was left at 3.01 p.m., St. John's being reached at 8.30 p.m. The lost time on the return run, not including station stops, was 38 minutes, and station stops took 13 minutes, making the actual running time 4 hours 38 minutes, and the average speed 24.75 m.p.h. Much of the lost time was caused by having to syphon water, for 16, 23 and 25 minutes respectively. For the round trip, the average one-way running time was 4 hours, 50 minutes, and the average speed 23 m.p.h. The steam pressure, throughout the run, varied from 280 to 300 lb. The coal consumption for the 213 miles was 2,388 lb., an average of 11.21 lb. per mile, this consumption also including the 1½ hr. stop at Trepassey. The amount of coal used in lighting up was 376 lb. The fire was maintained for 15 hours without cleaning it. It was found that the water tank holds enough

October 1938

Railway Rolling Stock Orders and Deliveries.

British Empire Steel Corporation has received one 2-6-0 locomotive, with cylinders 19 x 26 in., from Montreal Locomotive works.

Canadian National Ry.—Sir Henry Thornton, Chairman and President, was reported in a New York press dispatch to have stated there, just before sailing for England, that the C.N.R.'s next rolling stock order would amount probably to from $10,000,000 to $15,000,000; also that the railway's passenger equipment appears to be adequate for present needs, unless the success of the Diesel electric passenger cars on the company's lines might lead to an increase in their use. Canadian Railway and Marine World was advised officially Sept. 8, that the C.N.R. had inquiries out for 55 locomotives, viz., 20 Northern, 15 Santa Fe, and 20 switchers, and that the car equipment programme was also under consideration.



Self Propelled Steam Rail Car, Newfoundland Railway.

Canadian Railway and Marine World was advised officially Sept. 26 that the C.N.R. had given orders for locomotives as follows:—To Montreal Locomotive Works, 20 Northern 4-8-4 type for freight and passenger service, to be of the same general design as the 6100 class now in use on main line passenger and freight service, which type is designed for long distance service and has proved entirely satisfactory under diverse conditions; also ten 0-8-0 switching locomotives. To Canadian Locomotive Co., 15 Santa Fe 2-10-2 type and ten 0-8-0 switchers. The C.N.R. has also made enquiries for 5 locomotives of a modified design from the mountain type used on main line passenger and freight service.

The C.N.R. has made enquiries for 1,500 50-ton box cars, 30 tank cars, 15 standard sleeping cars, 25 first-class cars, and 2 combination baggage and smoking cars. It is expected to invite tenders for additional passenger and freight car equipment at an early date.

Canadian National Ry. has ordered 15 Hart convertible ballast cars from Canadian Car & Foundry Co.

Canadian National Ry. has received deliveries of this year's rolling stock orders as follows:—two 7-compartment library observation cars, Canadian Car & Foundry Co., completed; 5 cafe parlor cars, Canadian Car & Foundry Co., 4 delivered; 20 colonist cars, National Steel Car Corporation, 10 delivered; 30 ballast cars, National Steel Car Corporation, completed.

The Canadian National is adding 10 Santa Fe locomotives to the equipment of its Saguenay Division, Quebec District, on account of the heavy grades. This releases a similar number of lighter locomotives, which have been sent to the Western Region to aid in hauling this season's grain crop.

Canadian Pacific Ry. had built at its Angus shops, Montreal, recently, from designs by its Motive Power and Rolling Stock Department, an all-steel dynamometer car, thoroughly modern in all details of construction and equipment, a well equipped kitchen being included in the layout. Communication between the operator at the chronograph table and the one in the locomotive cab is maintained by apparatus similar to that used in airplanes. One of the first tests in which the car will be used, it is reported, will be that of the K-1-a class passenger locomotives described and illustrated elsewhere in this issue.

Canadian Railway and Marine World for September, in referring on pg. 530, to the two large passenger locomotives built by Canadian Pacific Ry. in its Angus shops, Montreal, stated that they are of the 4-6-4 type. This was an error, as they are of the 4-8-4 type. The information on which the statement that they are of the 4-6-4 type was based was contained in a Montreal press report which there was not time to verify before going to press. So far as we are aware, there are no 4-6-4 locomotives in operation in Canada, although the New York Central Rd. has a large number of them, designated as the Hudson type, in passenger service.

Canadian Pacific Ry. has received from Montreal Locomotive Works, the first of an order of 25 freight locomotives of the 5300 class, duplicating an order filled in 1926. These were the first locomotives to be put into service in Canada of a boiler pressure as high as 250 lb. per sq. in. The balance of the new locomotives will be delivered at the rate of two or three a week.

Canadian Pacific Ry. has received one K.1 locomotive, no. 3100, built at Angus shops, Montreal; one P-2-f (2-8-2) locomotive, with cylinders 23 x 23 in., built by Montreal Locomotive Works; 4 double track steel snow plows; and 2 single track steel snow plows, built at Angus shops.

Canadian Pacific Ry. has built a school car at its Angus shops, Montreal, similar to one built a few years ago.

Lamoreux-Kelly, Limited, Montreal, is having 25 four-yard hand dump cars built by National Steel Car Corporation, 6 of which have been shipped to Foundation Company of Canada, at Rapid Falls, N.S.

