Street Railway Journal

Vol. XIV. *NEW YORK AND CHICAGO, AUGUST, 1898.* *No. 8.*

THE ELECTRIC RAILWAY SYSTEMS OF SPRINGFIELD AND HOLYOKE, MASS.

The Connecticut River valley, which crosses the western part of Massachusetts in a northerly and southerly directions, forms one of the most attractive and prosperous regions of that State. Its largest cities are Springfield and Holyoke, both noted for their manufacturing interests. Besides these cities there are many others within the confines of this region which are centers of industrial activity, or are the sites of educational institutions of national reputation and importance. Many of the streams tributary to the Connecticut River are dammed to provide water power, and at Holyoke the river itself is impounded by a dam 60 ft. in height and 1009 ft. long; this supplies power to

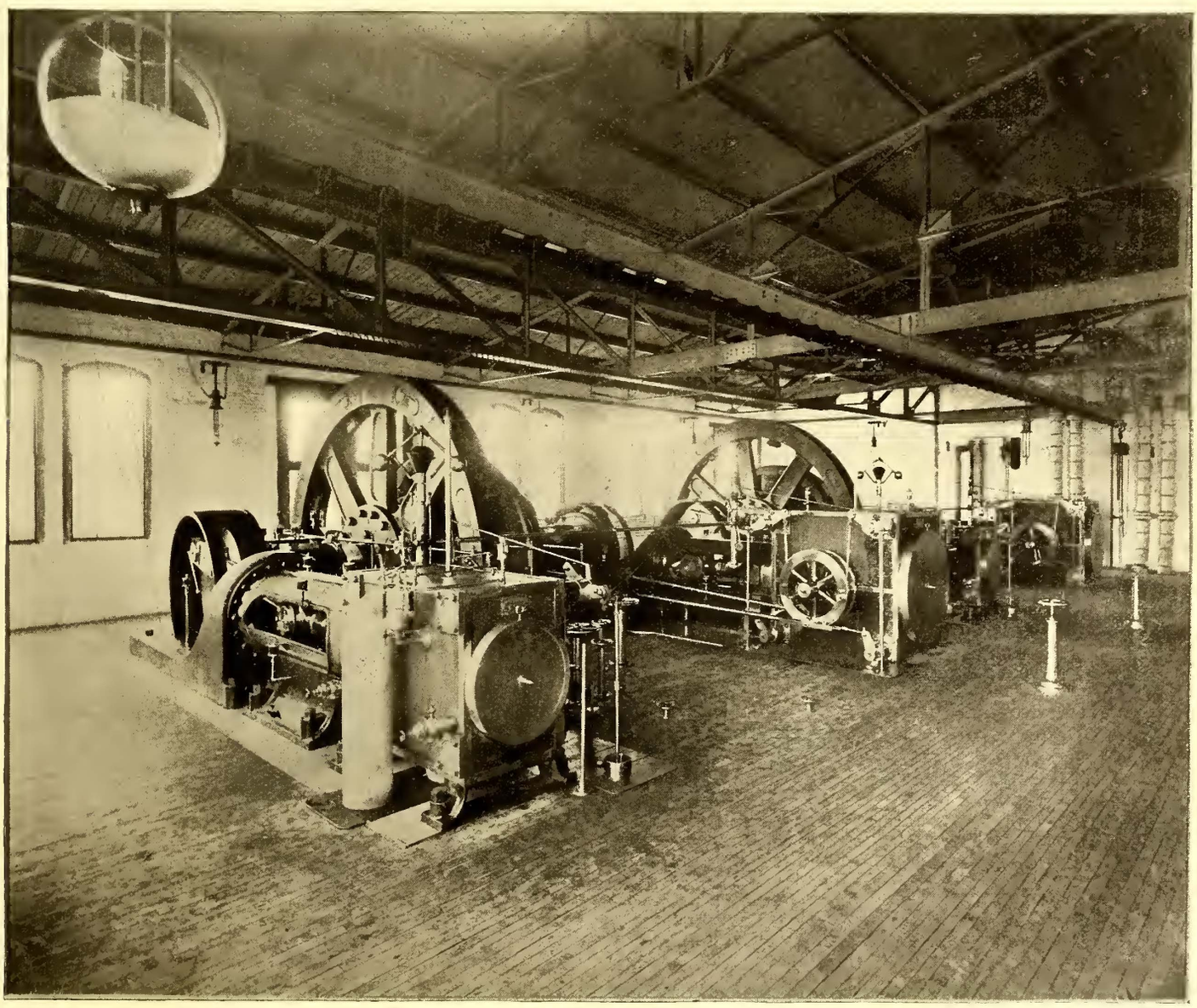


FIG. 1.—INTERIOR OF POWER STATION—SPRINGFIELD, MASS.

the industries of the city, the chief of which is the manufacture of paper.

The thickly populated character of the region, and the general prosperous condition of the inhabitants, together with liberal legislation, have united in developing the transportation facilities so that these are now excellent. The principal steam railways serving the lower portion of this valley in Massachusetts are the New York, New Haven & Hartford Railroad, the Boston & Maine Railroad and the Boston & Albany Railroad, all of which enter Springfield, while Holyoke is served by the first two. The growth of the street railways during the past ten years has also been great and continuous, and, of course, has far outstripped the increase in population. This will be seen from the fact that in 1887 the total length of track in the Springfield and Holyoke systems, which were then unconnected, was 19.9 miles, whereas to-day it is 94.8 miles. During this time

THE SPRINGFIELD SYSTEM

Springfield is a large residential city, and its industries are more varied than in Holyoke, where manufacturing is the chief pursuit followed. It is also surrounded to a greater extent by near lying towns and villages, which are cut off to the north and west of its sister city by a range of hills, the highest peak of which is Mt. Tom. The Springfield Street Railway Company has been engaged actively in building up a traffic with these outlying communities, and on a number of occasions has pushed its lines in advance of the travel, though careful not to have, at any one time, too many unprofitable lines. The wisdom of this policy has been shown by the development of the company's traffic as given above, and which now requires 180 passenger cars for a mileage of sixty-five. Although many of these lines extend out into the suburbs for 10 miles or more, no extra fare is charged on any over the standard

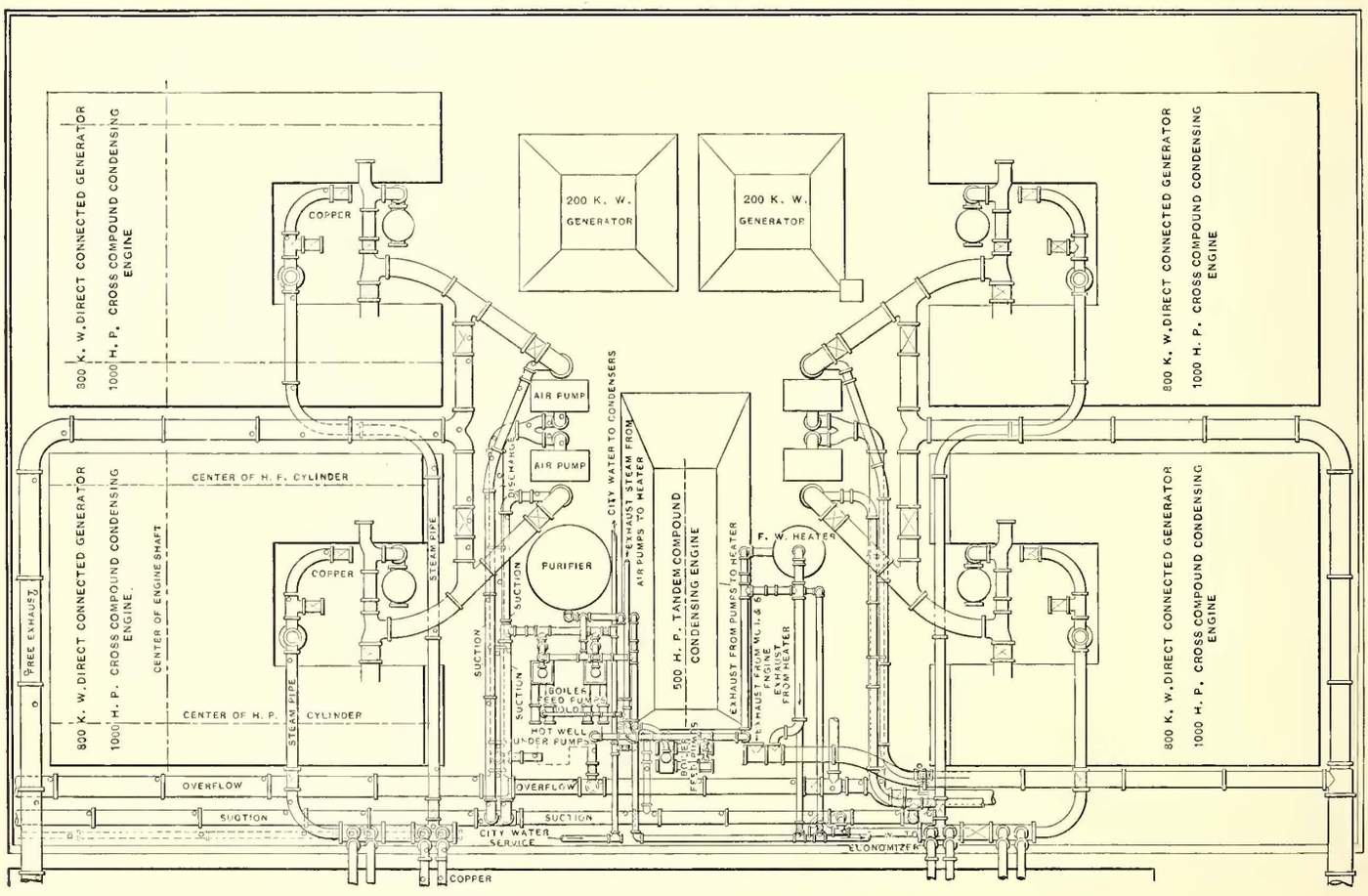


FIG. 2.—PLAN OF POWER STATION—SPRINGFIELD

the number of car miles run has increased in Springfield from 372,656 to 2,747,678, and in Holyoke from 101,299 to 956,500. The number of passengers carried per year in Springfield has risen during the last decade from 2,135,016 to 10,994,699, and in Holyoke from 491,905 to 4,081,888. These figures are taken from the report of the State Railroad Commissioners for the years ending September 30, 1887 and 1897.

The character of the railways themselves and the service given have changed as radically as the amount of traffic and kind of motive power. From a horse railway serving the streets of the city only, the system in each city has been developed to a network of interurban lines reaching to all the neighboring towns and villages. The properties in the two cities are in no way connected in ownership, and they are considered together in this article only because they connect with each other and from a traffic standpoint naturally form a complete unit. Both are conservatively managed and prosperous, and are conducted on the same general lines of operating policy, although in minor points different practice is followed.

"nickel." In another respect the practice of the company in development of traffic is interesting. While supplying passengers with every comfort and everything in the line of good service, the company has established no parks of its own and has not undertaken exhibits or engaged in the supply of park attractions. The cars carry, of course, many pleasure travelers during the summer, but the policy of the company has been against any special development in any one direction by means of entertainments of its own. As a result the winter traffic of the company is 83 per cent of its summer business.

The power station of the company is on the Connecticut River, in the southern part of the city, and adjoins the track of the New York, New Haven & Hartford Railroad, from which a spur is led over the coal storage for easy delivery of fuel. The station now contains two 1200-h.p. cross compound Hamilton-Corliss engines, manufactured by the Hooven, Owens & Rentschler Company, and one 600-h.p. tandem compound McIntosh & Seymour engine. The cylinder dimensions of the 1200-h.p. engines are 26 ins. and 50 in. x 48 in. stroke, and each is direct connected to an

800-k.w. General Electric generator. The cylinder dimensions of the McIntosh & Seymour engine are 18 ins. and 29 ins. x 17 ins., and it is belted to two 200-k.w. Westinghouse generators. The company is now installing two additional 1200-h.p. generators of the Hamilton-Corliss type and foundations are now being built for them. It is expected they will be in operation by the fall. A 50-ton traveling crane, of Baush & Harris make, extends the full width of the room.

The boiler room contains a battery of three Babcock & Wilcox boilers of 500 h.p. each, two Snow steam pumps, 8 ins. x 10 ins. x 12 ins., and Blake vertical twin air pumps, 11 ins. x 22 ins. x 18 ins., with Blake condensers. Stratton separators, Green economizers and National feed water heaters are employed. The stack is an exceedingly graceful one, and is of brick, 150 ft. high. The arrangement of machinery and method of piping in the engine room are shown in Fig.2, and were designed under the supervision of Sheaff & Jaastad, who have had charge of the reconstruction of the station. The system of suction and discharge pipes for the water of condensation, which was also laid under the supervision of these engineers, is illustrated in Fig. 4.

Fig. 5 shows an exterior view of the company's new car house, recently erected at a cost of about $60,000. It is undoubtedly one of the finest in the country, and the managers justly feel proud of it. The plan in Fig. 6 shows the arrangement of the house. The offices of the company occupy the front of the building and are tastefully fitted up. To the right of the main entrance are the rooms of the general manager and president, while to the left are those of the accountants and treasurer. Adjoining the latter is the locker room of the employees; this is commodious, with double rows of lockers, and permanent ladders fixed on rollers on the ceiling so that the upper tier of lockers can

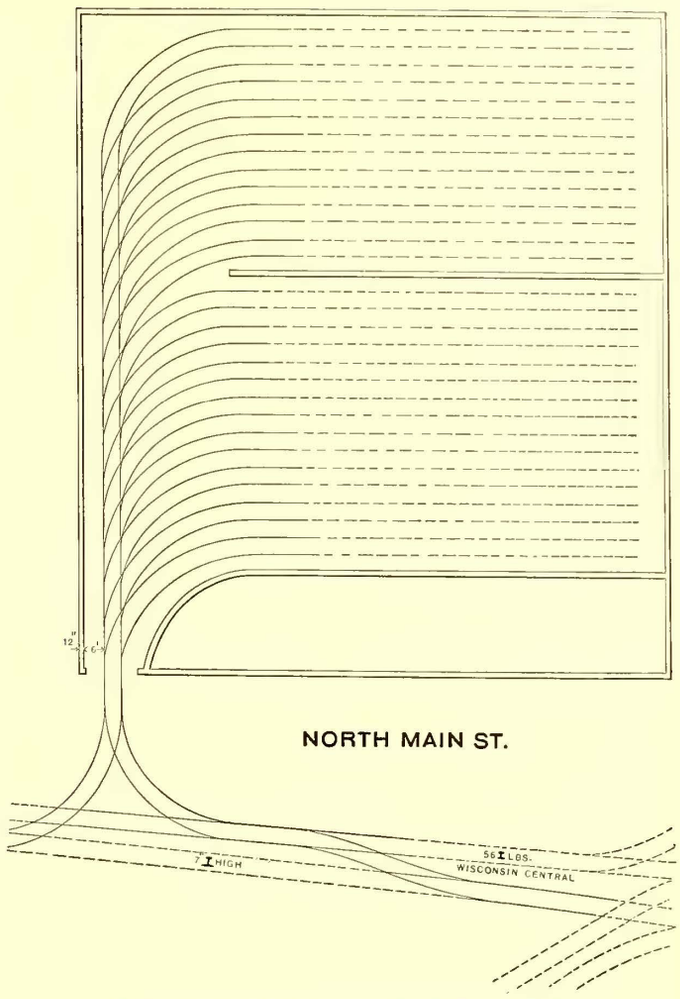
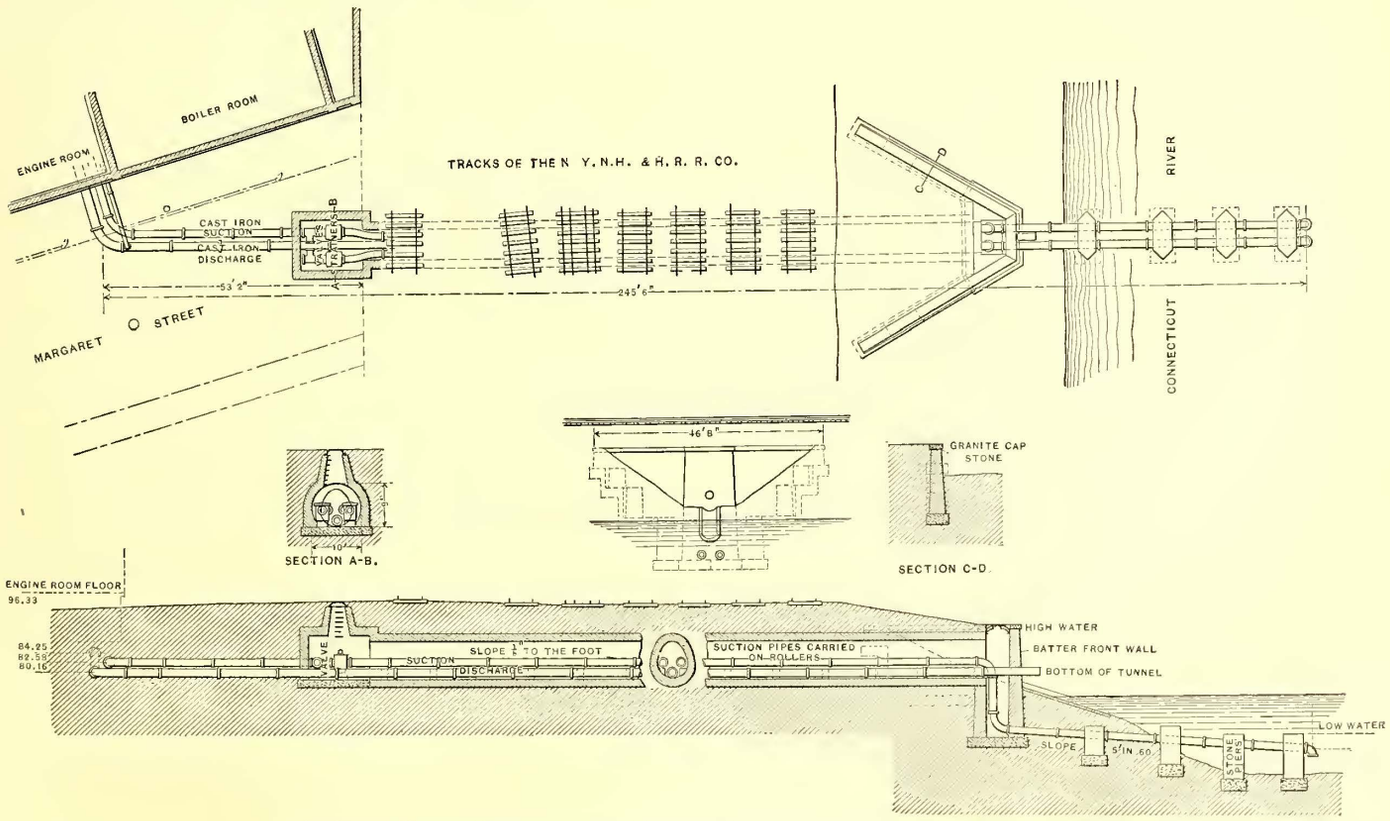


FIG. 6.—PLAN OF CAR HOUSE—SPRINGFIELD



FIGS. 3 AND 4.—SECTION AND PLAN OF SUCTION AND DISCHARGE SYSTEM

easily be reached. Above the offices mentioned are the waiting rooms of the conductors and motormen. One is supplied with chairs, tables, checker boards, etc., and is a general lounging room. The other is a reading room in which the conductors make out their accounts, and in it are two chutes which lead to the treasurer's safe on the ground

floor. One is for the conductors' reports, the other for their receipts. The men's lavatory is fitted with three porcelain tubs and all the modern conveniences.

As will be seen, the car entrance is on the extreme left of the building and is provided with one track which branches

employed, the overhead conductor having a 2½-in. T-iron bolted to planks which are attached to trusses overhead by hangers. The object of this is, of course, to have no sagging wires and the arrangement seems to answer perfectly the purpose for which it was intended.

FIG. 5.—EXTERIOR OF CAR HOUSE—SPRINGFIELD

off into fifteen stubs, each capable of holding five cars. The track work and special work in the car house is of the highest grade. It is made up of 4¾-in. rail with all special work

The car house is fireproof throughout, there being no wood used in its construction other than the single planks to which the overhead conductors are bolted. The offices

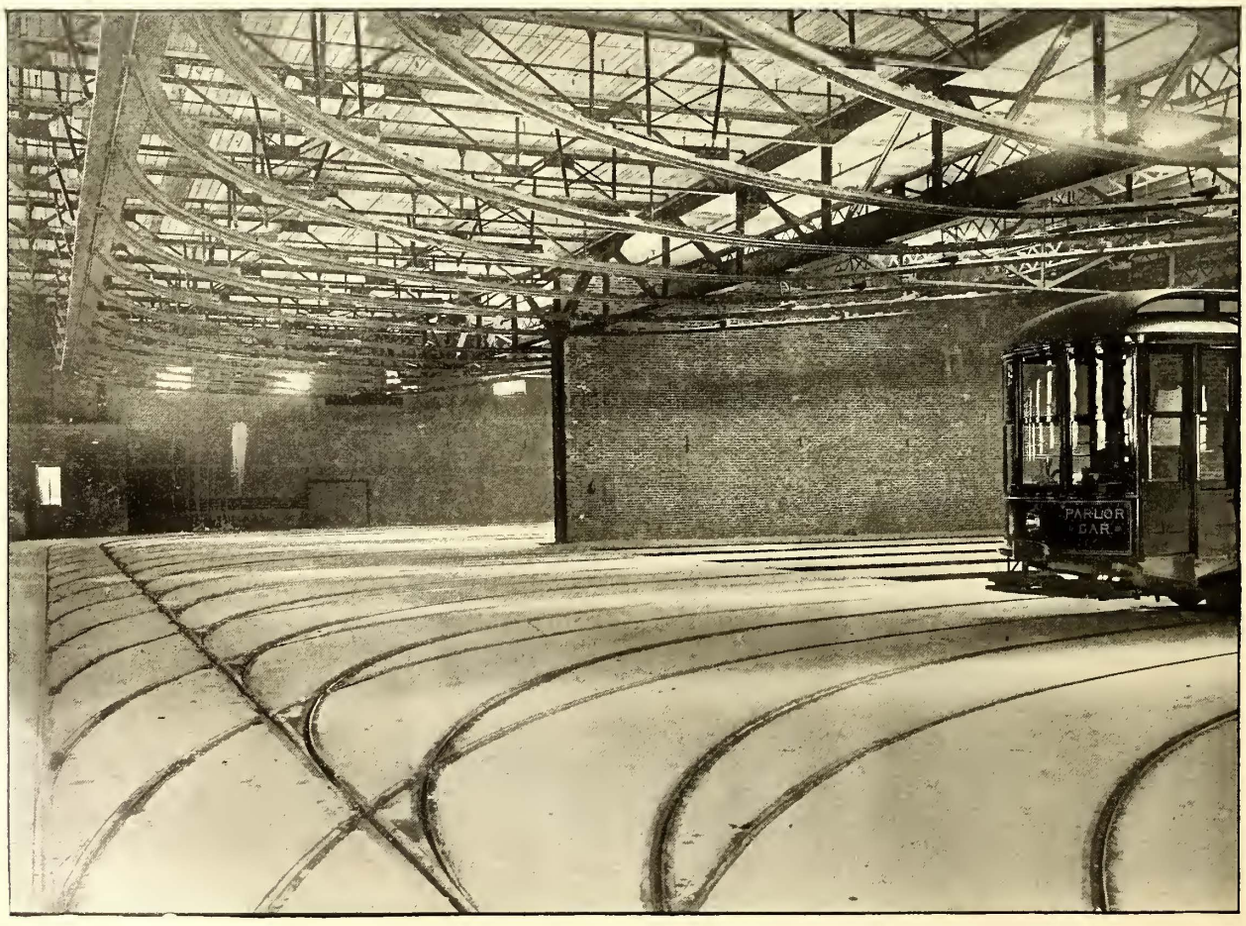


FIG. 7.—INTERIOR OF CAR HOUSE, SHOWING OVERHEAD CONSTRUCTION—SPRINGFIELD

of the Wharton manganese type. The floor is of concrete and a pit extends under each track.

Fig. 7 also gives a very good idea of the overhead construction in the car house. As will be seen, no wires are

are not lighted by the 500-volt circuit, but in the daytime from the local lighting circuit and at night from a rotary transformer consisting of a 500-volt 10-h.p. Westinghouse motor directly connected to a small 110-volt lighting

dynamo of 100 lights capacity. Standpipes and hose are located at convenient intervals, so that cars can be washed down at any point, or used in case of fire to the rolling stock. The car house is also fitted with automatic sprinklers. The entire building is heated by steam in winter, something which can be easily done, because the single entrance can be kept closed when not in use.

Adjoining the new car house is the old car house of the company, now largely used for the offices of the track engineer, electrical engineer and other heads of departments and for repair work. The entrance curves to this house are fitted with Wharton unbroken main line switches.

The car shop is not a large one, containing only two lathes, a spool winder and a wheel press. Among the ingenious tools used by the company is that shown in Fig. 8. It is a dummy truck to be used under cars disabled by a bent or broken axle, and it is carried on the repair car. As will be seen, it consists of an extension piece made out of two channel irons which can be fitted under the side bar of the truck and held to it by a strap and bolts. This extension piece carries on its outer end the box for a pair of 10-in. wheels. The disabled end of a car can be mounted on this truck, as shown in the engraving, the entire performance taking fifteen or twenty minutes at longest, and it can then be drawn to the car house or it can move under its own motive power.

In the electrical engineer's room was a convenient instrument for testing voltage. It consisted of a jointed bamboo fishing pole, the brass ferrules of which were connected by a small copper wire, and at the end of which was carried a large brass hook. The lower end of the pole was carefully insulated. The parts, when put together, made a convenient appliance for making contact with the trolley wire overhead, in case of voltage or other tests.

The rolling stock of the company consists of a variety of types of cars, mostly of the 4-wheel type. These were built by the Wason Company, and are mostly mounted on Bemis trucks, which is the standard 4-wheel truck employed. A few lines, however, use a double-truck car, and for this service the company is well satisfied with the car shown in Fig. 9. This measures 39 ft. 4 ins. over dashers and 30 ft. over end panels. The car has a narrow aisle with cross seats, but the latter are arranged in a somewhat novel way, a single seat on each end being placed longitudinally on the side opposite from the entrance door.

Many types of motors are used, practically all makes of the General Electric and Westinghouse companies being represented. Consolidated heaters are employed.

The standard track construction of the company is a 7-in. 70-lb. T-rail, although considerable 6-in. 60-lb. T-rail is also used. For certain streets, at the request of the city, the company has recently put in a 9-in. 95-lb. one-half

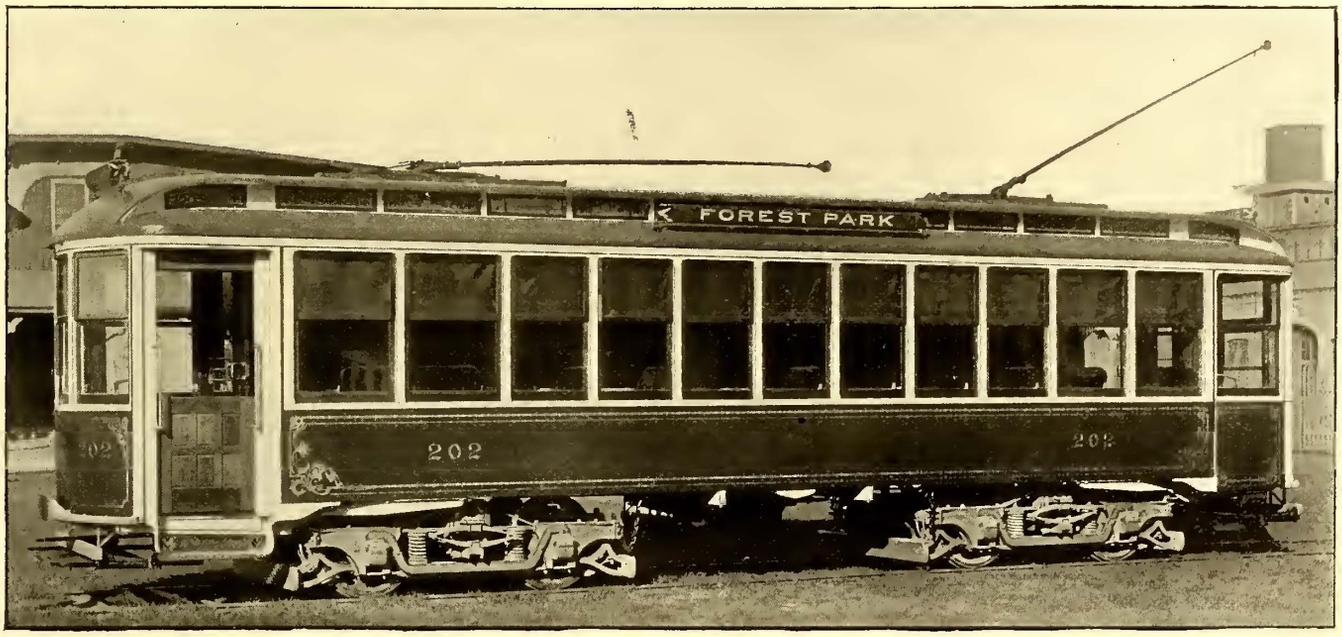


FIG 9.—DOUBLE TRUCK CAR FOR SUBURBAN SERVICE—SPRINGFIELD

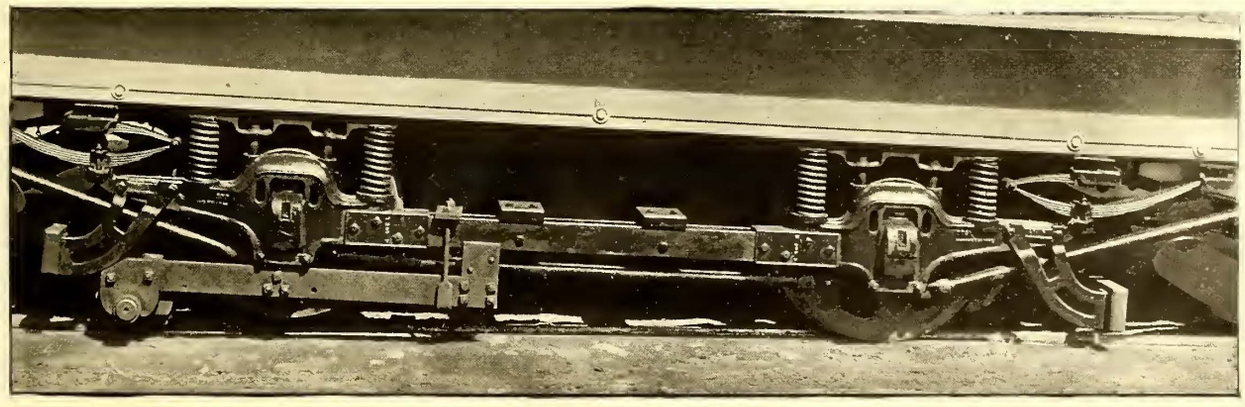


FIG. 8.—DUMMY TRUCK FOR DISABLED CARS—SPRINGFIELD

groove and 107-lb. full groove Broadway head rail. The standard joint on the 7-in. rail is an 8-bolt joint, and on the 9-in. rail a 12-bolt joint. The rails were supplied by the Wharton Company, the Cambria Iron Company, the Pennsylvania Steel Company and the Johnson Company.

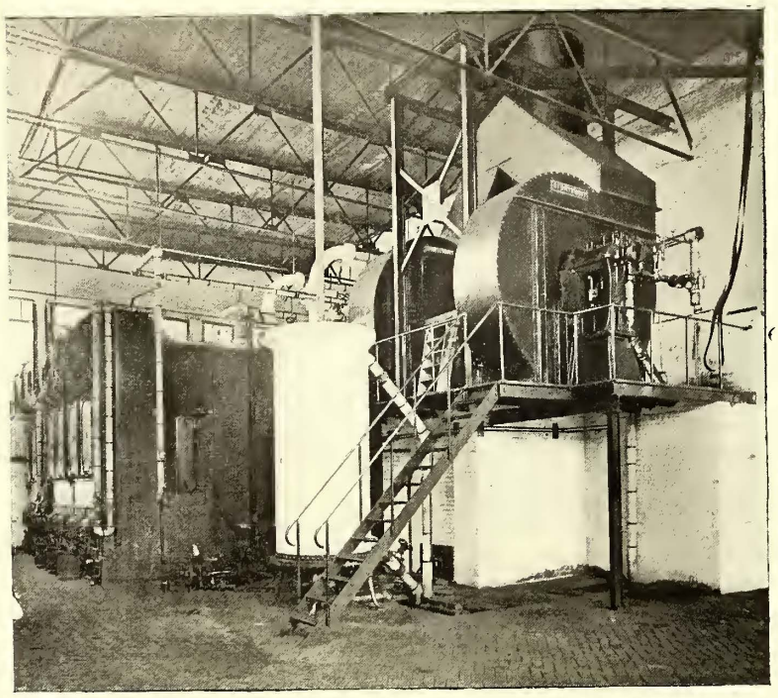


FIG. 10.—BOILER ROOM, SHOWING MECHANICAL DRAFT FANS—HOLYOKE

They are bonded with Washburn & Moen 0000 bonds and supplementary wires are used throughout, connected to the bonds every 30 ft. to 90 ft.

THE HOLYOKE SYSTEM.

Holyoke is 10 miles distant from Springfield, and by electric railway the running time from the Springfield Post Office to the Holyoke City Hall is fifty-five minutes. Through cars are run on a ten-minute headway and the fare charged is 10 cents. While on the tracks of the Springfield Street Railway Company, which extend about

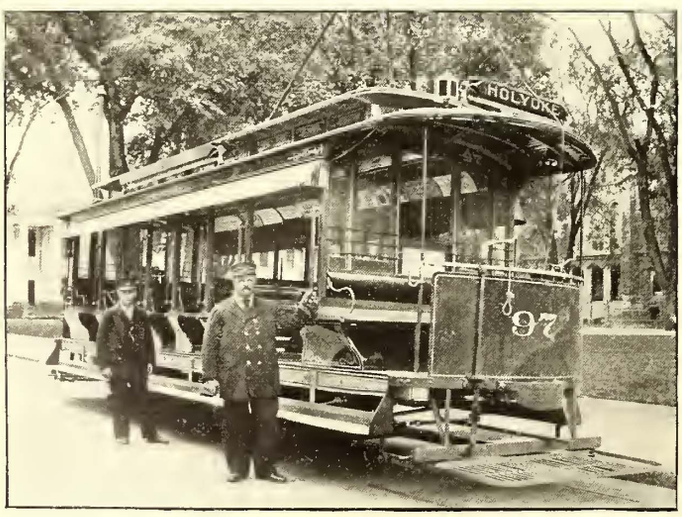


FIG 11.—STANDARD CAR FOR CITY SERVICE—HOLYOKE

halfway between the two cities, the crew are part of the Springfield Railway force. As soon as the car crosses the dividing line, they act under orders of the Holyoke Street Railway Company. The rolling stock for the through cars is provided by both companies.

The Holyoke system proper radiates from the city in all directions, a number of lines being across the river. The character of the streets traversed is generally hilly and there are a number of sharp grades. In addition to its city system the company has a very attractive park called "Mountain Park," at the base of Mt. Tom, and also operates one of the most interesting mountain lines in the country to the summit of Mt. Tom.

Somewhat curiously for a city in which there is so much water power, the station of the Holyoke Railway Company is operated by steam. It is contained in a substantial brick structure located on the Connecticut River in the southern part of the city, and immediately strikes the observer on account of the absence of any stack, mechanical draft being employed. In this connection it should be said that the managers of the company are most enthusiastic over the use of mechanical draft, which they consider especially adapted to the extremely variable conditions of electric railway work.

The draft is provided on the Sturtevant system, by a duplicate set of 8-ft. fans, driven by a small engine. The speed of this engine is regulated by an automatic damper, so that exactly the right amount of draft can be secured at all times. The coal consumed per electric horse power per hour, as measured by the wattmeter, varies from 2.19 lbs. to 2.10 lbs., and in tests has been as low as 2.03 lbs.

The rest of the equipment of the boiler room consists of three Babcock & Wilcox boilers of 250 h.p., equipped with Hawley down draft furnaces, a National feed water heater and Green economizer. Adjoining the boiler room is a special Deane fire pump 18½ ins. x 10½ ins. x 12 ins., with a capacity of 1000 gallons per minute.

The engine room contains three Green tandem compound engines with cylinder dimensions 15 ins. and 20 in. x 48 in. stroke, each directly connected to a 300-k.w. Gen-

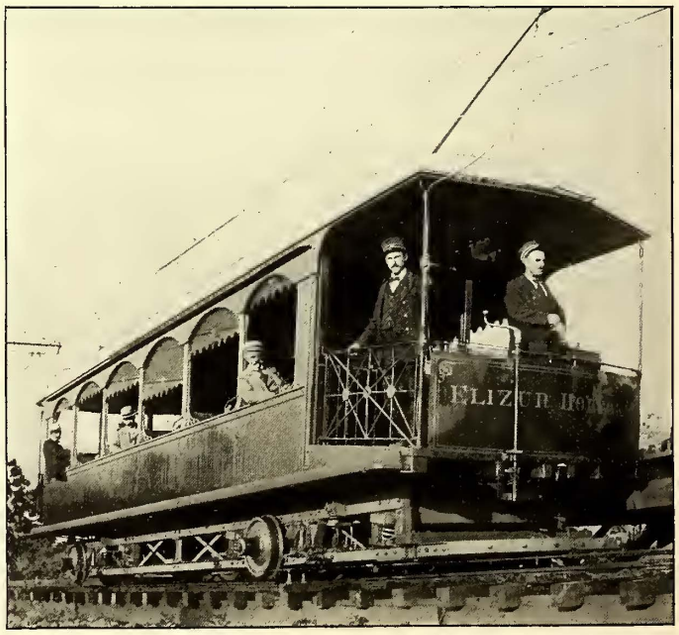


FIG. 12.—MT. TOM ELECTRIC CAR

eral Electric generator. The engines are operated in connection with Deane condensers. As a usual thing two engines are used at all times, and one additional for heavy riding. The company employs forty-nine open cars for days of heavy traffic, and from this number all the way down to thirty for ordinary traffic.

FIG. 13.—ENGINES—HOLYOKE POWER STATION

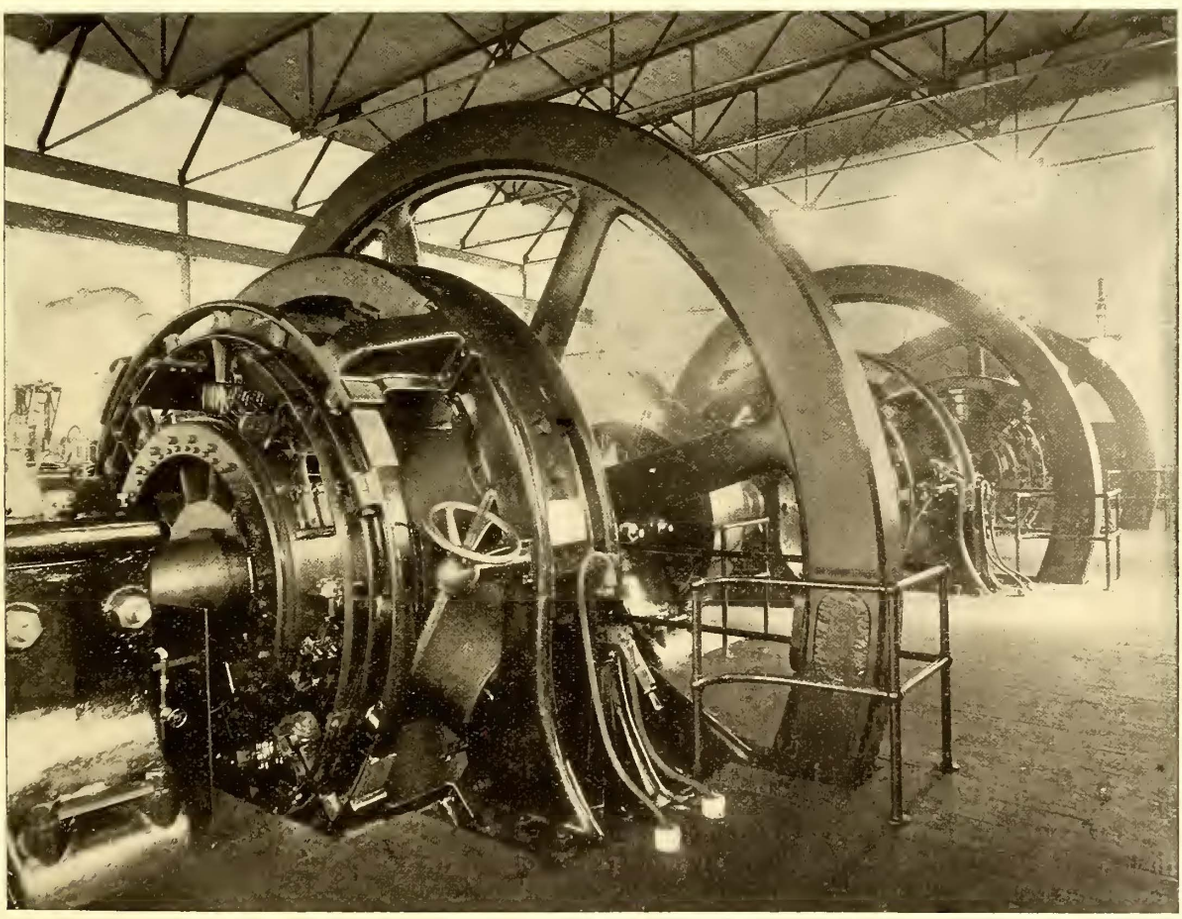


FIG. 14.—GENERATORS—HOLYOKE POWER STATION

Outside of the Mt. Tom line the maximum grade is 7½ per cent. The track construction is mostly 56-lb. 4¼-in. T-rail, but last year a 70-lb. 7-in. T-rail was employed. This is laid on chestnut ties. Formerly kyanized wood ties were employed, but it was thought that the chestnut ties will last as long as the rail, and so will be amply sufficient for the purpose. Opposite joints are laid as a rule.

The special work is mainly of the Wharton type, though some Johnson special work is employed. Tie rods are used throughout the entire system. Crown 0000 bonds are used throughout, connected to No. 0 supplementary. In the city iron poles are employed, but outside wooden poles are the rule. Both southern pine and chestnut poles are used, but the latter are considered more satisfactory.

A view of one of the standard open cars of the company is shown in Fig. 11. It is the ten bench open type. The standard box car has a 20-ft. body. An interesting feature of the open cars is the use of the narrow awning on the side. This was originated in Holyoke, and the managers are most enthusiastic over its advantages. One chief point in its favor is that it leads the drippings from the roof out some distance, and thus protects the conductor when he is on the running board. It also shields the passengers from the sun to considerable extent without interfering with the circulation of air. The awning is hung on hinged brackets so that it can be folded up close to the car if desired at any time to allow a car to pass near a post in the car house or in any other narrow place.