Newfoundland Ry.—The three 35-passenger steam driven self-propelled cars ordered by Newfoundland Ry., with bodies and running gear to be built by Cammell, Laird and Co., Nottingham, England, and the power plants and control apparatus by Sentinel Wagon Works, London, Eng., were delivered in the latter part of August. A detailed description of the car, with plans, was given in Canadian Railway and Marine World for August, pg. 477. One of the cars was given a test run on Aug. 29 on the Trepassey Branch, from St. John's to Trepassey and return, the one way distance being 106.63 miles. The car left St. John's at 7.27 a.m., and arrived at Trepassey at 1.32 p.m. the elapsed time being 6 hours 5 mins. The lost time, not including station stops, was 47 minutes, and station stops took 19 minutes, making the running time 5 hours and the average speed 21 m.p.h. On the return trip, Trepassey was left at 3.01 p.m., St. John's being reached at 8.30 p.m. The lost time on the return run, not including station stops, was 38 minutes, and station stops took 13 minutes, making the actual running time 4 hours 38 minutes, and the average speed 24.75 m.p.h. Much of the lost time was caused by having to syphon water, for 16, 23 and 25 minutes respectively. For the round trip, the average one-way running time was 4 hours, 50 minutes, and the average speed 23 m.p.h. The steam pressure, throughout the run, varied from 280 to 300 lb. The coal consumption for the 213 miles was 2,388 lb., an average of 11.21 lb. per mile, this consumption also including the 1½ hr. stop at Trepassey. The amount of coal used in lighting up was 376 lb. The fire was maintained for 15 hours without cleaning it. It was found that the water tank holds enough

December 1928

We were advised officially on Nov. 7, that the Canadian National Ry. was operating self-propelled cars as follows:—

Atlantic Region.—Car 15,823, hauling trailer 15,754, on assigned run no. 1, runs as trains 205 and 206 between Charlottetown and Tignish, P.E.I., 115.2 miles, one round trip a day, making 1,380 miles a week.—Car 15,798, without trailer, on assigned run 2, runs between Lunenburg and Mahone Bay, N.S., 7 miles, 4 round trips a day, making 336 miles a week.—Car 15,802, hauling trailer 15,758, on run 3, runs between Halifax and Windsor Jct., N.S., 15.9 miles, as trains 173, 174, 175, 176, 177 and 178, 3 round trips a day, making 570 miles a week.—Car 15,809, without trailer, on run 4, runs as trains 231, 232, 233 and 234, between Stellarton and Sunny Brae, N.S., 16.2 miles, 2 round trips a day, making 390 miles a week.—Car 15,821, hauling trailer 15,755 when required, between Londonderry and Truro only, on run 5, operates as train 296 between Oxford Jct. and Truro, N.S., 46.7 miles, as train 17 between Truro and Sackville, N.B., 86.6 miles, and as train 18 between Sackville and Oxford Jct., N.S., 39.9 miles, making 1,038 miles a week.—Car 15,811, hauling trailer 15,752, on run 6, operates between Stanley and Stanley Jct., N.B., 5.4 miles, 2 round trips a day, making 126 miles a week.—Car 15,792, hauling trailer 15,757, on run 7, operates between Bathurst and Campbellton, N.B., 63 miles, as trains 329 and 330, one round trip a day, making 756 miles a week.—Car 15,793, without trailer, on run 8, operates between Campbellton, N.B. and Matapedia, Que., 12.8 miles, 2 round trips a day, making 306 miles a week.—Car 15,822, without trailer, on run 9, operates between Moncton, N.B. and Springhill Jct., N.S., 65.2 miles, as trains 19 and 20, one round trip a day, making 780 miles a week

December 1928

Self-Propelled

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December 1928

Self-Propelled Car Operation, Canadian National Railway.

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Central Region.—Car 15,820, hauling trailer 15,738, on assigned run 15, operates between Lyster and Richmond, Que., 59.5 miles, as train 687; between Richmond and Sherbrooke, 24.6 miles, as train 602; between Sherbrooke and Richmond as train 603; between Richmond and Coaticook, 46.1 miles, as train 604; between Coaticook and Richmond as train 605; and between Richmond and Lyster as train 688; making 1,560 miles a week.—Car 15,819, hauling trailer 15,744, on run 16, operates between Sherbrooke and Richmond, Que., 24.6 miles, as train 601; between Richmond and Quebec, 102.3 miles, as train 684; between Quebec and Richmond as train 683; and between Richmond and Sherbrooke as train 606; making 1,524 miles a week.—Car 15,824, hauling trailer 15,739, on run 17, operates between Montreal and Waterloo, Que., 69.4 miles, as trains 609 and 610, making 834 miles a week.—Car 15,825, hauling trailer 15,742, on run 18, operates as trains 614, 613, 630 and 635 between Coteau and Cantic, Que., 46.7 miles, 2 round trips a day, and between Coteau and Valleyfield, 5.3 miles, 4 round trips a day and 5 on Sundays, making 1,421 miles a week.—Cars 15,903 and 15,904, hauling trailers as required, on run 19, operates on various trips between Montreal and Cartierville.—Car 15,826, hauling trailer 15,743, on run 20, operates between Montreal and Ottawa, via Coteau, 116.2 miles, as trains 615 and 616, one 15,828, without trailer, on run 22, operates as trains 611 and 612, between Ottawa and Pembroke, Ont., 89.6 miles, one round trip a day, making 1,074 miles a week.—Car 15,808, without trailer, on run 23, operates between Brockville and Westport, Ont., 44.4 miles, as trains 677, 678, 679 and 680, 2 round trips a day, making 1,068 miles a week.—Car 15,817, hauling mail and express car 7,619 between Tweed and Napanee, Ont., on trains 690 and 691, and between Napanee and Tweed on trains 696 and 697, on run 24, operates as trains 690, 691, 692, 695, 696 and 697, between Kingston and Tweed, Ont., 75 miles, making 900 miles a week.—Car 15,794, hauling baggage car 8456, on run 25, operates as trains 671 and 672 between Brockville and Belleville, Ont., 95 miles, one round trip a day, making 1,140 miles a week.—Car 15,797, hauling trailer 15,753, on run 26, operates as trains 605 and 606, and 609 and 610, between Toronto and Weston, 9.4 miles, making 2 round trips a day on all days of the week except Saturday and Sunday, and one round trip on Saturday, and making 204 miles a week.—Car 15,830, hauling trailer 15,745 between Hamilton, Ont., Toronto and Guelph, or Stratford, as required, and mail car 9,511 between London and Hamilton, on run 27, operates between Hamilton and Merritton, 34.2 miles, as train 600, between Merritton and Hamilton as train 601, between Hamilton and Toronto, 38.7 miles, as train 602, between Toronto and London, 121 miles, as train 603, and between London and Hamilton, 79.4 miles, as train 604, making 1,842 miles a week.—Car 15,795, without trailer, on run 28, operates between Black Rock and Bridgeburg, Ont., 0.8 mile, 10 round trips a day except on Saturday, when it makes 12 round trips a day, and some trips on Sundays, making 117 miles a week.—Car 15,814, without trailer, on run 29, operates on Tuesdays, Thursdays and Saturdays between Capreol and South Parry, Ont., 140 miles, as train 618, and, on Mondays, Wednesdays and Fridays, between South Parry and Capreol, as train 617, making 840 miles a week.—Car 15,796, on run 30, operates as trains 689 and 690 between Ste. Rosalie and Nicolet, Que., 59.6 miles, one round trip a day, making 715 miles a week.