The latest cars are equipped with G. E. 1000 motors and most of them were built by the Wason Company and are mounted on Bemis trucks. Consolidated heaters and New Haven registers are the standard in use. The company is favorably disposed toward the use of rawhide gears on account of their noiseless qualities and the ability to avoid the use of gear cases.

The Mt. Tom mountain line, to which reference has already been made, connects with the end of the Highland division of the company. Its lower terminus is at Mountain Park, and its upper terminus the summit of Mt. Tom peak. The length of incline is 4900 ft., in which distance it rises 700 ft. The maximum grade is 21½ per cent, minimum grade 7 per cent and average grade 14 per cent. Near the top of the line there is a curve of 2000 ft. radius.

The line was built and equipped by a separate company at a cost of $100,000, but has been leased by the Holyoke Street Railway Company at a rental of 6 per cent on the capital stock. During 1897 the road carried 80,000 passengers. The fare is 25 cents for a round trip.

Two cars are used, connected with a 1¼-in. cable which passes over an 8-ft. return sheave at the upper end of the line. The line is single track with the exception of a turnout 700 ft. in length, placed at the center of the road. There are no winding engines to drive the cable, and in this respect the line is peculiar. Each car is equipped with two G. E. 1000 motors, mounted on the axles in the usual way. These furnish the only motive power, the use of the cable being only to balance the dead weight in the cars. Usually on the ascending car the motors are driven on the parallel notch of the controller, the lower car descending with the motors shut off. If more power is required, however, current is admitted to the motors of the descending car. The advantage of this arrangement is, of course, in avoiding the use of winding engines, which are expensive both in first cost, operation and maintenance. The arrangement also reduces the strain on the cable. The current is taken from trolley wires in the usual way, and these

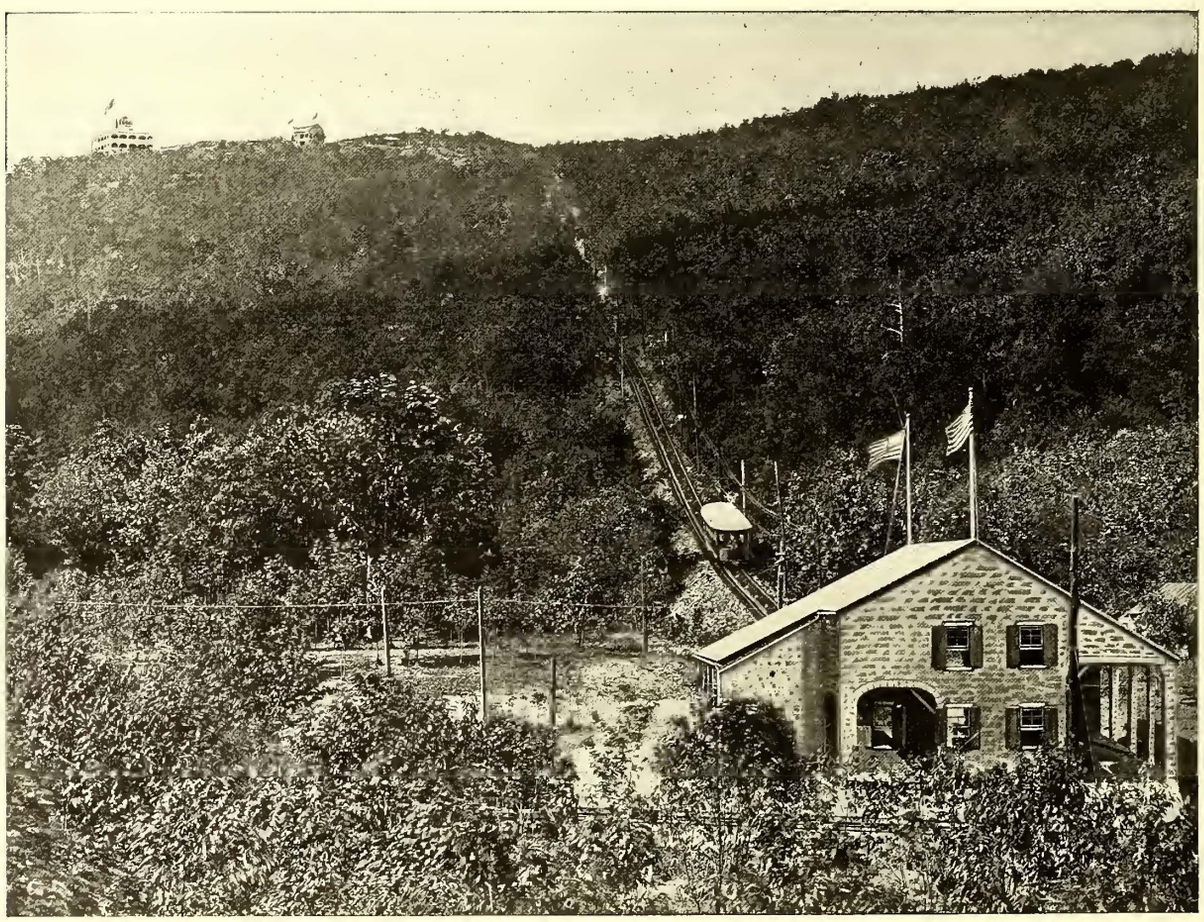


FIG. 15.—MT. TOM RAILROAD, VIEW FROM FOOT OF INCLINE

wires are fed from the regular railway circuit. The power station of the company is some 6 or 7 miles distant from the foot of the incline.

The track construction of the incline railway was fully described in the September, 1897, issue of the STREET RAILWAY JOURNAL, and need only be incidentally referred to here. The rails are of the 56-lb. T-type, and are spiked to 6 in. x 6 in. yellow pine ties, which are carried on 8 in. x 12 in. yellow pine stringers. These are in turn spiked to 12 in. chestnut mud sills, spaced 5 ft. 2 in. center to center. The turnout, which is a special feature of the road, is illustrated in Fig. 12. No spring or movable switches are required, their use being avoided by the employment of deflecting rails, as shown. Each car axle carries a pair of extra wheels mounted outside the journal boxes, as can be seen from a photograph of the car. The sole use of these wheels is to carry the car on the outside rails when the turnout is reached, allowing the interruption of the regular rails so as to permit the carrying of the cable through the turnout, as illustrated in the engravings. The advantage of this is, of course, in the ability to use a single track instead of a third rail or double track on the incline, thus lessening materially the cost of construction. The arrangement described is the invention of Chas. F. Parker of New York, the builder of the road.

The safety devices employed are very complete. Each car is equipped with eight brake shoes operated by hand brake, and in addition the electric brake, which is the one in regular use for controlling speed of the cars. In addition to these a specially designed cable grip is arranged at the head of the incline for gradually stopping the cable in case the speed of the cars exceeds 1400 ft. per minute, 1300 ft. being the ordinary speed. Still another safeguard is provided by an automatic grip located under the car for engagement with a safety T-rail, spiked to a stringer between the rails. This can also be operated by hand, was manufactured by the Sprague Electric Company, and is similar to that employed on the well-known electric elevators of the company.

The view from the top of the incline is most picturesque, as the mountain is high above the general country about it, and on a clear day a grand panorama can be seen. The excursion is a favorite one for the residents of Holyoke, as well as for parties from the surrounding country. The summit house, owned by the company, is a large and solidly built structure, three stories high and 76 ft. x 92 ft. The two lower stories are devoted to a restaurant and attractions in the line of autoharps, stereopticons, etc. On the upper floor is a large observation room, furnished with numerous telescopes for the use of visitors. This floor has an elevation of 1266 ft. above the level of the sea.

Mountain Park, which is located at the foot of the incline, is a most attractive resort, and is visited annually by very large numbers of people. It contains a large Denzel carousel, located in a special building; a bicycle track, toboggan slide, menagerie in which are birds, monkeys and other animals; a deer park, and an open-air theatre, in which during the summer two performances are given daily. Reserved seats in this can be secured for five cents, but the performance can be watched from a short distance away without extra charge, if desired.

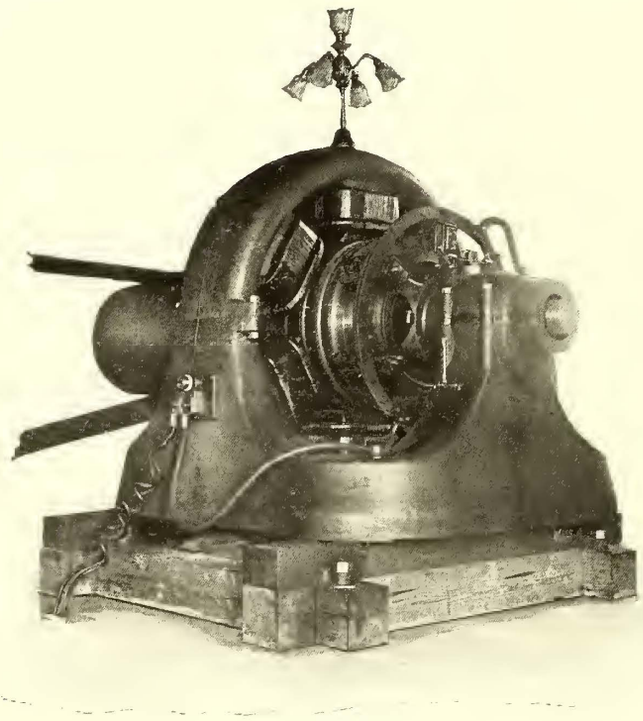
FIG. 16.—TURN-OUT, SHOWING ARRANGEMENT OF RAILS ALLOWING CAR TO PASS OVER CABLE OF OPPOSITE CAR

The treads of cast-iron wheels have the hardest surface which it is possible for the manufacturers to provide, and this hardness is absolutely necessary for the service required. This surface cannot be touched by a tool to any extent. It is harder than hard steel, and when brake shoes of the same material are used, or shoes of considerable hardness, friction results instead of wear, with a consequent burning of the treads of wheels, in many instances shortening the life of the latter and putting the railroad company to a great deal of expense in replacement of wheels or in having them refitted; hence it becomes a question of wheels versus brake shoes.—From paper read at the Atlanta, Ga., Convention, 1894.

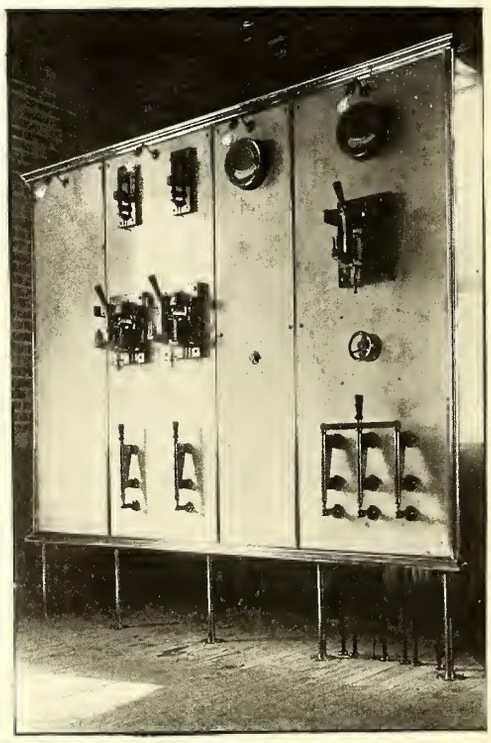
The Holland & Lake Michigan Railway.

The Holland & Lake Michigan Railway, which was opened July 4, extends from east to west along Black Lake, an arm of Lake Michigan on the east shore, and connects Holland, a city of some 11,000 people, with Macatawa, situated on Lake Michigan at the inlet to Black Lake. Macatawa is a summer resort, with a population of 3000, and is without steam railway connections, its only transportation facilities previous to the building of the Holland & Lake Michigan Railway being the lake steamers. The electric road is 7 miles long and runs through a very productive fruit belt, and while the passenger traffic from Holland to Macatawa is expected to make the road a paying property, the moving of fruit and other freight will be no small part of the service.

At right angles to the road now built, and crossing it about midway between the two towns, a second electric line called the Sagatuck, Douglas & Lake Shore Electric Railway is being constructed. This will extend in a straight line north and south, and will connect the fruit region through which it passes with the steamboat docks on Black Lake.



GENERATOR



SWITCHBOARD

The power house now built will serve for both lines; it is located some 4½ miles from Holland and 2 miles from Macatawa. It is of brick, 50 ft. x 100 ft., with a steel roof. The land rises rapidly from the lake, and 900 ft. distant from the water's edge the power house is 20 ft. above the water. The soil is sand, making the foundation problem an easy one. The steel stack is 110 ft. high and 52 ins. diameter. Three tubular boilers, 66 ins. x 16 ft., carry steam at a pressure of 110 lbs.; steel breeching connects the furnaces with the stack. At present there are but one engine and one dynamo installed. The engine is a "Fisher" single-valve, side crank, non-condensing, and of 350 h.p. It is the intention within a short time to add condensers to the plant.

The generator is of 200-k.w. capacity, belted to the engine and designed to run at 700 r.p.m. It was manufactured by the Triumph Electric Company, and is a duplicate of those furnished the Waterloo & Cedar Falls Suburban Railway, described in the Street Railway Journal for February. Another engine and generator of the same kind is to be installed shortly; lighting machinery will be put in to furnish light for docks, beaches and other places along the line of the road. The switchboard was also furnished by the Triumph Electric Company; it is white marble, equipped with Triumph rheostats and Weston instruments.

The line of the road after it leaves Holland is almost straight, passing directly across the farms lying along the lake. The right of way was purchased of the owners, and does not at any place run along the public highway. The ties are of cedar, and on these are laid 65-lb, T-rails with joints broken. The ballast is gravel. The line is nearly level, the maximum grade being 3 per cent. Two wooden trestles 14 ft. to 16 ft. high and 1000 ft. and 600 ft. long, respectively, had to be built for crossing ravines.

The trolley wire is 00. For 5 miles it is hung from flexible steel brackets, and the remainder of the distance from span wires. The poles are shaved cedar, 30 ft. high and 6 in. diameter at the top. The Ohio Brass Company's overhead material was used throughout the work.

The car house is 50 ft. x 150 ft., adjoins the power house, and is also of brick with steel roof. It has five tracks running the full length of the building. The repair shop facilities are also under this roof. Twelve cars make up the rolling stock; three of these are 30 ft. long with double trucks; two have baggage and freight compartments. The remaining ones are smaller and on single trucks. The cars were built by the Barney & Smith and Brill companies. The large cars have two 50-h.p. and the smaller two 25 h.p. Walker motors.

Cars began running nearly a week before the opening day, and everyone was allowed to ride free. On July 4 the first fares were collected. A regular five-cent fare is charged inside either village, and ten cents for the ride between the two. The road, including the power house, was built by Foster & Lewis of Chicago, $100,000 in bonds being issued for the purpose. The officers of the road are: Pres., Chas. M. Humphrey, Ironwood, Mich.; Secy. and Treas., J. E. Cochran, Chester, Pa.; Supt., M. J. Kinth.

Fares and Earnings of the Copenhagen Tramways

By V. Faber-Madsen

The fares charged on the Copenhagen tramway system up to 1884 were not fixed by either law or concession, and consequently the standard fare per unit distance cannot be given exactly. An article in the Street Railway Journal (May, 1897) showed graphically in a most striking manner to what an enormous extent the American public has been benefited by the extensions of their street railway systems. As all fares in Europe, except in Paris and a few small German cities, increase with the distance traveled, the question of relative fares in Europe and America may be dealt with in another way.

Mr. Sullivan in a recent article in the Street Railway Journal states that "The prevailing general opinion in the United States is that street car fares in Europe are 2 cents, regardless of distance," etc., etc. Mr. Sullivan says this is wrong, but that such an opinion can prevail is, to a certain extent excusable. If the gross receipts of a European tramway line are divided by the number of passengers carried, the average fare paid will be found to be generally 2 cents, or, rather, a fraction more.

This shows, however, that a passenger in Europe seldom spends more than 2 cents for a street car ride, simply because if he wants to go beyond the 2-cent limit the fares becomes excessive for the distance, so that whether the European fares are higher or not can only be answered, in the writer's opinion, by considering the distance a passenger can travel for the standard 2-cent fares. The importance of an European street railway system also depends on the number of 2-cent routes.

Reverting to the actual conditions in Copenhagen, 2.67 cents is the average fare paid by each passenger, taking into account the receipts from commutation tickets and the fares of 1.38 cents over very small distances. In the following will be shown the present fares from terminus to terminus, and the maximum distance traveled for 2.67 cents or 10 öre Danish. These figures refer to the present day:

	Max. distance, miles.	Fares cents.	Transportation rate per mile, cents.	Max. distance for standard fare (2.67c.) miles.	Transportation rate per mile, cents.
No. I. Copenhagen Tramway,	4	7.07	1.77	2.12	1.21
No. II. Suburban Company	2.8	4	1.33	1.90	1.40
No. III. Frederiksberg Tramway	2.5	5.33	2.132	1.89	1.41
No. IV. Noerrebros Tramway	2.3	4	1.74	1.70	1.48
No. V. Falkonerallee Tramway	2.3	2.67	1.16	2.3	1.16
No. VI. Solvgadens Tramway	2.6	2.67	1.03	2.6	1.03

Average transportation rate per mile: 1.40 cents (of both columns).

Average transportation rate per mile: of the London 3 mile rides for 1d., 0.66 cent.

Averages of Chicago (per mile) 0.37 cent.

From the above it can be seen that while our tramway fares are not low they can be favorably compared to other European cities, except the English ones, in which country the cheapest fares in Europe are to be found. As for America, it can again be stated that the fares there will invariably show themselves to be the cheapest in the world.

For convenience the several companies will frequently be referred to hereafter in this article by the Roman numerals in the first column.

The transportation rate per mile in Copenhagen is based upon the present fares, but a decrease has taken place in later years, and only two or three years ago they were somewhat higher per mile. The Suburban Company had a fare of 2 cents a mile, and Company V. of 1.74 cents per mile.

All the companies, except the Frederiksberg, which is the most expensive, have established, at least on some of their routes, the previously mentioned 1.38 cents fare (in Danish 5 öre). That fare was originally introduced by the Nörrebros Company, and the others followed later. In some cases this fare (especially for Company V. and Company IV.) has materially increased the number of passenges carried. The maximum distance which can be traveled on this fare in no case reaches one mile.

The number of tickets issued at the standard fare is, however, considerably in excess of those issued at the low fare, which also can be seen from the average fare or receipts from each passenger, that is now slightly more than 2.3 to 2.5 cents (average for all companies). The highest receipts are on the Frederiksberg line, viz., above 3 cents.* Some years ago this was the standard fare, and that it is now lower is due chiefly to Company I., which has greatly increased the length traveled for the standard fare, and still more by increasing the number of standard fare-routes.

The wages of the Copenhagen conductors and drivers have in the course of time been somewhat increased. The employees of the Copenhagen Tramway Company receive now 65 cents per day when commencing work, and after five years' service 69 and 73 cents per day. Besides this sum they are supplied with uniforms, and in the winter with a great coat (one company also supplies its men with fur-top boots), and have every fourth day as a holiday with full wages. In addition to their daily wages the men have commissions with this company amounting to 1 per cent of the gross receipts. They are also entitled to 33 cents for each day they are absent when sick. The Suburban Company pays its men according to another scale, viz.: The wage per day is 33 cents, also payable on holidays (every fourth day), but the company allows a commission on the gross receipts from cars of $3\frac{1}{2}$ to 5 per cent, according to the number of years a man has been in the company's service. As in the former company, the men get uniforms and fur coats in the winter, and their weekly wages average from $6.14 to $6.50.

Although the wages may be considered low if compared to those paid in America and England, the men are better paid than in Germany, and also earn more than a thoroughly trained man in the Danish manufacturing industries. Assuming the latter to work 300 days in a year, he can rely upon an income in a year of kroner 1000.00 or $267. (The working hours are twelve a day, including dinner and rest.) The tramway man works sixteen to eighteen hours per day, or he has 274 working days and ninety-one holidays with wages. Assuming the wages paid by the Copenhagen Tramway Company to represent a fairly good average, the tramway employee receives $256 a year, not counting his commission. The amount of the latter is somewhat uncertain, but at a low estimate it will amount to $20 a year, or each man has

*The lowest is that of Company VI., viz., 1.93 cents.

directly from his company in a year $276. The income on a low estimate for a tramway conductor or driver is, then, somewhat more than that received by the average skilled workman, and considerably more than the income of helpers or all-round workmen.

On the whole our tramway men are exceedingly well satisfied, and many of them have been in their company's service for more than thirty years. Some years ago the men formed a union for supporting old or infirm members and their widows. Situations as tramway employees are very much in demand.

In dealing with the question of the influence exerted upon the present population of Copenhagen by the tramways, it is, of course, impossible to arrive at exact figures, as reliable and complete tramways statistics are almost unobtainable. The statements made below are correct, however, as far as they go, and are based upon the Government and municipal statistics, and are also upon several articles upon Copenhagen's growth, written by M. Rubin, chief of the statistical office of the State, and Th. Green of the Danske Fonds og Aktier (Danish funds and shares).

In 1860, before tramways were built, 84 per cent of the total population were living in the old part of the city, inside the walls, as it was called. Twenty years later, in 1880, 56 per cent were living there; in 1885 only 46 per cent, and in 1895 of the total population only 34.7 per cent lived in the old city. From 1855 to 1870 the yearly increase of the population was 1½ per cent, but in the years immediately following, when several important tramways were put in operation, or from 1870 to 1880, the annual increase was 2½ per cent, and in the period 1880-85, when at least the more important part of the system was completed, the yearly increase reached its maximum, viz., 3½ per cent. Practically little has been added to the aggregate length of the lines since that time, and the yearly increase in population is now diminishing, and in the period 1890-95 was only 1¼ per cent. In actual figures the population of the outlying districts increased during this period from 24,000 to 175,000, and the population of the old city has in the same period decreased from 114,000 to 88,000.