Western Region.—Car 15,800, hauling trailers 15,756 and 15,769, on run 39, operates between Winnipeg and Transcona, 9 miles, 9 round trips a day, making, with some Sunday operation, 1,071 miles a week.—Car 15,807, without trailer, on run 41, operates between Victoria and Youbou, B.C., 83 miles, as trains 391 and 392, one round trip a day, making 996 miles a week.—Car 15,827, with trailer 14,740, on run 42, operates on Mondays, Wednesdays and Fridays as train 71 between Regina, Sask. and Saskatoon, via Dunblane, 220.2 miles, and on Tuesdays, Thursdays and Saturdays, as train 72, between Saskatoon and Regina, via Dunblane, making 1,320 miles a week.—Car 15,829, without trailer, on run 44, operates as train 31 from Somerset to Winnipeg, 102 miles, as train 56 from Somerset to Winnipeg, and as train 32 from Winnipeg to Somerset, making 1,020 miles a week.

Grand Trunk Western Region.—Car 16,805, without trailer, on run 50, operates as trains 46 and 47 between Richmond and Jackson, Mich., 105.6 miles, one round trip a day, making 1,266 miles a week.

The total of motor cars miles per week-day is 4,578, and the total of motor car miles per week, excluding that of the multiple unit cars between Montreal and Cartierville, is 27,353. The cars operate on week days only, unless otherwise specified.

Types of Cars.—The following are storage battery cars:—15,792; 15,793; 15,795; 15,796; 15,798; 15,799; 15,800; 15,801; 15,802. At the time of our advice, car 15,799 was in the Montreal shops, and car 15,801 was being held at Montreal as a spare.—The following are gasoline-electric cars:—15,794; 15,797; 15,805.—The following are gasoline driven cars, with mechanical drive:—15,700 and 15,701, in company service between Kamloops and Kamloops Jct., B.C.; 15,702, in company service at Port Arthur, Ont.; 15,703, used as an inspection car by A. E. Warren, General Manager, Central Region; 15,807; 15,808; 15,809; 15,810, held as a spare at Victoria, B.C.; 15,811; 15,812, held as a spare at Port Mann, B.C.; 15,813, in company service between Kamloops and Kamloops Jct., B.C.; 15,814; 15,815, held as a spare at Stellarton, N.S., and 15,816, held as a spare at Brockville, Ont.—The following are oil-electric cars:—15,817 and 15,818 fitted with 8-cylinder engines; 7 cars, 15,819 to 15,825 inclusive, fitted with 4-cylinder engines, and 5 cars, 15,826 to 15,830 inclusive, fitted with 6-cylinder engines.—There are 2 steam driven cars, 15,900, held as a spare at Bridgeburg, and 15,901, held as a spare at Toronto.—There are 2 multiple unit cars, 15,903 and 15,904, operating between Montreal and Cartierville.

December 1928

Peacock geared hand brakes applied to the latter cars have hand wheels instead of the Miner operating attachment.

The interior finish of the sleeping cars is in mahogany. The men's washing room and lavatory facilities are at the A end of the car, adjacent to the berth sections, and the drawing room, compartments and women's lavatory facilities are toward the B end. Permanent headboards are arranged between the berth sections, and intercommunicating doors are installed between the drawing room and the adjacent compartment, and between the two compartments, so that any two of these rooms, or all three of them, may be taken en suite. The drawing room and the compartments are each fitted with independent heat control.

The women's washing room is equipped very completely, the floor being carpeted, 3 large and comfortable upholstered chairs being installed, and the fittings including wall type electric fixtures, 3 wash bowls with dental faucets integral, curtains of dark brown material, one large and 3 wing mirrors, a mirror 15 x 60 in. on outside of toilet door, cup dispenser, water cooler, brush and comb rack, used drinking cup and used towel holders, towel racks, etc.

The compartment floors are carpeted, the seats and chairs are upholstered in decorative material. The drawing room is treated similarly, and is fitted in addition with a sofa which makes up into a comfortable bed. Each of these rooms has its own lavatory facilities, the hoppers in the compartments being concealed under seats, and the drawing room having connecting washing room and lavatory. Lockers for employes' clothing and for linen are located as shown on the plan. The compartments and drawing room are each equipped with a boot cabinet opening into the aisle. Carpet is laid throughout the car from the aisle door adjacent to the men's washing room to the aisle door adjacent to the women's washing room, in addition to the compartments and drawing room; the men's washing room and the aisle ends have inlaid rubber on the floor. Each compartment and the drawing room are equipped with an electric fan, and all equipment throughout the car is of the most modern character.

The 29 new cars of this type have been named Rapid City, Rathwell, Ravenscrag, Raymond, Redcliff, Red Deer, Redvers, Regent, Regina, Renfrew, Rennie, Renown, Reston, Revelstoke, Richford, Riverton, Roblindale, Rocanville, Romford, Rosemary, Rosemere, Rosenfeld, Rosetown, Rosser, Rossland, Rossport, Ruby Creek, Ruskin and Rutherglen.