It will always be open to discussion what part of the increase in population can properly be attributed to the introduction and influence of tramways. It is certain that increase in population naturally depends upon the number of births in excess of the number of deaths, but besides that factor we have the increase due to immigration, and in the writer's opinion this latter can almost entirely be credited to the tramways.

The influence upon the Copenhagen suburbs of the tramways in the city has been such that their suburban character has in all cases completely vanished, so that the former suburbs now form parts of a large city, with the usual appearance of shops, large houses, manufactories, etc., etc. The tramways have, therefore, opened new districts, not only for residences, but also for businesses of all kinds, or, in other words, the metropolis has been able to give employment to many thousands of new hands. From these facts the author concludes that the increase of population by immigration is to a great extent due to the tramways. The correctness of this view may further be strengthened by the official statistics, showing that the growth of the other cities in Denmark was faster than that of the metropolis in the period 1801-60, but that the metropolis is heading the list in the decades 1860-70 and 1870-80, or after the introduction of tramways.

Prior to 1870 the increase of population due to immigration was only a trifle more than that due to excess of births. The table below will show how the increase took place in the years immediately following.

YEARLY INCREASE OF POPULATION.

	Immigration. Per cent.	Excess of Births. Per cent.	Remarks.
1870-75.....	2.6	0.5	All outlying parts connected with the old part.
1875-80.....	1.1	1.1	No extensions took place.
1880-85.....	2.1	1.4	Important extensions.

Since the opening in 1889 of the line of Company VI., and in 1893 of the Istedgade line, now part of the system of the Copenhagen Tramways Company, nothing has been done in the way of tramway building, and the yearly increase in population gradually dropped, and immigration has almost entirely stopped.

Copenhagen is one of the most densely populated cities in Europe, having about 70,000 inhabitants per square mile. To some degree this can be explained by stating that the poorer class lives chiefly in the northern and western parts of the city, where the houses recently erected contain at least four floors, each floor accommodating two families. But in a majority of cases, directly back of each tenement house, fronting on the street, is a second, very often containing several more families than the one in front, and sometimes there are, in the rear, still others. This way of building explains the dense population.

The following table gives the relative percentages of flats of different sizes, in periods of five years each, and from it some idea can be obtained as to the influence of the tramways in distributing this population:

RELATIVE PERCENTAGES OF FLATS OF DIFFERENT SIZES.

	1896.	1890.	1885.	1880.
Flats of:				
1 room	12.8	14	15	17
2 rooms	39.8	40	36	33
3-4 rooms	31.5	30	30	31
5 rooms and above	15.8	16	19	19

The period 1880-85, in which the tramway lines were about completed, shows a marked increase in the number of two-room flats, or a decided improvement for the poorer classes. The proportion of flats of three to four rooms has remained practically constant. The number of flats of five rooms and above is decreasing. This is to a certain degree due to the fact that in recent years the rural or suburban character of Frederiksberg has also disappeared, at least along the two main streets, and a large number of fine buildings and blocks, almost all of them containing residences only, have been erected on the areas of the former villas.

If we consider the population per unit area contained in the flats (about 400 sq. ft.) we find in the old part of Copenhagen an average of 1.4 persons per unit area, and in the new parts 1.9. These figures were exactly the same in 1886 as in 1895, a fact which strongly points to the desirability of opening new districts, although the statisticians tell us that two to three persons per unit area can be considered as being fairly good. The densest population per unit area exists in the northern part, viz., 2.4, but the highest death rate per 1000 is also to be found here, viz., 26. (The average death rate of Copenhagen is 18.4 per 1000, equal to that of London.)

The increase of population in the different outlying districts can be seen from the following figures:

	1860.	1880.	1885.	1895.
Western part	7,000	25,000	36,000	56,000
Northern and Eastern	17,000	60,000	78,000	117,991
Southern (Christianshavn) ..		17,800	18,000	19,955

A considerable increase has thus taken place in all the parts except in the South, Christianshavn. The reason for this is that this part was already densely populated by a poor population prior to the introduction of tramways. As this section of the city is by no means attractive, no increase in population due to immigration could be expected. On the other hand, the Sundbys have greatly benefited by its tramway connection with the city, which was made in 1884. This can be seen from the fact that the population of Sundbys, which in 1885 was 11,000, was increased to about 16,000 in 1895, and this rapid increase accounts in a measure for the very low increase of the population of Christianshavn. It may be mentioned that in 1895 an entirely new suburban section was opened in the Sundbys, and it was from here that the projected electric railway was to have started, connecting other villages on the same island of Amager.

In Sundbys the population increase up to 1885 was due to excess of births over deaths, and to immigration in about equal proportions. A change in which the increase from immigration became larger must have taken place between 1885-95, but the writer has not been able to lay his hands upon these statistics, they only appearing occasionally.

Another suburb which has been developed by the Copenhagen Tramways Company is Valley (from 3147 in 1890 to appr.ximated 6000 in 1897.)

The northeast point in the tramway system and the north frontier in Copenhagen's municipality is Stukefter. Although the Copenhagen Tramways Company has had a line out to this distant point for many years, in the writer's childhood it was considered quite as much in the country as Frederiksberg was forty or fifty years ago. Time has altered all that. The old interesting inn in that place will vanish this summer, and fine two-story houses have been erected along the track and in close vicinity to the company's buildings and terminus.

The Köbenhavns Sporveis-Selskab (Copenhagen Tramway Company) has done the largest amount of new construction during the past thirty years, and has been steadily increasing the number of its lines and routes, whereas all the other companies (except Company II.) have remained unaltered from the beginning to the end of their existence. Had the Copenhagen Tramways Company followed the same policy there is no doubt that the company's dividends would have been equal to the highest of those now paid, whereas a marked decrease in the dividends has taken place.

The Torstaedernes Sporveis-Selskab (the Suburban Company) has been eminently successful. While since 1873 this company's main line (connecting the outlying parts with each other) has reached slowly but surely its present favorable condition, and has been a most valuable help in building up the third important road in Frederiksberg. The company's Tarimagsgade line has also been an assured success from its first day of operation in 1882. What influence the line has had upon the population of the area served is difficult to say, but as a connecting link between the two main centers in the east and west its performance is conspicuous. When the line was to be built bonds were issued, but they have been completely repaid out of the earnings, hence the company has very low capital liabilities per mile of track. The line is worked by single horse cars, following each other on a headway of 3 minutes. The cars go unusually fast, 9 miles an hour, or faster than is allowed by the British Board of Trade on tramways operated by mechanical power. The operating expenses are only a trifle more than 51 per cent of the gross receipts, and these again amount to about 130 per cent of the capital originally invested. The company's financial position is marvelously good.

The effect of the tramways in increasing the value of property is shown in the following table, based upon insurance valuations:

INSURED VALUE IN BUILDINGS IN COPENHAGEN.

	Inner Copenhagen.	Outlying districts (except the Southern).
1860	$36,189,000	$7,000,000
1870	44,444,000	11,142,000
1875	50,109,000	20,144,750
1880	53,357,000	27,456,000
1884	57,743,000	40,063,000

Per cent increase for the old part, 60; for the new parts, 471. Total insurance value, 1884, $97,806,000; 1895, $135,500,000. Per cent increase, 39.

As the most important section of the Copenhagen tramway system is that located in Frederiksberg, it is natural that this suburb, or really village as it was in 1860, has benefited to an astonishing degree by being connected to Copenhagen by three different tramway companies, so that now Frederiksberg is generally considered as a fine and attractive part of the metropolis.

The increase of Frederiksberg's population has been as follows:

1860.	1880.	1890.	1895.	1896.
8,164 inhab.	26,150	46,954	56,100	60,000 (approx.)

The first tramway was opened in 1862 and the last one in 1884, and in thirty years the population has increased approximately 500 per cent. The increase due to immigration is almost four times greater than that due to excess of births, and the insurance value of the buildings has been raised from $5,000,000 in 1870 to $13,000,000 in 1884.

The following table will show passenger traffic on the tramways during the last thirty years:

	Population.	Passeng. carried.	Rides per cap. and year.	Receipts from each passenger.
1863 } English				
1864 } prop-		959,000		
1865 } erty....		1,534,000		
1866	202,000	2,373,834	11.7	2.7 cents
1876	332,000	7,940,234	23.9	3.0 cents
1886	340,000	15,728,399	40.0	2.6 cents
1895	408,000	23,500,000	57.6	2.6 cents
1896	424,000	25,965,750	61.0	2.3 cents

It may be of interest here to mention that the average receipts from each passenger on the private steam railway lines is 16 cents, and the average length of journey is about ten miles.

All of our tramways except two are inside the "horse car limits," so that horse traction has been able to make a good showing. In the matter of speed, the most important advantage of electric traction, the horse cars are not much inferior to any electric system, since it would be impossible to increase the speed of electric cars much above that of the present horse cars.

The number of rides per capita and year is astonishingly small. It is true that a rapid increase is shown from 1866 to 1886, but that can be attributed largely to the construction of new lines. If the figures showing the yearly rides per capita are compared to those of other cities, Copenhagen will be at almost the bottom of the list, Edinburgh only having a still smaller number of rides per capita. In the writer's opinion this fact can be explained only by assuming that the population in the old city never rides. In the period 1886-96, when the tramway system was not subjected to important changes, the increase in number

of rides per capita year was almost nothing, a circumstance which may lead to the conclusion that the passenger traffic on the present system has practically reached its maximum. It may be difficult, therefore, to realize any considerable increase in earnings (gross receipts) if the lines, as they are, should be converted to mechanical traction, a conclusion which can only be strengthened by mentioning that the increase in gross receipts on the accumulator line is only 5.72 per cent more than when the line had horse traction (1897-96). These circumstances point strongly to the necessity of opening new districts by increasing the length of the present lines and by adding new ones.

There can be no doubt that if this is done mechanical motive power will not only show itself to its best advantage, but the inhabitants of Copenhagen will avail themselves to a large extent of the improved and modern means of transportation afforded.

The rapid rise in number of passengers carried, as shown in the tables given, point naturally to the conclusion that the inhabitants of Copenhagen, especially those in the suburban and outlying districts, are good patrons of city transportation systems.

To explain the very slight increase shown by the first electric line, it is enough to mention that the conversion of this line to electric power was not followed by any increase in speed.

All concessions for the present tramway system in Copenhagen were granted by the Government prior to 1880 and according to the tramway law of Jan. 23, 1862. They were for a period of from thirty to forty years (forty years in one case only), and were upon the condition that the lines, when the concession expired, should revert to the Government. This reversion, however, does not include the cars, horses, buildings, etc.

The concessions after 1880, so far as Copenhagen is concerned, were given by the magistrate and County Council, and were generally for thirty years. These concessions state that the municipality at any time shall have the right of purchasing the line and all its accessories for a price to be fixed by arbitration. As in the Government concessions, the grantee or operating company is required to maintain the pavement between and 18 ins. outside the rails; but in no case have the companies to pay taxes on either gross receipts, capital, track or rolling stock. No workman cars are required, and there are no restrictions as to fares, headway, etc. In the two last municipal concessions, however (of which the last one belongs to the Copenhagen Tramway Company) it is provided that if dividends in excess of 6 per cent on the capital invested be paid, such excess shall be divided equally between the municipality of Copenhagen and shareholders. The last concession also limits the fare on a certain part of the route to 1.34 cents.

The first Government concession to expire was that given to Nörrebros Sporveis-Selskab (the Northern Tramway Company), viz., on Dec. 31, 1896, at 12 P. M. In 1902 (but in different months) the expiration of all the most important concessions will follow. In fact, only those of Companies V. and VI., with a few other short lines, will remain in force after that date.

From the last few lines it will be seen that important changes must take place before long, and also that the much-debated question, municipal or private ownership, must be settled soon.

It might be admitted, perhaps, that the conditions upon which the present concessions are granted are, on the whole, most favorable, and no doubt this is one of the factors by which the present high dividends can be explained, but, on the other hand, these dividends have been the occasion of most exaggerated ideas generally prevalent as to the financial results of working tramways. Moreover, it is the common opinion that electric traction is so much cheaper than horse traction that interest upon the increased capital can be paid through the saving in operating expenses only. On the other hand, the fact that almost all of our lines are within the "horse car limit" is overlooked.

As the Northern Tramway Company had paid during its thirty years' operation a dividend averaging more than 12 per cent, it was evident that its concession would not be renewed without the imposition on the company of heavy financial burdens. An indication of the future policy of the city was shown in the passage of the new tramway law of April 10, 1895, which permitted the substitution of electric, gas or other traction for animal power, or its use on a new line, but provided that the municipality could take over the system at any time desired, instead of the State, by paying the latter 10 per cent of the capital invested. It could then operate the line directly or lease it to private parties.

As the Northern line was a marvelously good one, it was no wonder that the County Council at once decided to take it over. But the question as to its operation was not so easily solved. The Social-Democratic and Liberal members were in favor of municipal operation, but they were opposed by the Conservatives, supported by the Magistrate, and, having the majority, municipal operation was rejected, and it was decided that the line should be leased to the highest bidder.

Of the conditions imposed the following only need be mentioned:

1. Mechanical traction was compulsory, but only electric traction was allowed.

2. The contractor was obliged to take his current from the municipal lighting station (situated very close to the terminus) at the enormous rate of four cents per k.w. hour.

3. The present wages were not to be decreased, and after twenty-five years' service the men should be entitled to a pension of 66 2-3 per cent of the average wages paid them during the three previous years.

4. A tax was imposed upon gross receipts.

Only five tenders were received. Among them was one from Messrs. Siemens & Halske of Berlin, which was accepted. That firm offered to install accumulator traction and to pay 20 per cent of gross receipts to the city.

The horse car company was accordingly dissolved, and the cars and horses sold at public auction last summer. The shareholders received three times their capital invested (they got exactly $290 for each $100 par value—the balance was given to the employees), and in the first half of January, 1897, the first accumulator cars were put in operation. It was not until May, however, that the conversion was completed, and the last horse car disappeared from the line. Nothing can yet be stated as to the financial results, as no figures have been published, and all information regarding the operation has been refused, but that the operation is not a success from the public's point of view is certain. Several accidents have taken place, and the service has been irregular. Again, the line has not been extended, and the fares have remained the same, so it can be understood that the public is somewhat disappointed as to the merits of electric traction.

The writer has been able, however, to obtain the exact operating income for the first year, 1897. That is only

5.7 per cent in excess of the operating income in 1896 (horse traction). It may be mentioned that the year 1896 was by no means an especially good one for the horse car company, so the increase between 1895-97 is still less than that between 1896-97. Expressed in per cent of capital the "electric income" is equal to 46 per cent, against 101 per cent for the "horse income" in 1896.

In the summer of 1896 a new plan was proposed. A syndicate had bought Frederiksberg Tramway Company and the Falkoneralle Company (Companies III. and V.), the former for 200 per cent and the latter for about 160 per cent of the original capital, and an application was made to the Frederiksberg County Council for a concession for forty years and for installing the electric trolley system. The current was to be supplied from the company's own station, which was also to furnish current for lighting. The concession was granted in the early beginning of 1898. By its terms the Frederiksberg municipality can take over at any time either the total installation or that part furnishing the lighting current only at a price to be agreed upon. After having put aside a reserve fund for renewal of capital, the complete amortizement to take place in forty years, and other funds to meet extraordinary repairs and renewals, the shareholders are to have 5 per cent, and any excess earned is to be divided in certain proportions between the municipality and the shareholders. At the end of the concession the municipality can buy the total installation for 125 per cent of the capital invested.

The lines to be converted will form a belt route, and beyond any doubt will be a very expensive installation, as large sums must be spent for special work, mostly due to the narrowness of the streets. Another drawback is that the valuable route through the old city must be operated separately by omnibuses; thus people will have to change cars, and the value of the present direct route will be much diminished. Operation is to be commenced, it is said, in June, 1899.

If compared with the English concessions the above conditions are by no means severe. It may be noted especially that no charges are imposed against capital or gross receipts. Some years ago a concession was given for an electric tramway, to be constructed on the Island of Amager, connecting several villages here. The starting point was at the end of the present tramway line to Copenhagen. The concessionaires were French and Belgian, but as the necessary capital could not be raised the concession was lost, and will not be given again to the same concessionaires. There were no public taxes.

Just as the STREET RAILWAY JOURNAL is to go to press it is announced that almost the same syndicate as that in Frederiksberg has purchased the present tramway and omnibus companies in Copenhagen, and will form one large company, and convert the whole system to electric traction, or, perhaps, compressed air. The company will operate under a forty years' franchise. At the time of writing the details of the concession could not be secured.

There is no doubt that cable traction would have been a marked success on many routes, but that system has not been seriously considered. In the writer's opinion a new era will commence for this system when Messrs. Dick Kerr & Company have finished the large Edinburgh installation.

Outside Copenhagen, even in cities from 20,000 to 70,000 inhabitants, there are no tramways in Denmark, although there are a few omnibus lines. Nor is any attempt being made of converting some of the private railway lines to electric traction, nor of installing electric lines for light railway service. In this field much more will surely be done than on the present horse car lines. Electric tramway lines in the vicinity of Copenhagen, and either operating in connection with the present inside system or extending their own track into the city, would undoubtedly prove profitable.

Repair Shop Practice

The development of the modern electric railway motor has taxed the ingenuity of railway managers and master mechanics in devising special appliances for facilitating the repair of electrical apparatus and its handling in the shop. Many of these are of an exceedingly ingenious character and add very much to the efficiency of a repair shop, while at the same time they simplify the work carried on at those points. They are the outcome of a great deal of experiment, and every shop boasts usually of some special appliances for accomplishing some particular character of work.

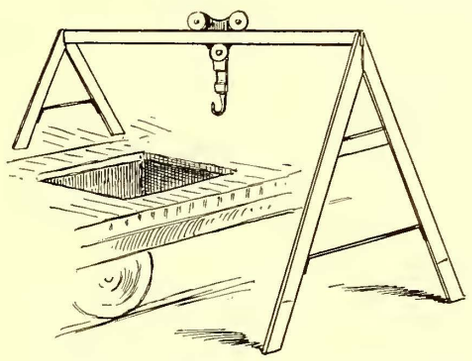


FIG. 1.—ARMATURE HOIST FOR OPEN CARS

Among those shops which have been particularly notable in the production of devices of this character are those of the Staten Island Electric Railway, the devices used being principally the inventions of the general manager, J. Bernard Brophy, and the master mechanic, H. S. Kemp. Some of these are illustrated herewith.

Fig. 1 shows a method of lifting armatures of the G. E. 800 and G. E. 1200 type of motors from an open car.

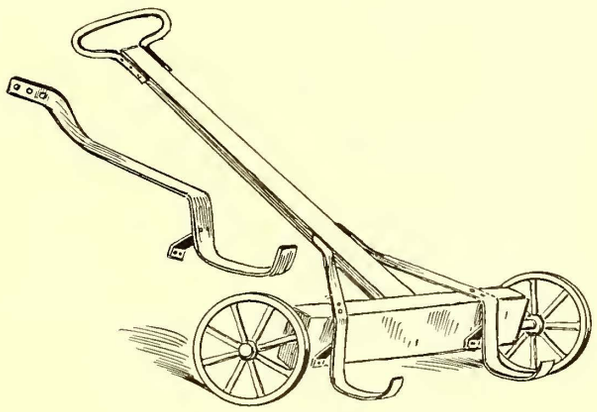


FIG. 2.—ARMATURE CRADLE

These have to be removed from trap doors located in the floor above the motors. The device consists of two "A" shaped pedestals of wood tied with iron, one arranged to rest on the floor of the car, the other on the floor of the shop and connected by an iron bar which fits into slots at the top of each "A" shaped pedestal. Upon the car runs a Harrington hoist, by which the armature is lifted out of position or replaced much more easily than by the tripod arrangement. Of course, this device is inapplicable to

closed cars, but for open cars it has proved most convenient.

Fig. 2 shows the armature cradle employed in the Staten Island shops, and, as will be seen, it differs somewhat from those which have been previously illustrated, being of wood, tied with iron straps, and therefore much lighter than if made entirely of metal. Its general construction is shown so clearly in the engraving that no special description of it is required. The wheels are fitted with rubber tires, so that it runs easily and noiselessly about the floors.

The oven for baking armatures is shown in Fig. 3. It consists of a sheet iron chest containing two ordinary Consolidated electric heaters, and has been found most convenient for the purpose for which it was designed, as the heat can be much more closely regulated than in most ovens of this character. It is large enough to accommodate two armatures, as well as several field coils, at the same time.

Fig. 4 illustrates a little kink employed to lock fender brackets in place. The Consolidated fenders are employed, and the lock consists simply of a U-shaped iron wire,

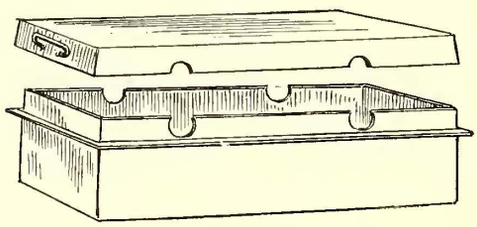


FIG. 3.—BAKING OVEN

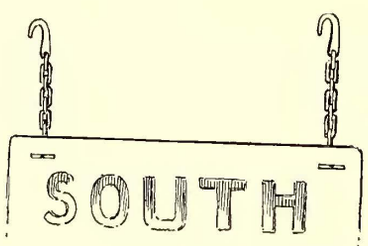


FIG. 5.—REVERSIBLE DASH SIGN

which is slipped through one of the holes in the fender support directly above the bracket, and prevents the latter from jolting out of position.

Fig. 5 illustrates the form of sign hangers used for the platform signs. It has been found more desirable than the use of a double hook, and the sign can be reversed as easily.