The dining cars are the same length inside coupler knuckles as the solarium lounge cars and sleeping cars, viz., 83 ft. 10½ in., but are 80 ft. 7 in. over end frames and have truck centers at 59 ft. Width over girder plates is 9 ft. 10 5/8 in., and width between post furrings is 9 ft. 2 in. The main room is 38 ft. 1¾ in. long; the kitchen and pantry combined are 27¼ ft. long. These cars have the same type of exhaust ventilation as the solarium lounge cars, one exhaust fan serving the kitchen and 2 the dining room. The interior finish is the same type of handsome inlaid walnut as used in the solarium lounge cars.

At the dining car B end, there is a crew's locker at the right. The auxiliary heater cabinet and steward's compartment are laid out so as to make a very short aisle which opens directly into the dining room. At the right of the aisle, looking toward the A end, are a sideboard, silver cabinet, mineral water locker, ice chamber, sink, etc. The car is arranged with walnut tables for 2 along one side and similar tables for 4 along the other, there being 6 tables of each type, making the total seating capacity 36. The floor is heavily carpeted, the pattern being a very decorative one, and the chairs are upholstered in blue leather. The silk faced Pantasote window shades are also blue. The windows are not so large as in some of the company's older dining car equipment. There are 3 fandoliers along the ceiling center line, and electric wall fixtures along each side of the car, with goatskin shades. All the metal trim is bronze. Each car carries 2 fire extinguishers. Proceeding toward the A end from the dining room, the aisle runs to the right. Adjoining the dining room partition, is a locker for soiled linen at one side of the door, and a switch locker and a locker for clean linen at the other. In line with the door, and adjoining the kitchen partition, as shown on the plan, is a large sideboard, with drawers and compartments for silver, etc. To the left of this, looking toward the A end, is a vertical steel rolling door, which effectively shuts off the kitchen portion of the car from the dining room, and which may be locked securely.

The kitchen and pantry equipment is of most modern type, laid out so as to afford the greatest possible facility in the preparation and serving of food, and shows a great deal of careful thought and painstaking effort in design. Monel metal is much in evidence, presenting surfaces which are clean and which may be easily kept so. All pastry served on the cars will be made on them, and only hard coal and charcoal will be used for cooking. Cooking ranges are of Prowse 601 type. Large water tanks are located under the car roof in the kitchen section, and water may be piped from the tanks under the car floor to these tanks if the necessity arises while the car is on the road. Refrigerators are iced from the roof, and an efficient ventilation system ensures ideal working conditions for the cook and his assistants. Each car will carry a crew of 11, viz., steward, cook, second, third and fourth cooks, pantryman, and 5 waiters. The crew will sleep in the berths in the combined baggage and sleeping cars.

The combined baggage and sleeping cars are, like the others, 83 ft. 10½ in. long inside coupler knuckles, length over end frames being 80 ft. 7 in. and distance between truck centers being 59 ft. Width between post furrings is 9 ft. 1¼ in. in the baggage section and 9 ft. 2 in. in the sleeping section. The baggage space, 45½ ft. long, is at the A end of the car, and the sleeping accommodation, men's washing room, etc., are toward the B end. The baggage room floor is fitted with floor racks, and the room is fitted with Utility ventilators. The floor in the sleeping section and the men's washing room is covered with linoleum, with carpet aisle strip in the sleeping section. The interior finish in the sleeping section and washing room is in mahogany, and the sofa and seat in the washing room are upholstered in leather. Equipment and furnishings in the sleeping section are of the same high standard as in the sleeping cars described above. The sleeping section may be used by passengers during the day.

The equipment described in the foregoing attracted a great deal of attention in the cities where it was placed on exhibition, on account of its thoroughly modern character, the comfort and luxury provided, the completeness and convenient arrangement of all appointments, and the beauty of the car interiors. The skill and thoroughness evidenced throughout, in both design and workmanship, formed the subject of much deservedly favorable comment. A thing worthy of special mention on all cars, but especially on the sleepers, is the application of large size Globe ventilators on the center line of car which not only takes the warm air from the highest point in the car but makes the ventilators operate successfully regardless of wind direction.

JUNE 1929

Self Propelled Cars on Steam Railways.

Canadian National Rys. has received two Brill model 55 gasoline self propelled cars, one of which has been placed in service on the Western Region between Neepawa and Beulah, Man., and the other on the Central Region, serving former Quebec, Montreal and Southern Ry. points. The car on the Western Region runs from Neepawa to Hallboro, 6.2 miles, on the Neepawa Subdivision, and from Hallboro to Beulah, 74.4 miles, on the Rapid City Subdivision, Brandon Division, Manitoba District, its one-way run being 80.6 miles. It leaves Beulah on Tuesdays, Thursdays and Saturdays at 7 a.m., arriving at Neepawa at 11.55 a.m., and leaves Neepawa on Mondays, Wednesdays and Fridays, at 1.30 p.m., arriving at 6.35 p.m. It is operated in place of a mixed train service given previously.

The other car makes a round trip daily except Sunday between Noyan, on the Iberville Subdivision, Portland Division, Montreal District, and Sorel, on the Sorel Subdivision, Levis Division, Quebec District, proceeding from Noyan to Sorel via St. Hyacinthe and Bellevue Jct., the one-way trip being 86.04 miles. Before the Quebec, Montreal & Southern Ry. was taken over by the Canadian National, the line between Noyan and Bellevue Jct. was known as the Southern Division, and that between St. Lambert and Fortierville (on which Sorel is located, being 44.51 miles from St. Lambert) was known as the Shore Division. The car leaves Noyan at 6.10 a.m., arrives at St. Hyacinthe at 9 a.m., leaves St. Hyacinthe at 9.15 a.m., and arrives at Sorel at 11.30 a.m. Returning, it leaves Sorel at 3.45 p.m., arrives at St. Hyacinthe at 5.50 p.m., leaves St. Hyacinthe at 6.15 p.m., and arrives at Noyan at 9 p.m. It was placed in service to provide passenger accommodation in connection with a readjustment in the routing of traffic following the taking over of the Q.M. & S.R. by the Canadian National.