All the cars of the company are equipped with the usual four-way deck signs, but the routes of the company are so many that the four sides of this sign are not enough to show all the routes. The auxiliary signs are therefore made as shown in Fig. 6, of the same size as one of the sides of the deck sign, but fitted with small hooks so that they can be slipped over the latter to show a route which is not indicated on the permanent sign.

Fig. 7 will give an idea of the kind of jig used in casting armature bearings. It is hinged and in two parts, making it much easier to remove the bearings than if a solid jig were employed. The core is shown next the jig. The jig is of brass, as this has been found to be more durable than cast iron.

The car house of the company measures 220 ft. front by 155 ft. in depth. It is of skeleton steel structure, the trusses being supported on steel columns, between which there is a brick curtain wall 12 ins. thick, with 4 in. pilasters. Two 8-in. brick walls carry the full length of the building and divide the entire building into three parts, thus reducing the rate of insurance, as well as cost of heating, since only part of the building needs to be heated at one time. The trusses are carried on 8 x 10 in. hard pine timbers supported on 8 x 8 in. hard pine posts, 10 ft. centers. The posts are set on iron plates on concrete foundations and are securely braced together. There is a 4 ft. 9 in. pit, or basement, under the entire building, so that every track is quite effectively supplied with a pit. The floor is of concrete 4 ins. in thickness and is drained toward a common center.

FIG. 6.—AUXILLIARY DECK SIGN

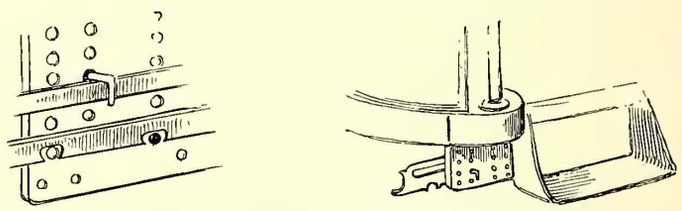


FIG 4.—FENDER LOCK

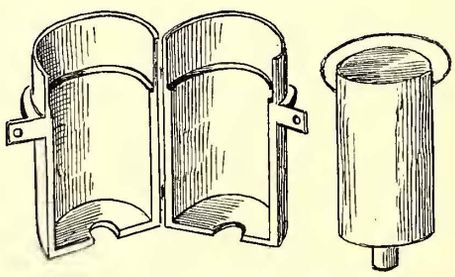


FIG. 7.—JIG FOR CASTING BEARINGS

It was electricity, applied to the movement of street cars, that solved the gravest problem of our city life. The census of 1890 showed that in but a single district in a single city of the United States had there been any increase in the density of the population. In every other district of that city, and in every other city, while the cities themselves had grown beyond example and comparison, the population was less dense, and the problem was on its way to its ultimate solution. No longer people are gathered, by the hundreds and even the thousands, into tenement houses, but they are carried miles into the suburbs, where they may have the enjoyment of fresh air and sunlight, and where the trees of the forest may furnish a border to the landscape about them.—From a paper read at the St. Louis, Mo., Convention, 1896.

These great Falls were worshipped by our red brother; the venturesome explorer and historian dipped his pen in consecrated fluid as he wrote reverentially of their grandeur; the poet and the maiden everywhere have sung of them in enchanting praise; reverence and poetry and romance have characterized the stories which tell us of them; but the matter-of-fact Yankee of to-day, casting reverence and poetry and romance to the winds, has harnessed them like an old plow-horse, and compelled them, just as subserviently, to do his bidding; they make heat and light, and power for all purposes; they revolutionize the processes of the manufacturer and the chemist, and ere we meet here again they will, without doubt, have been saddled with the menial duties of cooking and washing and tilling the soil of all the country round.—From President's address at the Niagara Falls Convention, 1897.

LETTERS AND HINTS FROM PRACTICAL MEN.

Pressing Wheels on Axles

Schenectady Railway Company,
Schenectady, N. Y., July 10, 1898.

Editors Street Railway Journal:

Referring to the article of Mr. Leverich in April issue in regard to pressing wheels on axles, and to the comments of Messrs. Magee and Lobdell on same in the June issue, my experience has been that the point made by these latter gentlemen is correct, and that the relations of bore of wheel and size of axle wheel-seat must be empirically determined in all cases where the density and elastic limit of both wheel and axle are not accurately known.

In the case of the axle this can and should always be known, as the products of the hammer and rolls have attained such perfection that axles can be obtained of any desired characteristics. But with cast-iron wheels, especially when surface-chilled, the case is different. With the most careful and conscientious admixture and melting of iron the characteristics of the resulting castings will vary, not only from heat to heat, but from ladle to ladle of the same heat, and even from different pourings from the same ladle.

With this one controlling fact in view it is easy to see that the establishment of any formula for the relation of diameter of axle wheel-seat to the bore of the wheel is, if not impossible, at least commercially impracticable.

What is, however, both possible and practicable is the establishment of a "mean effective pressure" for use with axles and wheels of certain sizes, proportions and uses. That is to say, the arrangement of a table of pressures which has been empirically determined by the different manufacturers and users as being those which have in actual use given the greatest cohesion between wheel and axle with the least strain on the wheel or its hub.

By actual practice wheel manufacturers have found that with a wheel of certain dimensions and having a certain service to perform a certain minimum number of tons pressure will keep that wheel tight on its axle during its life and without bursting its hub. If these results of practice were collected and collated in a table or tables, and to such tables were added the data concerning the dimensions of the hub and in what manner its strength was reinforced (or weakened) by the character of the web, arms or rim, we would then have in practical form data that would give the best results of modern practice, and that would be of great and mutual advantage and practical use.

The data required would be about as follows:

1. Diameter of bore of wheel (nominal).
2. Length of bore of wheel.
3. Outside dimensions and general shape of hub.
4. Character of arms, web or rim, as affecting strength of hub.
5. Diameter of wheel.
6. Weight of wheel.
7. Service to which wheel is to be put.
8. Material of axle.
9. Finish of axle-wheel seat (i. e., whether dead smooth, fine or coarse tool-cut).
10. Tons pressure—minimum and maximum—allowed in actual practice in pressing such a wheel on its axle.

Can you not, therefore, prevail on the wheel manufacturers—and also on such street railways as do their own wheel-fitting—to give the results of their experience in this matter, at least in regard to those sizes of wheels and axles most used under electric cars and trailers?

I think that the publication of these would be rather of a mutual surprise in regard to the diversity of practice as regards some of the items, and the uniformity as regards others. It might even lead to an averaging of results from the different tables that would give figures that would take the place of formulæ, and so bring us that much nearer to that long-looked-for-and-at-present-very-far-off "Electrical M. C. B. Standard!"

H. S. Cooper, General Manager.

Regrinding Car Wheels

New York, July 15, 1898.

Editors Street Railway Journal:

In your July issue I notice an article on grinding car wheels, in which you say: "Many superintendents who ask the question, Does it pay to grind car wheels? say their experience with wheels which have been re-ground has not been satisfactory." The writer having been interested in this particular branch of business for the past ten years, more particularly in steam roads until the past two years, has given the subject a great deal of study and has had considerable experience, and when reading your article it occurred to him that it was more than probable that the majority of superintendents who thought grinding the wheels was not practical were themselves in fault by not giving the theory an honest test. In the first place, we ought not to let anything get beyond repair if we intend to repair it. It is an actual fact that the writer has had street car wheels sent to him to be re-ground when there was not one-sixteenth of an inch of the chill left below the flat spot. The patient was practically dead before the doctor was called; therefore, the writer believes that with those who are unsuccessful the principal evil is procrastination. The wheel is lost before they try to save it. If car wheels are properly looked after, and the proper machine is used, there is no question but what there is a large saving in grinding them. It has been and is being demonstrated by some of the largest steam railroads in the country, as well as many of the electric roads.

Below we give you a few figures computed by one of our largest steam railroads in this country, which show that oftentimes more mileage is obtained from wheels ground even the second time than was made in their first run.

1st Mileage.	1st Grinding.	2d Grinding.	3d Grinding.
2684	9039	25163	14724
24788	1712	9027	
19991	30684		
2442	36096		
19601	9155	28325	
36377	5729	11333	15972
4872	9867	48416	
264	35007	41057	
390	37685	8054	11054

It will clearly be seen by the above figures that it is a fact that the second and third life (if the wheel is not destroyed before it is attended to) is often greater than the first. To have wheels properly ground they should be ground with a machine which will leave them perfectly round, and the machine to accomplish this should be constructed very rigid, with head and tail stocks, as well as wheel heads, on one solid and rigid base to avoid any spring. If the wheels are removed when they first become flat and are ground as above described, no management would say that it did not pay to regrind street car wheels.

G. W. J.

Power Consumption in Rapid Transit Service

2 HOLFORD ROAD, HAMPSTEAD, LONDON, N. W., July 5, 1898.

EDITORS STREET RAILWAY JOURNAL:

The article in the STREET RAILWAY JOURNAL for June by Mr. A. H. Armstrong raises a point of some importance for those interested in electric railway work. The article referred to is based upon the assumptions that for rapid transit service the best results are arrived at with uniform acceleration up to full speed, and also that when full speed has been reached it is better to allow the train to "coast" than to allow it to be driven by the motors at a uniform speed.

With the former assumption I have already dealt in a paper recently brought before the Institution of Electrical Engineers in London. I would now ask your permission to make a few remarks upon the latter assumption.

Throughout Mr. Armstrong's article the only two items of energy expenditure considered are those for acceleration and friction. He takes no account of the item for C^2R losses in the starting rheostat and in the motors. These cannot, however, be neglected, and in fact they are so large a part of the whole expenditure of energy that they seriously modify results obtained by omitting them.

Let us take the case considered by Mr. Armstrong in discussing the question of the relative values of coasting and uniform speed-running. He shows that in order to cover a distance of one mile with a total accelerating force of 60 lbs. per ton (of 2000 lbs.), and with a frictional resistance of 20 lbs. per ton, the train must accelerate up to 41.4 miles per hour for coasting, and to 35 m.p.h. for uniform running. The time required to do this will be 63 seconds in the first case and 53 seconds in the second, by calculation.

I will follow Mr. Armstrong in assuming that we are able to accelerate uniformly up to full speed in each case. This practically means neglecting the resistance of the motors, which we may do for the present.

Since the acceleration is the same in the two cases, and since the final speeds are as 41.4 to 35, it follows that the magnets of the motors for the coasting method must be weaker than the others in the proportion of 35 to 41.4; and since the acceleration is the same in the two cases, the current taken by the coasting motors must be greater than that taken by the others in the proportion of 41.4 to 35. Hence, not only is the starting current passing for a longer time, but it is also greater with the coasting method.

To fix ideas, suppose our train weighs 100 tons, and that the tension of the line is 500 volts, the driving wheels 33 in. in diameter, and the gear ratio 4.78. Then we should require, with two motors, 655 amps. per motor for 63 seconds for coasting, and 552 amps. per motor for 53 seconds for uniform full speed running. Series-parallel control will halve the C^2R losses, and give us 76,000 foot-pounds of energy per ton for coasting, as compared with 53,700 foot-pounds for uniform running.

Mr. Armstrong gives the total energy for acceleration and friction as 162,000 for uniform running, and 146,000 for coasting. I think he does not here make the best of his case, for I find the numbers to be 174,900 and 151,700, respectively, and shall take these values.

It appears, then, that in the coasting method the C^2R losses are about equal to one-half of the expenditure for acceleration and friction, or one-third of the total expenditure. We have, however, been neglecting the resistance of the motors. If we suppose each motor to have a resistance of 0.04 ohms we shall get for the coasting method a loss during acceleration of 7900 foot-pounds, and for the uniform method a loss of 4700, and a further loss of 1300 when running at full speed. These results may be tabulated as follows:

	Coasting.	Uniform running.	
Acceleration	113,500	80,700	
Friction	38,200	94,200	
C^2R losses	83,900	59,700	
	235,600	234,600	ft.-lbs. per ton.

It would seem that while the C^2R losses can by no means be neglected, there is little to choose between the two methods as far as total expenditure of energy goes.

We must bear in mind that 30 per cent more heat is generated in the motors with the coasting method than with the uniform speed method, and this is a serious disadvantage. The maximum current from the line also is 20 per cent greater, a fact which tends to increase the objectionable peaks in the load curve at the power house.

CHAS. A. CARUS-WILSON.

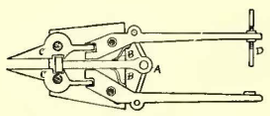
Tool for Straightening Out Wires

BOSTON, MASS., July 19 1898.

EDITORS STREET RAILWAY JOURNAL:

A mechanic at the West End Railway shops here uses a new style of tool, made by himself, which has for its object to provide a strong and efficient tool for drawing back into place and straightening the wires of armature windings. As is known, in practice it frequently happens that one or more wires may be bent or twisted out of place. Where the wires are but slightly bent, it is now the practice to bend them back by hand with a fine pair of pliers, but when the wires are too badly bent or twisted out of shape and cannot be corrected, considerable trouble arises. The cut is a side view, illustrating the manner in which this tool may be used for straightening the wires.

Examining the accompanying illustration, it will be seen



TOOL FOR STRAIGHTENING BENT WIRES

that the body portion of the tool is formed by side plates having a recess or opening. Pivotally mounted in the side plates are operating handles. Threaded into one of the operating handles is a set screw. The movable jaws are made of hardened steel. The retracting connections comprise the toggle-links, which connect the operating handles to a link (A), which in turn is provided at its end with a T-shaped head for engaging notches in the movable jaws. Springs (B) are secured to the operating handles and engage the link to normally keep the handles open. The fulcrum-plates (C) are pivotally mounted in the side plates and can be adjusted to vary the width of the opening between the movable jaws by means of screws tapped into removable pieces or keys. The tailpieces of the jaws are arranged to engage notches in the ends of the operating handles. By means of this construction when the operating handles are moved toward each other the jaws may be closed upon the wires and the toggle-retracting connections will exert a tension or pull on the wires, so that the wires will be efficiently straightened and brought back to proper position. The stroke of the movable jaws or the distance which the same can be retracted can be adjusted by means of the set-screw (D). Any mechanic can make this wrench.

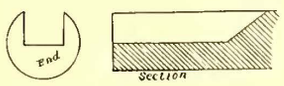
B.

Tool for Boring Wire Holes in Walls

Omaha, Neb., June 2, 1898.

Editors Street Railway Journal:

It often becomes necessary to drill holes through the walls of a car house or power house for wires. This is an easy thing to do if the proper tools are used. I have been employing, for this purpose, the home-made device shown in the accompanying drawing. To make this tool, take a half-inch round soft steel rod a foot long. Cup out one end and round off the other, and then mill a channel



about 9 ins. long and back from the cupped end. Let this channel be about 5-16 in. wide, with a thickness of metal of 3-32 in. at each side and 5-32 in. at the bottom. A 3-16 in. hole is then drilled through the rod about 3-4 in. from the rounded end, and a piece of stiff wire 6 ins. long run through it, and slightly swaged at the ends to prevent it from pulling through. With this tool, used with an alternating rotary motion, brick and plaster are easily and cleanly bored without the aid of a brace. R. D. F.

New Type Controller for Electric Cars

By John C. Henry.

During the past year the writer has been engaged in the development of a new method of control for electric cars, which is named "the regenerative system," a brief description of which was published in the principal electrical papers last summer.

The system consists mainly of a combination of the features of the series multiple control, electric brake, and independently excited motors. After making hundreds of tests, the great majority of which were failures, we have succeeded in producing a street car controller which has great advantages in economy over those in common use.

For traction purposes an independently excited motor has about 25 per cent greater capacity than a series motor of the same size and cost. To explain, it is well known the capacity of any form of motor is limited only by its ability to withstand heat. It is also well known that the heating effect in the conductors is proportional to the density of the currents. It is also well known that in order to secure light weight, compactness, etc., the efficiency of railway motors is not high when they are working hard or when they are over-loaded. The field magnets absorb about 25 per cent of the energy. Theoretically they should absorb none. The best dynamos do not require over 1 per cent of their energy in magnetizing their fields, and the earliest dynamos and motors made used permanent magnets for fields, which required no expenditure of energy. What is needed is a magnetic abutment. It is not essential whether it be in the form of temporary or permanent magnets, providing it is strong and compact enough.

Now, by way of illustration, say, to do a certain work, the motor (either the series or independently excited kind), requires 100 amps. at 500 volts pressure. In the series motor the armature and fields would heat badly because they have to carry the entire current, while in the other case the armature would have to accommodate but 75 amps., while the fields provide a path for the balance. The heating effect is consequently decreased 25 per cent just at the desired time.

Our claims to improved efficiency will be readily appreciated in considering the following points: Tests made on the principal street and elevated railways in the country show that about 60 per cent of the total energy used by the cars is absorbed in getting them under headway. The most popular controllers now in use have eight running positions, six of which waste energy by passing the entire current through dead resistance. With our controller we use no resistance in the armature circuits. Our regulation is done by the smaller member, i. e., the fields, which ordinarily handle but about 10 per cent of the current, and at no time over 25 per cent of it. The other principal saving comes in by recouping current to the line. It takes nearly as much power to stop a car as it does to start it. In stopping, our motors automatically become dynamos and generate a current to the line, thus relieving the station dynamos, feeders, etc.

High speed of the car is automatically maintained in the suburbs where the voltage is low. The explanation to this is the strength of the fields are controlled by the line voltage. When it is low the weaker fields allow the armatures to take more current, and consequently they tend to run faster, but with less torque. In consequence of these influences the speed of the car remains about the same as when it is near the power station.

The greatest advantage of the system is in the ideal way in which it brakes the car without friction, avoiding flat wheels, etc. By simply turning the controller handle backward the car is readily stopped, smoother even than with the air brake, or it is retarded on descending grades, and any desired speed maintained by regulating the controller handle. The breaking is all done by the armatures, without any additional mechanism. Braking through the gears has frequently been referred to as objectionable, but such conclusions have certainly been reached without proper consideration. The braking of motor cars by hand brakes brings about as much strain on the gearing as when it is done by the armatures. If the reader has any doubt about this point, let him examine the gearing from a single ender car and he will find the teeth are worn just as much on one side as on the other.

On many roads rapid acceleration is desired. This is within easy reach with our form of control, and may be obtained in a much more economical way than is possible with series motors. In series motors heavy currents are necessary to speed up the armatures quickly, while these same heavy currents must pass through the fields which strengthen its magnetization and in turn tend to retard the armatures. Rapid acceleration with series motors is only obtained with abnormal currents in the armature and using the same currents in the fields, which are generally saturated with the more moderate currents. Consequently the excess current does not check the armature, but its wasted energy is absorbed in heating the fields, increasing their resistance, which in effect is the same as if idle resistance was inserted in the main current.

While the same theory applies in series motors, with them it has but a small fraction of the force, as in the former the voltage across the fields is the maximum from the line, while in the series motor, in excessive cases, it would not be over one-quarter of this.

The most frequent cause of injury to motors is the "back kick," which occurs when the circuit is broken. This is generally the cause of grounding motors. The pressure of this induced current, which is higher than that from the line, depends mainly on the rapidity of the break, and on the number of convolutions on the field coils. Principally for this reason shunt wound motors have not been used for traction purposes. There are two ways to avoid this danger. The first, to wind the magnets with heavy wire, which is not practicable. The second, to provide a better path for this discharge than through the insulation. The pressure of this induced current is proportional to the resistance it encounters; in other words, it could not kick without resistance to kick against. If we short circuit the fields there is no kick, because there is no resistance. If, instead, we place them in parallel with the low resistance armatures the kick is insignificant. To avoid this flash we place a non-inductive resistance of small carrying capacity within the controller, and arrange it so that it is connected in parallel with the fields whenever the armature circuit is opened independent of the fields. The same resistance may be used in special cases to protect the motors from lightning by using a supplementary switch.

When running with the motor in series the adhesion is greatly improved. The motors may be connected together so that any tendency of one of them to race is instantly and automatically checked by its current supply being decreased and that of its mate increased. In the ordinary method of connecting motors the reverse is the case; that is, the slipping of the driving wheels of one motor decreases the torque of the other.

The series-multiple method of controlling motors looks very simple, but it was canvassed over a long time before its success was assured. To change a pair of motors which are using a heavy current from 250-volt to 500-volt machines in a fraction of a second without injurious arcing of the current, or mechanical strains on the machine and car, is the requirement. It was first met by Mr. Potter in a unique way; that is, by short circuiting one of the motors. In doing this the motor starts to act as a dynamo and generates just sufficient current to counteract the residual magnetism in the magnets, which, if it were allowed to remain, would be sufficient to cause a tremendous current to be generated in the armatures. In changing the armatures in the regenerative system from series to parallel this same method could not be employed.

Instead, we short circuit one of the armatures with resistance, leaving the fields excited. The resistance is predetermined, and arranged so that the armature, although revolving under strong fields, has its tendency to generate in the short circuit. Counteracted by the line currents, which attempt to drive it as a motor, these neutralizing forces permit the armature circuit to be broken without any flashing. Another method of changing the armature from series to parallel is to break the circuit when the fields are weak and connect them in parallel under the fields when their strength has been doubled.

In the regenerative system the reversing is done by the fields instead of the armature. Provision may be made within the reverse switch, whereby putting the reverse handle in a second notch connects the fields from series to parallel, thus providing for great torque or braking force. This is operative only while the motorman has the reverse handle in the second position, and is intended for use in emergencies only, such as starting heavy loads, pushing disabled cars up short heavy grades, or for emergency braking stops to prevent accidents.

With the regenerative system the car must be accelerated by moving the controller handle slowly, instead of depending on the gradual automatic reduction of the field's strength, as in series motors. It is also very important that the controller be turned off slowly, because when the handle is back in the starting position the car is at a stand. A quick sweep of the handle backward would make a stop too sudden for the passengers.