Both of the cars are 43 ft. 10⅝ in. long over all, 41 ft. 10 1/16 in. long over vestibules, 43 ft. 2 15/16 in. long over end sills, 10 ft. 5 9/16 in. high from rail to top of roof, 11 ft. 7 9/16 in. high over all, 9 ft. 4 in. wide over steps, and 8 ft. 4 in. wide over posts. Wheelbase is 6 ft. 8 in., and distance between truck centers is 22 ft. 2 in. Each car is divided into an engine and baggage compartment at the front, 11 ft. 10 1/16 in. long, and a main passenger compartment, 26 ft. 1 13/16 in. long, the latter being fitted with 19 transverse seats, arranged on each side of a central aisle and upholstered in leather, providing seating accommodation for 38 passengers. In addition, there are 2 folding seats in the baggage compartment, providing accommodation for 4 additional passengers. The baggage compartment is fitted with sliding side doors, with 3½ ft. door opening, and contains a heater and coal box. A lavatory is provided at the rear of the passenger compartment.

The cars are of the mechanical drive type, the drive being through a multiple dry disc clutch and transmission mounted as a unit with the engine, through an auxiliary transmission in the cast steel swing bolster of the leading truck, and finally through one drive shaft to each axle of the leading truck. This combination provides 6 speeds forward and 3 in reverse. The power plant is a heavy duty Hall-Scott 6-cylinder gasoline engine with cylinders 4¼ in. bore and 5½ in. stroke, developing, at maximum speed of 1,800 r.p.m., 92 h.p. It is equipped with overhead valves operated by an overhead camshaft, and has two carburetors. The cars are equipped with Westinghouseair brakes, and hand brake of the vertical shaft drop-handle type.

Freight Car Location Statistics.—The Railway Association of Canada reports location of freight cars on Nov. 1, based on returns from Algoma Central and Hudson Bay, Canadian National, Canadian Pacific, Dominion Atlantic, Kettle Valley, North-

December 1929

Self Propelled Cars on Steam Railways.

The two gasoline self propelled cars bought by Canadian National Rys., one for operation between Neepawa and Beulah, Man., in the Manitoba District, and the other between Noyan and Sorel, in the Montreal and Quebec Districts respectively, were described briefly in Canadian Railway and Marine World for Dec. 1929, pg. 758. As there stated, the cars are of the mechanical drive type, and each is divided into an engine and baggage compartment at the front, 11 ft. 10 1/16 in. long, and a main passenger compartment, 26 ft. 1 13/16 in. long. Additional information in regard to them is as follows:—Length over all 43 ft. 10 5/8 in.; length over end sills 43 ft. 2 15/16 in.; length over vestibules 41 ft. 10 1/16 in.; distance between truck centers 22 ft. 2 in. Width over steps 9 ft. 4 in.; width over posts 8 ft. 4 in. Height from rail over smoke jacks 11 ft. 7 9/16 in.; height from rail to top of car 10 ft. 5 9/16 in. Seating capacity in the main compartment, 38, and in baggage and engine compartment, 4. The baggage and engine compartment is fitted with sliding doors. There are 3 windows in the front of the car, and 11 at each side. The seats are upholstered in imitation leather. The front truck is the Brill 81-M type, and the rear truck the 81-T type, truck wheelbase in each case is 6 ft. 8 in., and total wheelbase of car 28 ft. 10 in. The axles, of alloy steel, are 3 in. diam.; the wheels are steel tired and 30 in. diam. Springs are semi-elliptic type, 44 x 3 in. The journal bearings are of the Timken taper roller inboard type. Air brakes are of the Westinghouse semi-automatic type; a Brill hand brake with Dayton drop handle is fitted at each end of car.

The drive from the engine is through a multiple dry disc clutch and transmission mounted as a unit with the engine, through an auxiliary transmission in the cast steel swing bolster of the leading truck, and finally through one drive shaft to each axle of the leading truck. This provides 6 speeds forward and 3 in reverse. The engine is a 4-cycle 6-cylinder one, with overhead valves, and with cylinders 4¼ in. diam. by 5½ in. stroke, developing, at speeds of from 800 to 1,800 r.p.m., 44 to 90 h.p. The cooling system includes a chain driven fan and water pump, the fan being 21½ in. diam. The carburetor is of the Zenith non-adjustable plain tube type. Gear ratios are:—1st, 4:1; 2nd, 1.76:1; 3rd, direct. The electrical equipment includes Delco lighting, starting and ignition system, 12-volt engine-driven generator, and 160 amp. hr. storage battery. The gasoline tank is of 65 gall. capacity. Other equipment includes Westinghouse DHB-10 air compressor, Golden Glow headlight, combination oil and electric marker lamps, Westinghouse simplex pneuphonic air operated horn, Brill signal system including bronze bell with cord, hand operated Brill sanders on driving truck, hot water heating system, and Brill exhaust ventilators.

January 1930

Rys express and trucking area at the west end of the station layout, 4 in the baggage area (the baggage room being in the west end of the concourse, below the tracks), 3 serving the postal wing at the east end, and 3 serving the Canadian Pacific Express Co. express and trucking area. There are 2 elevators in platform 1 and 4 each in platforms 2, 3 and 4. In addition, there are 2 elevators serving the Canadian Pacific Express Co. facilities proper.