In the regenerative system arc extinguishing devices, such as magnetic blowers, etc., are not necessary, as, owing to the small number of turns on the armature the self induction and arc formed on breaking its circuit is very small as compared with that of series-wound machines.

Another reason is explained as follows: When running with any form of motor the back pressure is nearly the same as that from the line; say, on a railway circuit it is 480 volts where the line voltage is 500. (Now, if these pressures were equal, there would be no current flowing in either direction.) If we break the armature circuit where the motors are in series the back pressure decreases as the fields are weakened by drawing out the arc, so that at the time the arc is ruptured there is a difference of 500 volts potential between the contact points. In the regenerative system we break the armature circuit and maintain the fields at full strength, so that the back pressure is not reduced, and the difference of potential between the points of contact is but about 20 volts, as compared with 500 with the series motors.

Power Station Tests

A test of the power plant of the Brockton (Mass.) Street Railway Company, by Stone & Webster. The test was made to obtain the following information:

Boilers—Evaporative performance. Commercial horse-power. Rate of combustion. Rate of evaporation.

Engine—Speed regulation. Power and efficiency.

Generator—Efficiency and capacity. Temperature under load.

The boilers are of the vertical type and are rated at 200 h.p. capacity each. They are 90¾ ins. in diameter inside the smallest ring, and each has 222 tubes which have an outside diameter of 2½ ins. and are 15 ft. long.

The engine was made by the E. P. Allis Company and is of the Corliss type, cross compound, condensing, and running at 110 r.p.m. The cylinders are 20⅛ ins. and 38 ins. x 48 ins., and the vacuum is obtained by use of a 24-in. x 12-in. Reynolds Independent steam power air pump and jet condenser. Direct connected to the engine is a General Electric ten-pole 500-k.w. generator.

The boiler feed water is taken from the city mains and is pumped through the main heater in the exhaust pipe, then through an auxiliary heater which takes the exhaust steam from the feed pumps and the condenser cylinder and then from the auxiliary heater directly into the boilers. The results of the tests are given below:

GENERATOR TESTS

The first tests were made on the generator alone, and may be divided as follows: Measurements of resistances of armature and field coils. Measurements of external characteristic. Measurements of potential around commutator at no load and at half load. Measurement of the efficiency of the generator by the stray power method.

First.—The resistance of the armature was measured by placing it in series with a water rheostat and connecting it to the 500 volt bus-bars. A current of about 100 amps. was then allowed to flow and the drop in pressure between the armature terminals measured. Fifteen separate readings were taken, the armature being moved slightly after every fifth reading.

The resistance of the series coils was measured in a similar manner to that of the armature and the resistance of the shunt coils was obtained by reading the current and the pressure at the terminals of the coils.

Resistance,	average armature	0,0189 ohms
"	Series field	0.0026 "
"	Shunt field	47.1 "

All resistance measurements were made after the machine had been running a sufficient length of time to fully heat the coils.

Second.—To obtain the external characteristic the machine was run at constant speed and loaded by connecting a large water rheostat across the terminals. The current was gradually increased from 0 to about 800 amperes, and simultaneous readings were made of the current and voltage. The results obtained showed a gradual increase in voltage from 500 at 0 amps. to about 510 volts at 800 amps.

Third.—In order to get the curve of pressure around the commutator, a wrought iron ring was made of slightly greater diameter than the commutator. This ring was mounted on the machine so that its center corresponded with the center of the main shaft, and arranged in such a way that it could be turned by hand. An arm carrying a small carbon brush was fastened to the edge of the ring in such a way that the brush could be pressed down on the commutator when readings were to be taken.

The method of making measurements was as follows: One terminal of a voltmeter was connected to one of the machine brush holders, and the other terminal to the arm and small brush on the edge of the ring; the brush was pushed down against the commutator and a reading taken. The ring was then moved through an angle of 5 degs. and another reading taken, and so on until measurements had been made entirely around the commutator.

The results obtained showed only a slight divergence from the true sine curve.

Fourth.—In order to test the efficiency of the generator, it was decided to run it as a motor, taking current from the 500 volt bus-bars. The connecting rods were disconnected at the crank pins and the valve rods at the rocker arms, leaving the machine in such a condition that on starting up the only moving parts were the main shaft with the armature, flywheel, and crank discs and the eccentric straps and valve rocker arms. The shunt field was then connected directly to the 500 volt bus-bars and the armature and series field coils were connected to the two bus-bars in series with a large water rheostat. The resistance of the rheostat was then gradually decreased until the machine started, and was finally short circuited when the machine was running at full speed.

The speed of the machine was regulated by the field rheostat in the shunt field circuit and the inverse electromotive force by changing the pressure between the bus-bars. It was then found that under the normal conditions of speed and pressure the currents and voltage were as follows:

Voltage at terminals	569 volts.
Current through shunt field coil	9.5 amps.
Current through armature and series field coil	47.5 amps.

The stray power (i. e., the power required to run the machine free exclusive of C^2R losses) was 27,100 watts. From the above the commercial efficiency of the machine is found to be

	Per cent.
Efficiency at full load	90.8
Efficiency at half load	87.0
Efficiency at quarter load	78.7
Efficiency at one-tenth load	60.4

The guaranteed efficiency of the machine is:

	Per cent.
At full load	95.0
At half load	93.0
At quarter load	91.5

But in considering the above results it must be borne in mind that no allowance was made for the fact that the machine was driving the main shaft with fly wheel and eccentrics when it was running as a motor.

It is interesting to compare these results with some tests made by Prof. R. C. Carpenter on the friction of engines. He tested five different engines, and in each case found that of the total engine friction 35 per cent or over was in the main bearings or was wind friction on the fly wheel. The average on the five engines was 41.7 per cent. To apply this to the Brockton engine let us assume that the total friction of the engine is 10 per cent of the rated power, which will be very approximately correct, and

that 40 per cent. of the friction is in the main bearings and fly wheel. This will give 30 h.p. required to drive the main shaft and fly wheel, and subtracting this from the stray power and recalculating the efficiency of the generator we find it to be:

	Per cent.
At full load	94.6
At half load	94.3
At quarter load	91.8

This is, of course, only an approximation, but is sufficient to show that the efficiency of the generator must be very close to the amount guaranteed.

During the generator test the machine was run for a few minutes at an overload of 40 per cent, and was found to carry this without difficulty and without excessive sparking.

In connection with this test several interesting facts were noticed. It was found that the current required to start the machine from rest varied slightly, but averaged about 700 amperes. When the machine was first started up as a motor it was connected directly to the bus-bars from which current was being taken for the electric road, the current being supplied by several generators belted to high speed engines. Under these conditions the current taken by the 500 k.w. generator varied constantly, and part of the time it would supply current to the bus-bars for fully a minute at a time. This was evidently due to the momentum of the fly wheel. The changes in load on the line and the poorer regulation of the high speed engines varied the bus-bar voltage, and some time was required for the large machine to change its speed and adjust itself to the new pressure. It was therefore found necessary to make the tests during the night, when there were no cars on the line. The momentum of the fly wheel was also shown when the machine was disconnected from the circuit, as it was found that it required from 25 to 30 minutes for the machine to come to rest after the switch was thrown.

These tests show conclusively that indicator cards taken on such an engine with varying loads give practically no idea of the actual output of the machine. If part of the load has just been thrown off, half the indicated horse power may be used up in slightly speeding up the fly wheel, and if the load has just been thrown on, a large portion of the output may be obtained from the momentum of the fly wheel and not appear on the indicator cards. The fly wheel on this engine weighs approximately 60,000 pounds.

TEST OF THE COMPLETE PLANT.

After testing the generator, arrangements were made for the full load run and efficiency test of the entire new apparatus. For this purpose it was necessary to make a number of changes in the steam piping and provide means for weighing water, etc.

The main steam header was first separated by having a blank flange inserted in one of the joints so that the new part of the plant would be entirely independent of the old. A temporary pipe was run from the old boilers to supply steam to the boiler feed pump and condenser for the new plant and two platform scales were set up, one to weigh the boiler feed water and the other to weigh the water discharged through the drip pipes from the steam piping. The water escaping from the drip pipes was weighed separately, in order to obtain the exact amount of steam delivered to the engine.

Four indicators were used on the engine and were provided with electrical attachments so that by pushing a button the cards would be taken simultaneously on all. The load for the generator was obtained by passing the curent through a large water rheostat in which two plates of boiler iron were hung in a solution of common salt. The current from the generator was measured by measuring the fall of potential between the terminals of a specially calibrated shunt.

The tabulated results of the foregoing tests are given in the following pages:

The Boiler Test.	
Date of trial	25th June, 1897
Duration of trial	10 hours.
Number of boilers in use	2
Dimensions and Proportions.	
Grate surface of each boiler	33.18 sq. ft.
Grate surface, total	66.36 "
Water heating surface of each boiler	1648 "
Water heating surface, total	3296 "
Superheating surface of each boiler	502 "
Superheating surface, total	1004 "
Total heating surface	4302 "
Ratio of water heating surface to grate surface	50
Ratio of total heating surface to grate surface	65
Average Pressures.	
Steam pressure in boiler, by gage, per sq. inch	112.3 lbs.
Atmospheric pressure per sq. inch	14.5 "
Absolute steam pressure in boiler per sq. inch	126.8 "
Force of draft in column of water beyond damper	0.40 "
Average Temperatures.	
Of external air	85 degs.
Of fire-room	88 "
Of feed-water before entering 1st heater	68 "
" " " " 2d "	137.3 "
" " " " boiler	197.1 "
Of escaping gases after leaving boiler	554 degs.
Of steam	384.4 "
Fuel.	
Moist coal consumed	10,149 lbs.
Moisture in coal	2.4%
Dry coal consumed	9966 lbs.
Wood consumed	458 "
Coal equivalent of wood	183 "
Total dry coal consumed, including wood equivalent	10,149 "
Total dry refuse	817 "
" " "	8%
Total combustible	9,332 lbs
Dry coal consumed per hour	1015
Combustibles consumed per hour	933 "
Quality of Steam.	
Number of degrees superheated	39 deg.
British Thermal Units.	
Heat units absorbed by boilers per lb. of steam generated	1021.4 B.T.U.
Factors of Evaporation.	
Factor of evaporation for boilers	1.06
Water.	
Total water pumped into boilers	98,119 lbs.
Water actually evaporated, corrected for quality of steam	100,007 "
Equivalent water from and at 212° F.	106,007 "
Equivalent water from and at 212° F. per hour	10,601 "
Evaporative Performance.	
Water actually evaporated per lb. dry coal	9.85 lbs.
Equivalent per lb. of dry coal from and at 212° F.	10.44 "
Water actually evaporated per lb. of combustible	10.72 "
Equivalent per lb. of combustible from and at 212° F.	11.36 "
Commercial Horse-Power.	
On basis of 34½ lbs. of water from and at 212° F. per hour by boilers	307.3 H. P.
No. sq. ft. of total heating surface per horse-power	14 sq. ft.
No. sq. ft. of water heating surface per horse-power	10.72 sq. ft.
Rate of Combustion.	
Dry coal actually burned per sq. ft. of grate surface per hour	15.3 lbs.
Rate of Evaporation.	
Water evaporated per sq. ft. of total heating surface per hour from and at 212° F.	2.47 lbs.
Water evaporated per sq. ft. of water heating surface per hour from and at 212° F.	3.16 lbs.
The Engine Test.	
Duration of test	6 hours.
Dimensions.	
Diameter of high pressure cylinder	20⅛ ins.
Diameter of low pressure cylinder	38 "
Stroke	48 "
Speed.	
Total revolutions of engine (6 hours)	38,526
Average revolutions per minute	107
Average Pressures.	
Atmospheric pressure per sq. in	14.5 lbs.
At throttle by gage " " "	112.0 "
At throttle absolute " " "	126.5 "
In receiver by gage " " "	5.9 "
In receiver absolute " " "	20.4 "
Vacuum in inches of mercury	24.0
Average Temperatures.	
In steam pipe at throttle	370.7° F.
In pond from which condensing water was drawn	71.3° F.
In condenser discharge pipe	106.0° F.
Condenser.	
Diameter of air pipe	24 in.
Stroke	12 in.
Total revolutions of condenser (6 hours)	22,525
Average revolutions per minute	62.6
Power and Efficiency.	
Average indicated horse-power	708.5
Total indicated horse-power hours	4251.0
Average electrical horse-power output	627.8
Total electrical horse-power hours output	3767.0
Efficiency of unit	88.6 %
Steam Consumption.	
Total steam supplied to engine	64,927. lbs.
Steam per indicated horse-power hour	15.3 "
Steam per indicated horse-power hour when engine is running with 125 lbs. initial pressure and 25 ins. of vacuum (calculated from indicator cards)	14.4 "
Steam per electrical horse-power hour output	17.2 "
Steam per kilowatt hour output	23.1 "
Coal Consumption.	
Water evaporated per lb. of dry coal	9.85 lbs.
Coal per indicated horse-power hour	1.57 "
Coal per electrical horse-power hour output	1.78 "
Coal per kilowatt hour output	2.4 "
Temperature of Parts at End of Test.	
Air of engine room	83.5° F.
Main bearing low pressure side	129.0° F.
Main bearing high pressure side	129.0° F.
Armature	146.0° F.
Commutator	146.0° F.
Field coils	129.0° F.

At the end of the eight-hour run a test was made on the engine regulations as follows: The speed was taken at full load and found to be 108 revolutions, the load was then changed to 75 per cent of full load and the speed found to be 109 revolutions. The load was next entirely thrown off the generator and the speed went up to 112 revolutions. On throwing 75 per cent. on again the speed returned to 109 revolutions. After this the engine was run under full load and the boiler pressure was gradually reduced from 125 lbs. to 110 lbs., and this was found to have no apparent effect on the engine speed.

It is also interesting to note that the coal consumption per kilowatt hour output was 2.4 lbs. during the test. The test was made at full load and this 2.4 lbs. is the coal consumption under the most favorable conditions.

In practice where the load is constantly fluctuating, and is sometimes but a small proportion of the full load for considerable periods, a very much larger coal consumption is to be expected.

STREET RAILWAY JOURNAL

AUGUST, 1898.

PUBLISHED MONTHLY BY
THE STREET RAILWAY PUBLISHING COMPANY,
HAVEMEYER BUILDING,
26 CORTLANDT STREET, NEW YORK.

WESTERN OFFICE:
MONADNOCK BLOCK, CHICAGO, ILL.
EUROPEAN OFFICE:
39 VICTORIA STREET, WESTMINSTER, LONDON, ENGLAND.

Long Distance Telephone, "New York, 2664 Cortlandt,"
Cable Address, "Stryjourn, New York."

TERMS OF SUBSCRIPTION.

In the United States and Canada..... $4.00 per annum.
In all Foreign Countries, per annum..... $6.00 / £1 5s 0 / 31 fr
Subscriptions payable always in advance, by check (preferred), money order or postal note, to order of C. E. WHITTLESEY, Treasurer.

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All matters intended for publication in the current issues must be received at our office not later than the twenty-second of each month.

Address all communications to
The Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

The difficulties of maintaining schedules when operating single track lines, particularly when the number of turnouts is not very large, are so great as to call for the most careful and intelligent work on the part of traffic managers. There is little question that some form of signal system, by which long waits at turnouts may be avoided, would immensely improve the service on many lines of this character, where at present a sort of "haphazard" method of running prevails. There is nothing which so quickly tends to reduce the receipts of any line below a maximum as irregularity of service, and when, in addition to this, passengers are compelled to wait five, ten or fifteen minutes at a crossing, the element of personal annoyance becomes a most serious factor to deal with.

Another kind of trouble often found in long suburban and interurban roads operated from a single power station is a loss of voltage along the line so great as to interfere materially with the speed of cars. Here various remedies are possible, such as the use of more copper, the installation of a storage battery auxiliary plant, the booster system, or a separate station. Some one of these remedies should certainly be adopted wherever schedules are slow, or are being materially interfered with on holidays or other times of special service. In Quincy, Mass., which is the center of an extensive network of street railway lines extending a long distance in several directions, certain of these lines have suffered greatly from lack of power, and the service became so uncertain and slow as to cause great vexation to the people through loss of trains, etc. A large storage battery has recently been put in with the result of bringing the voltage up so that the cars run at greatly increased speeds and make their schedules easily. The change was noticed almost immediately by the patrons of the road, and has been reflected in increased earnings, many of the residents of the town, who had previously abandoned the use of the street cars and driven each morning to the station by carriage, having returned to the more convenient cars.

An opportunity for profitable transportation, which seems to have large possibilities in many places but which has not been developed to any extent, hardly, in this country, lies in the construction of mountain railways. We believe that there are many opportunities for building roads of this kind which have not been worked up, because it is thought that they would not pay, but there are many reasons why roads of this character, especially when near large cities, should be quite profitable. In the first place, a high fare can be charged, because there is no competition, and in the second place the cost of construction and operation is comparatively low; that is to say, it is much less, under modern methods, than formerly. Usually by a little grading electric cars can be made to operate on these roads without any additional appliances, and where this is not possible much steeper grades can be surmounted without the use of a rack or auxiliary cable driving machinery by the balance weight principle, described elsewhere in the article on the Mt. Tom railway at Holyoke, Mass. This road, which takes its power from the regular trolley circuit by means of motors under the cars, has proved most popular; and while the season is short, the earnings are understood to be most satisfactory.

Some novel features in car house construction are illustrated in a large house recently completed by the Springfield Railway Company and described in the article on that system in this issue. The old horse car barn pattern was entirely discarded in the construction of this new house, which has been built with the purpose of securing a structure of whose fireproof and substantial qualities there should be no doubt. The idea of a car house with a capacity for seventy-five cars and yet with only one entrance track is new to most railway engineers, but this arrangement has certainly some positive advantages, whatever may be said in its disfavor. It removes the special work from the wear of the street, and prevents the clogging of switches with snow and ice in winter, and what is also important, the use of a single small door makes it easy to

keep the car storage room warm in winter. While on the subject of car houses, we suggest that the terms "car barns" and "car sheds" ought now to be considered as obsolete, certainly so far as buildings for the reception of electric or cable cars are concerned. The term "car house" is the one in most general use to designate buildings of this character, and seems more appropriate than the earlier expressions used when horses or mules were employed as the sole motive power.

The Metropolitan Street Railway Company of New York commenced last month upon what is probably the most important portion of its new underground electric railway construction yet undertaken, that of the equipment below Fifty-ninth Street of its Sixth and Eighth Avenue lines. Extensive as has been the work already done, the building of these two lines commands particular attention, first, from a constructive standpoint, because the streets through which the lines run are in the older part of the city, where the difficulties of construction, owing to subterranean pipes, will be greater probably than on any other portion of its electric road, except, perhaps, on part of the Fourth Avenue line; and second, from an operating standpoint, because it will give the company two routes from Fifty-ninth Street down town independent of those which it already has. This will relieve greatly the traffic on the present Broadway and Madison Avenue lines. Up to this time the capital expended on the building of the Amsterdam and Eighth Avenue lines north of Fifty-ninth Street has been partially unproductive, because of no additional rapid transit routes below that point.

* * * * *

The present time is selected because both lines extend through the shopping district for a considerable distance, and it was thought that if work be carried on during the summer there will be less interference with trade than at any other time, and the company received many compliments from the public and metropolitan press because it advertised the proposed change shortly before the work was begun, and advised the public of the changes in its routes. The effect of the substitution of high-speed electric cars of large carrying capacity for the present horse equipment must be enormous, since President Vreeland, in a recent interview, stated that the change from horse to electric power on the Madison Avenue line allowed the company to increase the car mileage from 7500 to 15,000 miles per day.

The subjects selected for the papers to be read at the Boston Convention of the American Street Railway Association, as announced by the secretary of the Association and published elsewhere in this issue, are exceedingly interesting, and their discussion by the gentlemen selected to present papers promises to throw much light on important departments of street railway operation. It is interesting to note in this connection that all of the papers, as announced, concern the operating of railways, and only in an indirect way their construction. This is natural, and shows that most of the large railway companies in this country have completed the greater part of their new electric construction, and that the problems arising in the operating departments, as to how to attract and retain traffic, how to carry the passengers on the cars most comfortably and cheaply, and how to furnish the power required in the most economical way, are the questions which concern most vitally the average railway operator of to-day. Railway construction is becoming more and more a question of standards. The broad principles of building railways are now pretty generally recognized, but in the operating department there is a host of queries to be considered, and the best answer to each question depends upon so many circumstances that the experience of all the others is of more value to each railway company now even than in the early days of construction.

* * * * *

It is generally recognized that the value of papers presented before scientific bodies is always greatly enhanced by the discussion of them by the listeners and author following the reading. For in this discussion the experience of the others on the subject treated is brought out, and the author himself often elaborates in a way not possible in his paper many points which were referred to in the discussion. We believe, therefore, that every railway manager who expects to attend the convention will find it to his advantage to carefully consider the topics selected and to make mental or written notes of any points in which he thinks that his experience would be of value to the others in attendance, or in regard to which he would like expressions of opinion from other delegates. We are aware that some hesitate about doing this, thinking that their conditions are probably so different from those of other companies that what might answer in another city would not in their own. But even if this be true, a discussion will nearly always bring out some points of value to the interrogator which he can adopt more or less completely, as the conditions require.

The adoption by various street railway companies of the standard classification of accounts recommended by the Association of Street Railway Accountants at their last convention is very satisfactory proof of the general acceptability of the measures proposed. It has been pointed out by a number of accountants that comparatively little change in their classification was necessary in order to make their plans agree with the standard established by the association. The changes necessary to make have been in minor details and in matters of no great importance, one way or the other, and therefore the companies have been much more ready to adopt the standard classification than would have been the case if the changes had been radical and sweeping. With this much accomplished, the Accountants' Association naturally turns to other questions. Officers, committeemen and members at large are at present giving more or less attention to the question of what is expedient to take up next.

A uniform method or form of statement for presenting to the management the results of operating, and construction and maintenance accounts, classified according to the plan recommended by the association, is perhaps the first in order of those to which attention should be given sooner or later. Given the results which the classification produces, there are still various plans possible of summarizing and presenting the results. No two accountants perhaps would handle these results in this respect in exactly the same manner. Even though uniformity be secured in the

detail accounts, yet the object which the Accountants' Association had in view in taking up the question of a standard system would be defeated if there is lacking unformity in method of presenting those results to the management.

It is extremely desirable that a man skilled in reading results and in drawing conclusions from accountants' statements by reason of his experience with one company should be able to intelligently read the results of the accounts of all other companies. Among investors it frequently happens that the same man will serve upon the boards of two or more companies. Certainly, in the interest of such men, the results of the accounts should be presented in a uniform manner. Otherwise it would be like having the proceedings conducted in one case in one language and those of the second board in another language. He would of necessity need to be acquainted with two or more different methods of expression. Still other illustrations might be employed, if further argument were necessary in support of the proposition that a uniform statement for presenting the results of classification to the management is almost as essential as the classification itself.

Unnecessary Track and Car Mileage

One of the most serious street railway diseases of the day is that of too much track mileage. In large cities it is the result in most cases of competition, actual, attempted or threatened. The company or companies first chartered to operate in such cities may be presumed to have originally pre-empted the best routes of travel. The success usually incited other capital to obtain new franchises upon parallel routes or in new territory, and such attempts have either been successful or have failed by reason of agreements by the original companies to build upon these routes themselves. The public may be counted on always to favor anything tending to break down existing "monopolies," particularly of the street railway variety, and to constantly demand more transportation facilities on one pretext or another. Their representatives in council frequently promote, or in fact suggest such schemes, sometimes for "sandbagging" purposes, and the result is, in practically all our large cities, overbuilding of track.

This means, of course, a temporary or permanent diminution of gross and net receipts per mile of track by reason of the resulting division of traffic among parallel lines or of "lean" mileage in the territory not built up, and—as the investment per mile of track cannot usually be reduced in anything like the same proportion—it follows that the percentage return on investment becomes naturally much less than if the company were allowed to choose its own routes of travel and build as little track as it pleased. In other words, the public has placed upon street railway companies burdens which are apt to be considered by demagogues as favors, and these burdens, however cheefully assumed, are in reality public benefits often given by street railway companies to their own private financial loss.

The causes of overbuilding of track by interurban railway companies are of a somewhat different character. There is usually here no public demand impossible to resist, and little fear of that kind of competition which will reduce traffic on lines already built. Starting, for example, with a given line—a successful one, we will say—between two towns as a nucleus, the question of pushing extensions to other towns is, or ought to be, one merely of profit-earning capacity. If there is any doubt of profits it may be better for the original company to allow other capital to build the new line as a feeder, not only because it will thus avoid the risk of failure itself, but also because it may be possible for two companies to charge a higher joint fare than one, owning both lines, would be permitted to do. In too many cases unwise concessions have been made to the public in the way of fares by interurban street railway companies. On long and thinly settled lines the fares should not be on a street railway five-cent basis, but rather on a mileage basis—less in amount, perhaps, than that of competing steam railroads, but not so much less as to amount to an unprofitable rate.

A second street railway disease, the cure of which may in many cases mean a remedy also for the disease of over track building, is excessive car mileage. Many city and interurban roads are running cars too often for their own good. There are not possible passengers enough to furnish reasonable receipts per car mile. One of the most striking evidences of skill in street railway management recently exhibited is found in a certain American city where a large annual deficit under fixed charges has been turned into an actual, though small, surplus, partly by simplifying the organization and reducing general expenses, but chiefly by the quiet and unostentatious withdrawal of a large number of cars from routes where too frequent service was being given, thereby reducing by a large percentage the total car mileage. Not a few successful managers are accustomed to establish a fixed minimum of earnings per car day for each of their lines, and run only enough cars to produce this earning power. In cases of parallel routes under one ownership mileage may be saved many times by giving an exceptionally good service on one of the routes and an extremely poor service on the other, so that passengers will become accustomed to depending on the former. Local conditions vary so much that no general suggestions can well be made, but it is probably true that on a large proportion of our city systems car mileage could be saved by a careful study of traffic requirements.

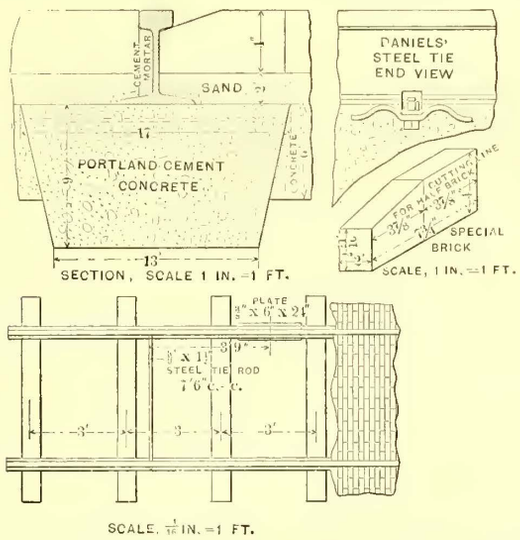
There is usually no necessity for granting the public a street railway frequency of car service on long interurban roads, whose character is more like that of steam railroads. It is probable that the one thing which has made interurban electric railroading in Massachusetts moderately or completely successful in almost every instance has been the fact that cars are run in most cases at half hour or hourly intervals, rather than the ten, fifteen or twenty minute intervals which many interurban roads seem inclined to adopt, at least at the beginning of operation. Of course, on these long interurban roads, particularly where there have to be two or more power stations, there must be a reasonable load upon the stations if there is to be any advantage in electricity over steam. If the balance between this load factor, calling for frequency of cars, and the profit factor, tending to reduce this frequency, be not accurately struck—so much the worse for the road in question. It has, perhaps, no *raison d'etre*

Too much track mileage, too much car mileage—these are diseases which have some interdependence and relationship. Both should be cured, if possible.

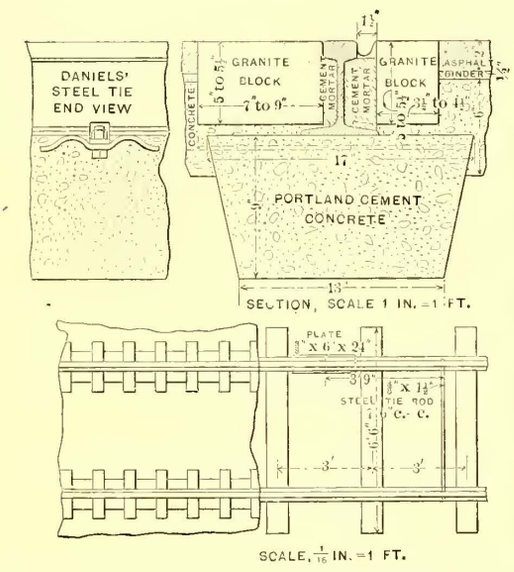
Recent Track Construction of the Sioux City Traction Company

By CHESTER P. WILSON.

In the spring of 1897 the city government of Sioux City ordered brick and asphalt pavements laid on streets occupied by our tracks. Both kinds of pavement were to be laid upon 6-in. concrete foundation, and necessitated the relaying of 8400 ft. of single track in the brick pavement, and about 5600 ft. of single track in the asphalt. During the season of 1896 8800 ft. of single track was laid in asphalt pavement, using 6-in. Shanghai T-rail. Our city government has never objected to the use of a T-rail, and as a 6-in. rail, with proper foundation, is sufficiently rigid to meet the requirements of our service, it was decided to lay the 1897 work with the same kind of rail, thus continuing in the direction of making it our standard. Considerable difficulty has been experienced in obtaining a uniformly good subsoil on the streets occupied by our tracks, and the idea followed in designing this new work was to obtain a standard type of track construction which could easily be adapted to both kinds of paving and meet the unfavorable conditions imposed by the subsoil. In expensive pavements a form of construction should be adopted which would minimize track repairs and their attendant paving repairs.



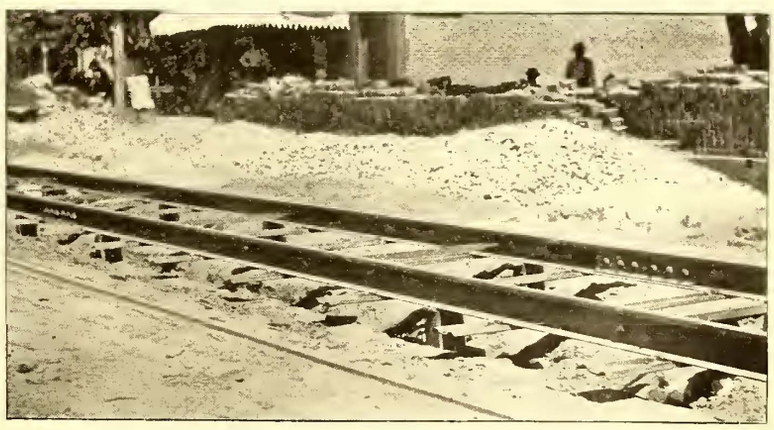
DETAILS OF TRACK CONSTRUCTION IN BRICK PAVED STREET



DETAILS OF TRACK CONSTRUCTION IN ASPHALT PAVED STREETS

In designing this work we have before us the results and experience of those who have installed concrete beam, steel tie and oak tie constructions, and finally decided to use what we considered the best features of each. Six-inch T-rail in 60-ft. lengths, with joints in the same track broken by 15 ft., were to be laid on steel ties spaced 3 ft. center to center. The rails were to be joined by 26-in. six-bolt splice bars, and separated by ⅜ in. x 1½ in. steel tie-rods spaced 7 ft. 6 in. between centers. Under each rail was to be laid a continuous beam of Portland cement concrete of an average width of 15 ins. and a depth of 9 ins., and to prevent any ill effects on the beam at the rail joints should the latter become loosened, a steel plate ⅜ in. x 6 in. x 24 in. was to be placed immediately under the rail at each joint.

VIEW SHOWING ONE-HALF STREET ROLLED TO SUB GRADE AND TRACK MADE UP ON BLOCKS BEFORE BEAM FORMS WERE PUT IN



NEAR VIEW OF TRACK ON BLOCKS WITH BEAM TRENCHES DUG

The details of the construction can best be shown by the following extracts from the specifications:

RAIL

The rail used will be a 60 lb., Shanghai, T-rail, Cambria section No. 510; 6 ins. high.

TIES

On straight track the rails will be laid on Daniels steel ties, weighing 8 lbs. per foot, and placed 3 ft. apart, center to center.

All curves and special work will be laid upon oak ties as hereinafter specified.

JOINTS

Joints in the two rails of the same track will be broken by at least 15 ft. Rail joints will not be carried on the ties, but will rest upon ⅜ in. x 6 in. x 24 in. steel plates running longitudinally with the rail, and supported snugly against the under side of the rail by the concrete beam, hereinafter specified.

CONCRETE BEAM STRAIGHT TRACK

Under each rail, and running longitudinally therewith, will be placed a beam of concrete to a depth of 9 ins. below the bottom of the rail flange and of an average width of 15 ins. The beam will be laid in a trench which shall be partially excavated below the sub-grade and partially left in the concrete paving foundation. The concrete for the beam shall be prepared as follows: One measure of Alsen's or any other equally good Portland cement, and two and one-half measures of clean, sharp sand, free from loam or clay, will be thoroughly mixed dry and then made into mortar with the least possible amount of water. Five measures of crushed or broken bowlders, crushed or broken granite, or crushed or broken hard limestone, thoroughly cleaned from dust and dirt, drenched with water ,but containing no loose water in the heap, will then be incorporated immediately with the mortar. The broken stone shall not be less than ½ in. in its smallest, nor more than 2 ins. in its greatest dimension. Each batch of concrete will be thoroughly mixed, the mixing to be continued on the board until each piece of stone is completed coated with

VIEW SHOWING BEAM FORMS IN POSITION

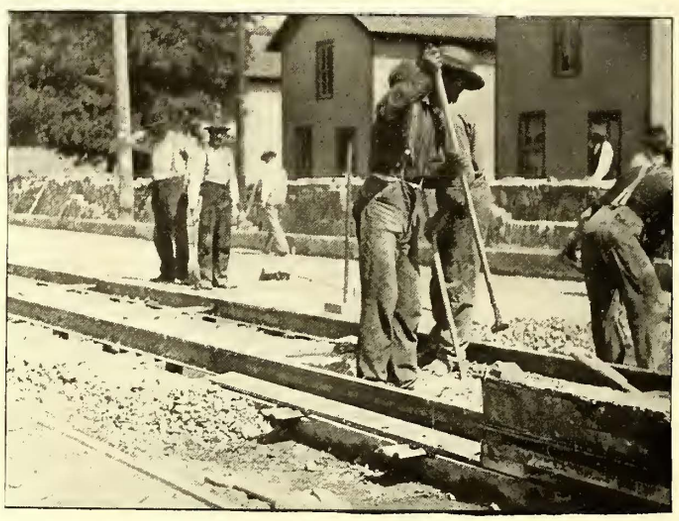
mortar, and will at once be placed in the trench, thoroughly tamped under the rail and rammed until free mortar appears upon the surface. This work shall be so done that when the concrete is set the rail shall be firmly supported thereby at every point in the rail length and the track surface be not disturbed as to line or grade. The surface of this beam concrete shall be brought flush with the top of the concrete paving foundation. The whole operation of mixing and laying each batch of concrete will be performed as expeditiously as possible by the use of a sufficient number of skilled men.

CONCRETE CURVES, ETC.

All switches, curves, etc., known as special work, will be laid upon 6 in. x 8 in. x 6 ft. 6 in. sawed oak ties. Underneath the ties will be laid a solid bed of concrete 6 ins. deep, extending 6 ins. longer at each end (12 ins. longer in all) than the length of track, supported by said oak ties, and 3 ins. wider on each side (6 ins. wider in all) than the length of said oak ties. This concrete must be thoroughly tamped under each tie so that the latter will be firmly supported at every point by said concrete and rammed so that its surface will be flush with the tops of the ties and with the surface of the concrete paving foundation. The concrete for the 6 in. bed underneath the ties shall be prepared as directed for the beam concrete for straight track work, but the concrete between ties shall be that called for by the city's specifications for the concrete paving foundation.

After the old track had been removed and the street excavated and rolled to the sub-grade the rails were placed in position and the track (rails, ties, tie-rods, joints, rail-bonds and joint-plates) made up, surfaced, lined and gaged, resting on wooden blocks placed under each rail every 8 ft. or 10 ft. The contractor then excavated under each rail the required additional depth for the concrete beams and placed in position the wooden forms for the beams. The 6-in. concrete paving foundation was then laid, the concrete being thoroughly tamped up under the ties so as to fill the corrugations. After the paving concrete had set for one day the wooden forms were removed and the concrete beam placed in the trench thus left for it, thoroughly tamped up under the rail and made to cover the rail flange. The beam concrete was then allowed to set for eight days before the track was used.

The city's specifications required that the concrete paving foundation should set for eight days before the brick or asphalt should be laid on it. During this eight days the track would be wholly exposed on the streets to be paved with brick, and partially exposed on the streets to be paved with asphalt. This work was done during our hottest weather, and the temperature changes between day and night caused expansion and contraction, which had to be met in order to insure success of the work. The amount of this expansion and contraction was observed on a sec-



TAMPING PAVING CONCRETE UNDER TIES

tion of track on the blocks before any concrete was laid, and was found to be from 3 ins. to 4½ ins. in 400 ft. To hold the track at uniform temperature while the concrete work was going in and until the entire pavement should be laid was the problem. For all practical purposes it was successfully met as follows: As fast as the paving concrete was laid the rails were covered with inverted "V"-shaped troughs made from cheap boards 12 in. wide and 7 ft. 6 in. long, so that troughs could set between adjacent tie-rods. In the brick pavement a 2-in. layer of sand was to be placed between the concrete foundation and the bricks, and as fast as the concrete beam was laid under the rails some of this sand was delivered on the street, heaped up over the rail, wet down and covered with the wooden troughs. The damp sand assisted the concrete and kept the rails at such a uniform temperature that the expansion and contraction was practically eliminated. As the work progressed the wooden troughs were moved up and along the street, so that we did not require more of them than would cover 1500 ft. of track.

In the asphalt pavement the troughs were used until the beam was put in. The toothing blocks were laid as fast as the beam work, and afforded the rail the same protection from temperature changes as did the sand on the brick streets.

The brick paving was brought to the rails in the following manner (quoting from the specifications):

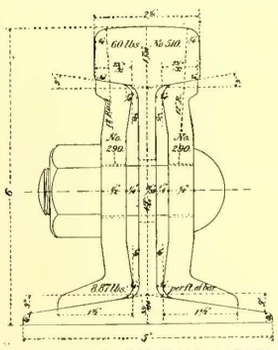
OUTSIDE OF TRACK

On the outside of the track the brick shall be brought snugly against the rail head, and the joints in adjacent courses shall be broken by 4 ins., alternate brick being full length and intervening brick half length. The space between the ends of the brick and the web of the rail shall be filled with cement mortar composed of one part by bulk of Alsen's Portland cement, and two parts by bulk of clean, sharp sand made into a stiff mortar.

INSIDE OF TRACK

Next to the rail on the inside of the track the brick shall be of special design, as per print attached, to admit of being laid snugly against the web of the rail and up to the under side of the rail head, and at the same time leave flangeway at the side of the rail head. The joints in adjacent courses of these special brick shall be broken 4 ins. by the use of half bricks. These half bricks shall be made by cutting a whole special brick in two at the point where the whole brick begins to bevel. These two half bricks shall then be burned. The beveled half brick shall be used to break joints on the inside of the rail, and the other half brick shall be used to break joints on the outside of the rail.

The city's specifications required a cement grout to be used as a filler. After the bricks were laid and rolled, two parts of sand and one of cement were mixed into a thin mortar and broomed into the interstices. Traffic was to have been kept off the street for ten days, when it was supposed the cement filler would have set sufficiently to bind the whole into a solid pavement. It was impossible to keep traffic off the streets for more than two or three days, and as soon as the pavement began to be used the cement was broken loose from the bricks and became but loose wedges between them. In order to make any job at all of the pavement it was necessary to fall back on sand for filling. This experience showed that cement was not the proper filling for brick pavement, for in order to fill the spaces between the bricks it was necessary to have a grout so thin that on setting the shrinkage would break the filling apart from the adjacent bricks.



SECTION OF RAIL USED (1-4 SIZE)

Asphalt paving was brought to the rails in the following manner (quoting from the specifications):

OUTSIDE OF TRACK

Against the rail on the outside of the track will be placed granite toothing blocks laid "header and stretcher," as shown in the attached drawings. These toothing blocks shall be set snugly against the rail head, with their top surfaces ¼ in. below the top of the rail head. They shall be laid in a bed of Portland cement mortar, and the joints between blocks shall be thoroughly well made with this mortar at the time of setting the blocks. The space between the toothing blocks and the web of the rail shall also be filled with the cement mortar. This Portland cement mortar shall be composed of one part by bulk of Alsen's Portland cement and two parts by bulk of clean, sharp sand, made into a stiff mortar. After the toothing blocks have been set to the rail in the manner specified, the concrete paving foundation shall be surfaced and brought snugly to these blocks, either with concrete or cement mortar, the intent of these specifications being that these toothing blocks shall be firmly imbedded in and held by the concrete and cement mortar work.

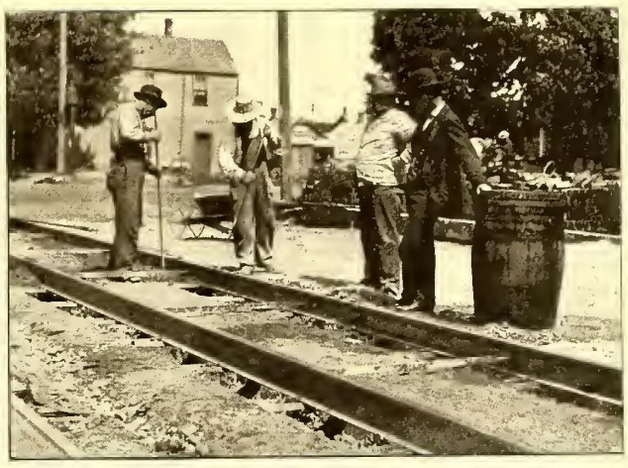
INSIDE OF TRACK

On the inside of the track the toothing blocks will be laid as specified for the outside of the track, with the exception that the blocks shall be brought to line 1¼ ins. from the side of the rail head. The space between the blocks and the rail shall be filled with Portland cement mortar, mixed by the same formula above specified under "Outside of Track," to within 1¼ ins. of the top of the rail head. The space between the toothing blocks and the rail above this mortar shall be filled to within ½ in. of the top of the rail with a special preparation of asphaltic cement, after which the Sioux City Traction Company will form the groove for the flangeway by running a car over the track.

TOOTHING BLOCKS

The toothing blocks shall be of granite and neatly dressed to not less than 3½ in. nor more than 4½ ins. wide, not less than 7 ins. nor more than 9 ins. long; not less than 5 ins., nor more than 5½ ins. deep. No block shall be more than 1 in. narrower on the bottom than on the top, nor more than 1½ ins. shorter on the bottom than on the top. In no case will any block less than 5 ins. nor more than 5½ ins. deep be accepted. The upper corners are to be right angle corners, and the blocks are to be so dressed that they can be laid with side and end joints not to exceed ⅜ in. in thickness. The wearing surface is to be so dressed that no part will be more than ¼ in. from a plane passing through the four corners of the wearing surface.