The station tracks, in the concourse and trainshed area, have slight curves, to accommodate varying platform widths. The platforms vary in width from 13 ft. to 18½ ft. widening out at the elevator openings, this being necessary to permit the operation of trucks past the elevator housings. The trainshed overhead clearance is 17¼ ft. from top of rail to bottom edge of smoke duct. In the southerly portion of the shed, to be erected after the southerly extension of the concourse is built, the span over tracks 7 and 8 and that over tracks 9 and 10 will be the same as that over tracks 5 and 6, viz., 51 ft. 5½ in., and will not vary throughout the length of the shed.

One of the most outstanding features of the trainshed is the lighting scheme which has been employed. Many train sheds have long been identified in the public mind as dark, gloomy, cavernous places, but this one furnishes a startling exception. There are 720 electric lighting outlets in the portion now built, this figure not including additional ones along the station tracks beyond the shed's east and west extremities. Instead of using the ordinary reflectors which have been employed formerly in lighting structures of this character, and which cast all light downward and leave upper and side places comparatively dark, Holophane units, which diffuse the light in all directions, have been used. In the spring, the whole interior of the structure will be painted with aluminum paint, which will undoubtedly increase the intensity of illumination and make the interior even brighter than it is now. The lamps used are 100-watt, and are arranged in two circuits, the idea being to promote economy in current consumption, there being many periods when half the lamps suffice to illuminate the structure, and to ensure that some light will be available in case of the failure of either circuit. The lamps are controlled by remote switches, placed at the top of the exit stairs and at the foot of the entrance stairs connecting the platforms with the concourse interior. The lighting units have been placed at a height which experiment proved the most suitable for best illumination of track platforms, and the interior generally. The current supplied is 115 volts, 25 cycle, it being stepped down from 13,200 volt a.c. in the station transformer room in the concourse sub-basement.

A temporary wooden wall has been provided at the south side of the trainshed, and will remain until the southerly extensions of the concourse and trainshed are built. Preparations for going ahead with the southerly extension of the concourse are being made.

The trainshed was built under contract from the Toronto Terminals Ry. Co. by P. Lyall and Sons Construction Co., the work being done under the supervision of the latter company's liquidator. The steel was supplied and erected under contract from Toronto Terminals Ry. Co. The roof was built by W. Moffatt, Toronto, under sub-contract from Canadian Johns-Manville Co. Construction was in charge of Toronto Terminals Ry. Co., of which C. E. Gillen is General Manager, and J. R. W. Ambrose, Chief Engineer. A. R. Ketterson, Assistant Bridge Engineer, Canadian Pacific Ry., being in charge of steel work and other engineering details.

April 1930

same leaps and bounds as it has done in the past few years. It is almost superfluous to state that railways, and particularly terminals, grow with the city and the country, and in the years to come the C.P.R.'s Montreal terminals will be even a more vital factor in the life and prosperity of Montreal and of Canada, because the larger they become the more dependent are they upon rapid and efficient transportation, and "the world's greatest transportation system" will continue as ever to play the same important part in this great development.

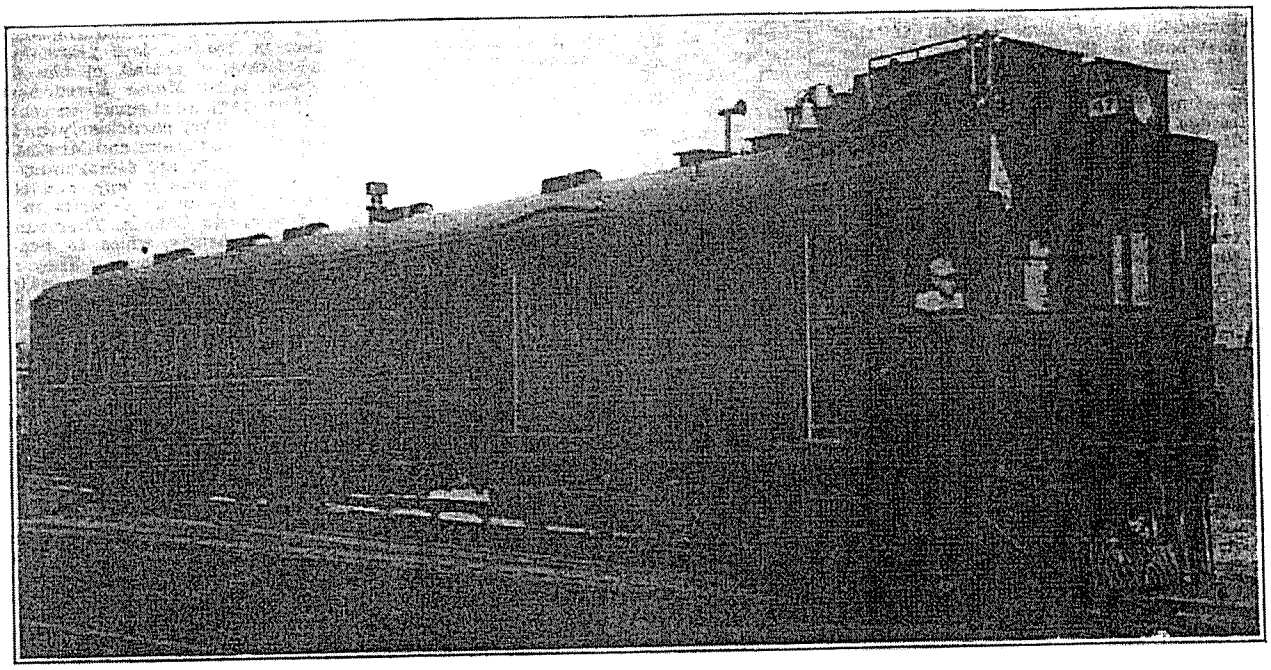
The foregoing paper was read before the Engineering Institute of Canada's Montreal branch.

Gas-Electric Motor Rail Cars, Canadian Pacific Railway.

The Canadian Pacific Ry. received recently two gas-electric rail motor cars, for passenger service on branch lines, which have been numbered 46 and 47. Their principal dimensions are as follows:—Length inside coupler knuckles 74 ft.; truck centers 52 ft. 10 in., width over side sheeting 9 ft. 9⅝ in.; height, rail to top of floor, 4 ft. 4 in., height, rail to top of roof, 13 ft. 1¼ in.; length of engine room, 15 ft. 10 in.; length of baggage room, 20 ft. 2½ in.; length of smoking room, 8¾ ft.; length of main room 23 ft. 4 in.

The under frame consists of 7 in. 18.8 lb. channel center sills, continuous from end to end of car, with ¼ x 21 in. top cover plate in one piece between draft lugs. The side sills are 5 x 3 x ⅜ in. angles, body bolsters are built up with ⅜ in. drawn steel webs, 20 x ⅝ in. top cover, and 20 x ½ in. bottom cover, with cast steel center braces. Side posts are no. 12 drawn steel, and the side plate a 3 x 3 x ⅜ in. angle. The roof over the car portion is ½ in. poplar, canvas covered, supported by metal carlines. The engine room is covered by a 1/16 in. steel roof. The floor consists of a steel floor sheet .04 in. covered by a layer of 3-ply Salamander insulation, the subfloor is 11/16 in. thick, laid on fir stringers; the top floor is 13/16 in thick, with a layer of slaters' felt between; this acts as insulation and also helps to reduce vibration. The floor in the engine room is 2¾ in. thick, laid on a ¼ in. steel plate. The side sheets consist of no. 12 stretcher levelled steel, with a double layer of 3-ply Salamander insulation. A wide vestibule is provided at the rear end, with side and trap doors, and a two-fold canvas diaphragm with light vestibule face plate. The interior of the car presents a pleasing appearance, the passenger end being finished in mahogany, and the baggage room with corrugated steel sheets. The floor is painted, and is furnished with an aisle strip of standard red and green diamond inlaid rubber with brass binding strips. The headlining is 0.06 in. sheet aluminum finished in cream enamel. A total seating capacity of 50 is provided, the main room accommodating 36 and the smoking room 14 passengers. The seats are fixed, as the car is intended for front end operation only, and are arranged to seat 3 persons on one side of the aisle and 2 on the opposite side. Standard green plush upholstery is applied in the main room and black leather in smoking room. Two lavatory rooms are provided, each with flushing hoppers and folding washbasins, with gravity water supply from overhead tanks. All sash in the passenger end of the car is of brass, poplar being used in the baggage room and cab. Window curtains are of the C.P.R. Co.'s standard double faced Pantasote. The car is heated by hot water, using a Vapor Co.'s no. 557 coal fired heater, which is located in the baggage room; fin piping is used throughout the car, and the circuit is connected to the radiator circulating system of the engine. A 32-volt lighting system is used, with Exide m.v.a.h. cells, which also provide current for engine starting.

Both air and hand brakes are provided. The air brake is the Westinghouse Air Brake Co.'s AML combined automatic and straight air brake equipment, with 2 brake cylinders. A 14 x 12 in. cylinder operates the brakes on the motor truck and a 12 x 12 in. operates on the trailing truck. A Miner drop handle hand brake is located in the cab, braking the front truck; a Lindstrom hand brake in the rear vestibule operates the brakes on the rear truck. Westinghouse Co.'s type M signal equipment is used. The car is fitted with a 2 bell Pneuphonic horn, also with a 12 in. locomotive type bell with internal ringer. Draft gear is of light construction, suitable for cars of this type, and is composed of 6¼ x 8 in. twin Harvey friction springs. The coupler is a light weight A.R.A. coupler with 5 x 5 in. shank. Cast steel trucks are used, the front truck, carrying the engine and motors, is fitted with 6 x 11 in. journals; the rear truck has 5 x 9 in. journals. The rolled steel wheels are 36 in diam. Journal bearings and wedges are A.R.A. standard.



Gas-electric Motor Rail Car, Canadian Pacific Railway.

The power plant consists of a 400 h.p. engine, 8 cylinder, 8 in. bore, 10 in. stroke, model 148, Winton Engine Co. Special winding built into the generator makes it adaptable for starting the engine from the batteries. Provision is also made to use an air starting system when the air reservoirs on the car are charged. Two gasoline tanks are located under the car, each holding 200 U.S.A. gall. The light weight is 136,600 lb.

The cars were built by St. Louis Car Co., and supplied through International Equipment Co. They have been placed in regular service as follows:—car 47 on Waltham Subdivision, Ottawa Division, Quebec District, between Ottawa and Waltham, Que., 79.1 miles; car 46 on Hamilton-Goderich Subdivision, London Division, Ontario District, between Hamilton and Goderich, Ont., 114.7 miles.

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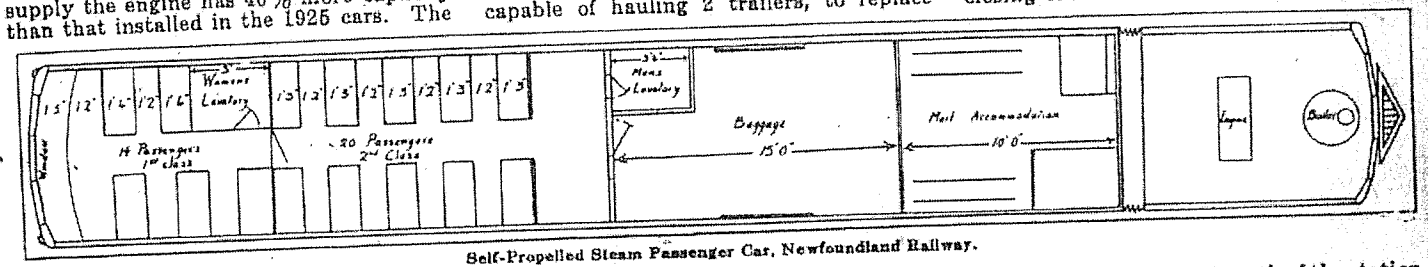
engine. This engine consumes 18 lb. of steam per b.h.p. hr., and the boiler to supply the engine has 40% more capacity than that installed in the 1925 cars. The engine is supported in the underframe, and is much more accessible than those in the cars now in operation. As there will be no articulated joint between the power unit and the passenger unit of the car, all controls will be straight. Superior riding qualities are claimed for the new type of car.



Self-Propelled Steam Passenger Car, Newfoundland Railway.

The new cars will have the following dimensions:—length over all, 64 ft. 7 in.; wheelbase, 54 ft.; clear space between seats, 1 ft. 2 in.; width of baggage compartment doors, 4 ft. There will be a door at each side of the baggage compartment, and also a door at each side for passengers. The baggage compartment will be fitted for the carriage of both mails and baggage. The passenger space will be entirely cut off from the engine unit, but there will be complete access from the passenger space to the mail and baggage space, through doors in the centers of the partitions. The cars will be lighted by a 32-volt system, and will be fitted with screw base lamps, axle driven generator and storage batteries. A headlight will be mounted on the front end of the engine unit, and 2 tail lights on the rear of the passenger compartment, one on each side. A pilot, somewhat similar to those on the cars now in operation, will be fitted on the engine unit, and the vacuum brake system will be applied, with a type of drop brake in which cast iron brake shoes act on all wheels of the car.

The engine will be of the vertical type, and of 100 h.p., and the boiler will be capable of evaporating 2,300 lb. of steam per hour. The boiler will have an extended stack, with latest type spark arrester, and will be complete with engine driven pump for supplying feed water when running, an injector for use while standing or running at slow speeds, and a Weir type auxiliary pump as extra equipment. There will be one rocking type and 2 crowned type grates supplied, this being in the nature of an experiment to see whether any better results can be obtained with the rocking type grates than with the crowned type.

advised officially that the management was under consideration the acquirement of a 250 h.p. gas-electric self-propelled car, capable of hauling 2 trailers, to replace steam trains, with the object of improving service by providing more frequent trips between Arvida and Port Alfred, Que., 19 miles, making connection with all Canadian National Ry. (Jonquiere Subdivision, Saguenay Division, Quebec District) trains, and also for the convenience of persons travelling locally. The Roberval and Saguenay connects with the Canadian National at Arvida and Chicoutimi, which places are 6.4 miles apart on the Canadian National line.

Toronto, Hamilton and Buffalo Ry. received early in Dec. 1927 the 60 ft. steel self-propelled car, the order for which was dealt with in Canadian Railway and Marine World for Aug. 1927, pg. 472. It has capacity for 50 passengers, and is fitted with a 16 ft. baggage compartment. It was built by Canadian Car and Foundry Co., and the motive power consists of the Electro-Motive Co. 175 h.p. gas-electric installation. The car was given a test run on Dec. 12, 1927, between Hamilton and Waterford, Ont., several railway officials, builders' representatives and others making the trip. It is in operation between Hamilton and Waterford, 42.97 miles.

Brandon, Saskatchewan and Hudson Bay Ry.—Notice was given recently that application would be made to the Board of Railway Commissioners for a recommendation to the Governor-General to sanction an agreement under which the B., S. and H. B. Ry. Co. has bought the following lines of the Manitoba Great Northern Ry.: from Morden, Man., southeasterly to the international boundary in range 4, and from West Gretna, Man., to the International boundary in range 1, both west of the principal meridian in Manitoba. The agreement also covers all the property and equipment and all charter rights, etc., of the Manitoba Great Northern Ry. Both companies are owned by the Great Northern Ry., and the proposal for consolidation was authorized by the Dominion Parliament last session.

which will enter it will be maintained at their present level. The plans call for the closing of Stuart St. at James St., but the railway will open a road south of the station near Murray St. which will run from James St. to John St. The closing up of McNab, Hughson and Catharine Streets, or Mary St. as an alternative to the latter, is asked for. The railway has secured most of the land required and expropriation proceedings in respect to the remainder have been started.

Freight Car Condition and Supply.—The Railway Association of Canada reports that on Dec. 1, 1927, there were 201,884 freight cars on Canadian lines, compared with 200,238 on Nov. 1, 1927, of which 12,204, or 6.1%, were in bad order, compared with 12,576, or 6.2%, on Nov. 1, 1927, and that there were 6,354 surplus cars on hand, compared with 6,850. The American Railway Association's Car Service Division reports that on Nov. 15, 1927, there were 2,269,062 freight cars on U.S.A. class 1 lines, of which 137,374, or 6%, were awaiting or undergoing repairs. Out of 1,049,523 box, automobile and furniture cars, 60,637, or 5.8%; out of 39,710 refrigerator cars, 2,341, or 5.9%; out of 956,618 gondola, coal and coke cars, 62,845, or 6.5%; out of 84,564 stock cars, 3,962, or 4.7%; and out of 93,222 flat cars, 5,752, or 6.2%, were awaiting or undergoing repairs. On Nov. 23, 1927, there were 301,393 surplus freight cars on U.S.A. class 1 lines, of which 135,619 were box, and 126,934 coal.

Hudson Bay Ry. Fort Churchill Line.—We were advised officially early in December, that Stewart and Cameron, the contractors for the construction of the railway from mile 356.5 from The Pas, on the Hudson Bay Ry., to Fort Churchill, expected to start freighting in supplies to points on the way to the future terminus, from construction headquarters at the present end of track, after Dec. 20, 1927, the exact date of starting work being dependent upon the amount of snow on the route. The work for the contractors will, it is stated, be in charge of D. Grant and A. McGregor. (Dec., 1927, pg. 692.)

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