This track has been in use nearly a year, and has been subjected to our hottest, as well as our coldest, temperatures. No settling or spreading has been observed anywhere, and it is impossible to notice the joints when riding over the track. Electric and cast welding have occasioned much discussion as to the success of a continuous rail, the main objection urged being the impossibility of preventing the ill effects of expansion and contraction. It has been reported that in cold weather the continuous rails would break, but my impression is that these breaks have occurred more frequently in the weld than in the rail itself. However this may be, our experience with this track indicates that in first-class paving the contraction and expansion is practically eliminated. The rails in our track are connected up by bolted joints, and, although laid in very hot weather, none of the joints opened up during the past winter, and it was with difficulty that more than 30 per cent of the joints could be found by careful inspection in the coldest weather.



VIEW SHOWING BEAM FORMS REMOVED AND BEAM CONCRETE GOING IN

When the joints were put on the bolts were pulled up as tight as possible and the cement mortar, laid between the brick or toothing blocks and the rails, will hold the nuts from backing off, and as long as this cement work retains its integrity these joints may be expected to remain tight. There can be no possible working up and down of the rail ends, as this is taken care of by the steel plate immediately under the joint.

One considerable element which entered into the success of this work was the very careful inspection given all concrete and cement work. The beam concrete was mixed fairly dry, so that it could be thoroughly tamped up under the rail without becoming too soft. This reduced the shrinkage very largely, and a careful examination shows that the beam, as well as the mortar work on the side of the rail, is firmly cemented to the rail. In our work we gave the cross section of the beam the shape of a keystone,

primarily because it would have been very difficult and expensive to follow the practice of those who have made their beam broadest at the bottom. Where the pavement is crowned it would seem that the keystone shape would add more strength than would the inverted form with its broader base. With the former the bond between paving and beam concrete can be more easily and better made with less cost.

The drainage for this trackwork was provided for by catchbasins placed every 400 ft. These basins were constructed of brick laid in cement, covered with an iron grating and drained by tile to the storm water sewer.

All bonding was done with No. 00 Columbia bonds manufactured by the John A. Roebling's Sons Company. One bond was placed at each joint. The rails of the same track were cross-bonded once every 100 ft., and the double track cross-bonded once every 200 ft. The special trackwork, comprising several three-part Y curves, double curve branch-offs, end side turnouts, etc., were furnished by the Paige Iron Works, and several cross-overs by the Pennsylvania Steel Company. The special work was of the built type of construction.

The St. Louis, Belleville and Suburban Railway

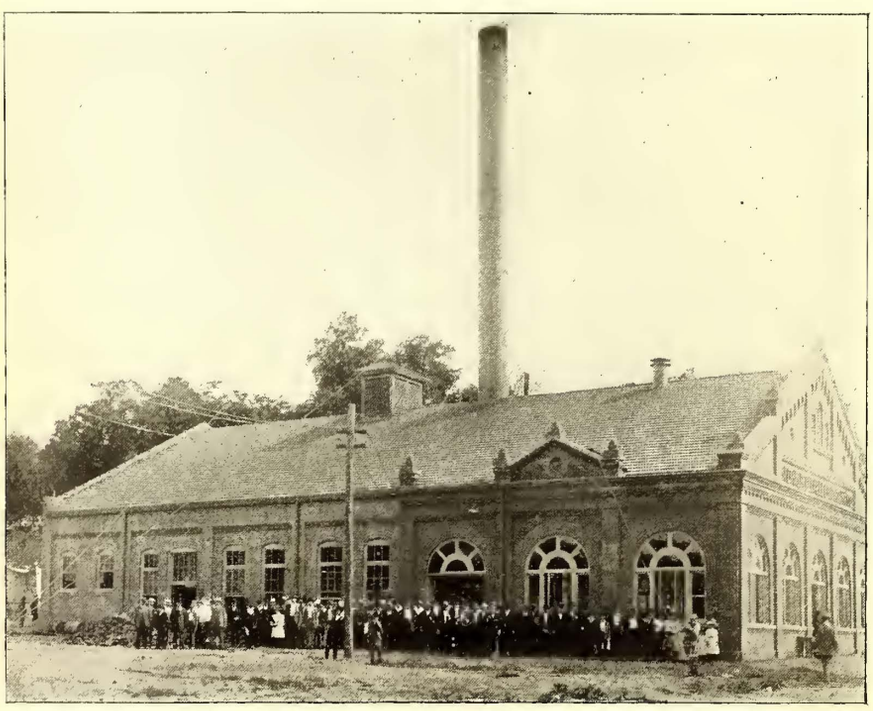
Belleville, Ill., with a population of about 22,000, is one of the oldest towns of the State, and is situated on the old St. Clair turnpike, about 15 miles east of East St. Louis, which has a population of some 35,000. Belleville is a thriving town and lies in the center of a very rich agricultural section, and, for its size, is one of the wealthiest towns in the United States. Heretofore travel between it, East St. Louis and St. Louis was by means of three steam roads, giving infrequent and unsatisfactory service, with a fare of 65 cents between Belleville and St. Louis.

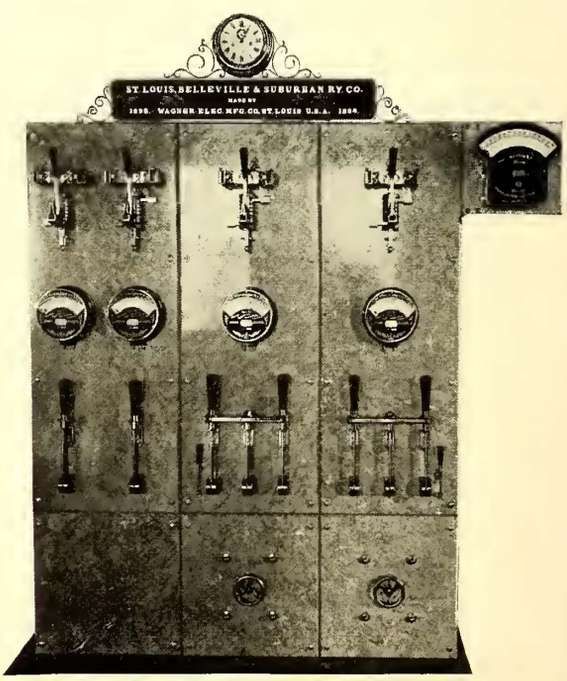
A project for an electric line between these cities has been under consideration for the past six or seven years, but practically nothing had been accomplished until Messrs. Townsend, Reed & Company of Chicago took hold of it about eight months ago, when they purchased the St. Clair County turnpike for a distance of 10½ miles, extending from the city limits of East St. Louis. They then secured the necessary franchises enabling them to run from the eastern terminal of the Eads bridge in East St. Louis to the public square in Belleville, making a total distance of 14 miles. Construction was begun early in November, 1897, and the line was in operation May 15, 1898. The construction work was all done by Townsend, Reed & Company, and reflects great credit upon the builders. The track construction was built in accordance with steam road practice, 60-lb. T-rail and standard oak ties being used throughout. After grading, the roadbed was filled in with 6 ins. of cinders on a solid clay bed, and the ties placed on these cinders. In the course of leveling the line more cinders were used for raising the track where necessary, so that in no case is there less than 6 ins. of cinders under any of the ties.

The result of this construction is thoroughly apparent in the easy riding of the cars. The joints are all made opposite, and there is not a particle of swaying in the large double truck cars, even when running at a speed of 60 miles an hour, a speed which is being constantly made on certain portions of the road, and in some instances exceeded.

The line is comparatively straight and has but few bad grades, the heaviest being 6½ per cent. The entire overhead equipment was furnished by the Electric Railway Equipment Company, through the Mason & Richards Company, St. Louis, selling agents.

This road opened with eight cars, 43 ft. over all, built by the Jewett Car Company. These cars are mounted on double trucks of the 14A "extra strong" type made by the Peckham Truck Company. Hale & Kilburn walk-over seats, Stanwood steps made by the Q. & C. Company and Columbia lamps go to make up the interior equipment of the cars, which are of a superior finish throughout. The exterior color is a light green with silver striping. Each car is named after a State, the name appearing also in silver bronze.





POWER STATION AND SWITCHBOARD—ST. LOUIS, BELLEVILLE & SUBURBAN RAILWAY

Each car is equipped with two 50-h.p. Walker motors, type S., and the Walker Company's new solenoid controller.

The power station is located midway between the termi-

nals of the line. It is a handsomely designed and well-constructed brick building, 75 ft. x 112 ft., and having the Berlin Iron Bridge Company's steel truss roof. The construction is fireproof throughout. The equipment consists of two Russell 4-valve semi-Corliss engines of 500 h.p. each, running at a speed of 150, built by the Russell Engine Company. These are direct connected to Walker generagood records, as the following notice recently posted each, but have been frequently worked up to 650 amps. each, the average for one day of ten hours being over 500 amps. for each machine. A zigzag separator, manufactured by J. S. Stevens, Chicago, is placed in the steam pipe above the throttle valve for the purpose of delivering dry steam to the engine. The switchboard was built by the Wagner Electric Mfg. Company of St. Louis, the switches, indicators, etc., being mounted on Rutland marble. I. T. E. circuit breakers are used.

The boiler room occupies about half of the power station, and is equipped with four tubular boilers, 72 ins. by 18 ft., with seventy-two 4-in. flues, which were also furnished by the Russell Engine Company. Pratt & Cady and Crane valves and Deane pumps are used. A W. H. Smith feed-water heater, manufactured by the National Boiler Works of Chicago, is doing excellent work. The water used at the power station is from a well 600 ft. deep, fitted with a 5-in suction pipe, the working barrel being placed 250 ft. from the surface, and is operated by an A. D. Cooke deep-well pump. The water supply from this well seems to be perfectly pure, making no incrustation or

BALLOON ASCENSION IN RAILWAY PARK

sediment in the boilers. The water is pumped into a 12,000-gallon cistern, and from this cistern is pumped to the heater.

This station was planned by Wm. M. Moran, chief engineer for Townsend, Reed & Company, and a great deal of credit is due to him for the excellent arrangement, which embraces some very novel and improved ideas. Adjoining the power station the company has a large amusement park and picnic grounds, delightfully located in the hills. Band concerts are given every Sunday afternoon and evening, and a vaudeville performance every night. There are also the usual merry-go-rounds and other park features.

The park has proved a great success, and the traffic of the line has so far exceeded the company's expectations that it has decided to at once double-track the whole line, and has already ordered twelve more cars of the same type as those now in use, and also another unit of 800-k.w. capacity for the power station. The fare between Belleville and St. Louis is set at 25 cents, including the bridge fare. As formerly stated, the steam roads are charging 65 cents.

STANDARD CAR

The service by the electric line is not only vastly superior to the steam car service, and with cars every 15 minutes up to midnight, but passengers by the electric line are landed in the heart of both cities, instead of at out-of-the-way stations as with the steam roads. Although this line was not fully in operation and terminals not completed, yet on July 4 it handled 17,960 passengers on seven cars, and the Sunday business has closely approximated these figures.

The officers of the company are Hon. F. F. Espenschied, former City Treasurer of St. Louis, president; George Townsend, secretary, and W. S. Reed, treasurer; and it is due to all the parties furnishing equipments to state that the managers of the road speak in the highest terms of the entire installation in all its parts. The general offices of the company are in the Security Building, St. Louis.

Increased Pay to Conductors

The Metropolitan Street Railway Company of New York believes in rewarding conductors who have made good records, as the following notice recently posted in the car houses of the company shows:

METROPOLITAN STREET RAILWAY COMPANY.

TO CONDUCTORS, ELECTRIC ROAD. May 27th, 1898.

Conductors on electric lines of this company who, on the 1st day of June, 1898, will have been continuously in the employ of the company for a period of one year or more, without having dropped on the extra list within that year, who have a good record, may make application to their Division Superintendent or General Foreman for an increase of pay, and upon approval of such application as to length of service and record by the General Superintendent, will be entitled to pay at the rate of $2.15 per day.

Conductors who arrive at the completion of a full year of service subsequent to the 1st day of June next may make application as above, and upon approval as stated the same rate of pay will be granted.

When any conductor has served continuously for one year under the increased rate of $2.15 per day he will be entitled, upon further application and approval, to another increase of 10 cents per day, making his pay at the rate of $2.25 per day.

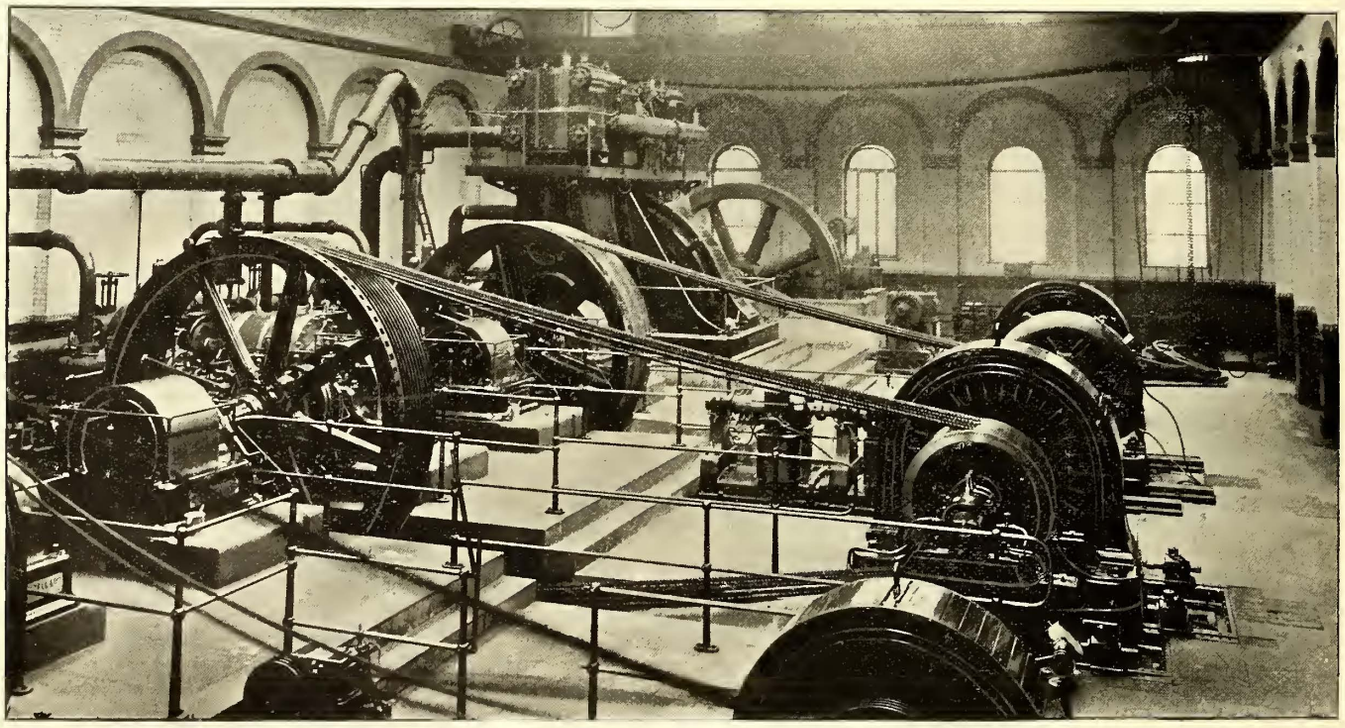
Rate of pay is to be based on the number of trips run, as under the present system.

H. H VREELAND,
President and General Manager.

Electric Tramways of Halifax, England

By T. P. Wilmshurst, A. I. E. E.

The busy Yorkshire town of Halifax, built as it is on the side of a hill, presents obstacles from a haulage point of view which are probably not met with in any other town in England. A few years ago a private company sought a concession for the laying down of tramways in the borough. The Corporation, however, then, as hitherto, steadfastly opposed the application. As with many other Northern towns, the Corporation of Halifax holds the view that it is inadvisable to hand over the partial control of the streets to any private individual. A necessary consequence of this is that all the public services, whether gas, water or electricity, are under municipal management. This agitation, however, had the effect of arousing a strong local expression of feeling in favor of the introduction of trams, and the Corporation, having obtained Parliamentary powers, decided, therefore, to lay down its own system.



POWER STATION—HALIFAX CORPORATION

The Tramways Committee soon came to the conclusion that for flexibility and economy electric traction on the overhead trolley system could not be beaten, and the Borough Engineer, Mr. Escott, and the Borough Electrical Engineer, the writer, were, therefore, instructed to prepare specifications and obtain tenders for the work.

The estimates amounted to about £50,000, and are made up as follows:

Permanent way	£20,000
Car shed, purchase of land, etc	6,550
Feeders, bonding, poles, wiring, etc	6,300
Fourteen cars complete	9,000
Additions to existing electricity works	5,500
Sundries	1,000
	£48,350

The contracts were eventually given to the following firms:

Rails	The Leeds Steel Works.
Spring points	Askham Bros. & Wilson, Sheffield.
Car equipment, bonding, overhead equipment and generators	The Electric Construction Company, Wolverhampton.
Feeders	The Callender Cable Company, London.
Poles	J. Spencer & Sons, Wednesbury.
Car bodies	G. F. Wilnes & Company, Birkenhead.
Trucks	Peckham Truck Company, New York.
Accumulators	The Choride Electric Storage Syn., Clifton Junction.
Switchboards	Laing, Wharton & Down, London.

It would be well here to explain that the necessary power plant has been installed at the existing Municipal Electricity Works, which is some 600 yds. distant from the line.

Owing to the narrowness of the streets it was impracticable to lay double track throughout, hence, about 3 miles of route are served by single track with turnouts, and half a mile by double track. Though this is a small line in itself it is the beginning of much larger things, as a bill is now being promoted authorizing the construction of another 13 miles of track.

The chief feature of the line is the number of steep gradients. On leaving the railway station in Horton Street the cars have to start on a 1 in 14 grade for several hundred yards. After passing Commercial Street, which is level, there are grades in rapid succession of 1 in 12½, 1 in 13½, 1 in 12.3, and 1 in 16. In fact, the whole journey from High Road Well into the town, about 1¾ miles, is accomplished entirely by gravity, the brakes being in use the whole time. At the bottom of this line are two curves of 30-ft. radius.

The rails, a section of which is shown in the accompanying diagram, are of the grooved girder type, and weigh 98 lbs. per yd. The ends are joined by a sole-plate weighing 40 lbs., and by two fishplates weighing 47 lbs. per pair. All bolts are secured by lock bars. A substructure of concrete is used, and the paving is usually Lancashire setts. The bonding is carried out by Columbia bonds, two No. 0000 bonds being used at each joint. Crossbonds are also fixed at each third rail.

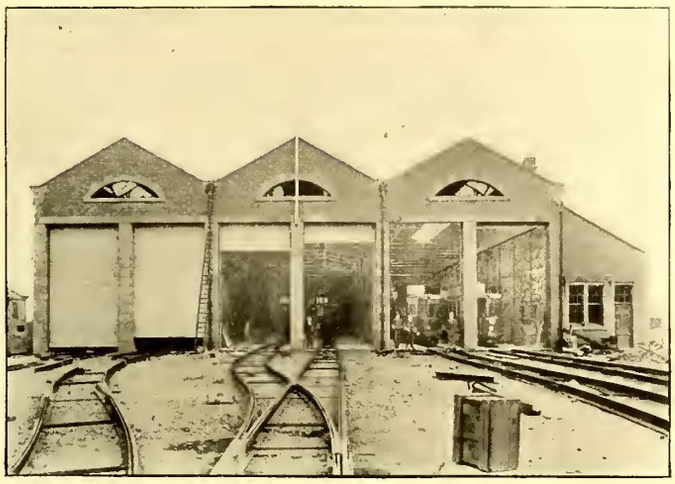
The poles are of rolled steel and made in two lengths, and fitted with ornamental cast-iron bases. The lengths of arms are as follows: Twenty-one of 5 ft., fourteen of 7 ft., seventy-two of 10 ft., twenty-eight of 15 ft.; there are three center poles and six terminal poles. In the center of the town arc lamps are suspended from the arms. Two No. 0 trolley wires are erected throughout. The insulators are of

the Ætna class, double insulation being provided throughout. The trolley wires are divided into half-mile sections, the section switch boxes being fitted with four switch fuses and two Garton lightning arresters. Guard wires of No. 7½ B. W. G. galvanized iron wire are erected where necessary.

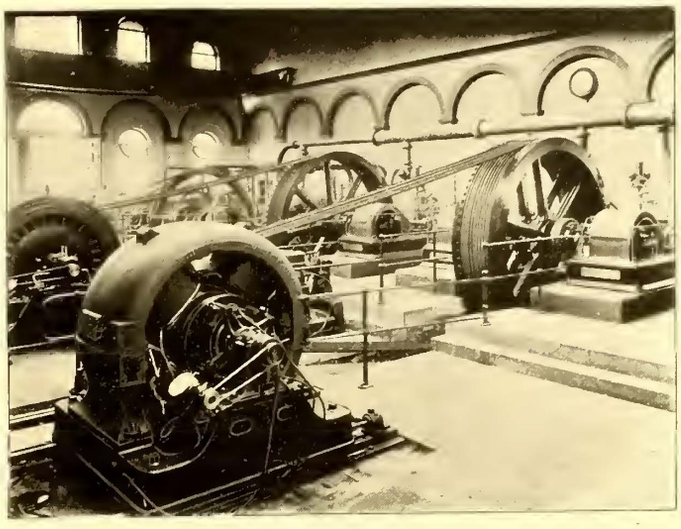
Two armored feeders of .15 sq. in. section are laid from the power house to the rails about 600 yards away. One of these feeds each route. Alongside the feeder is laid a telephone and pilot cable. The car shed, power station and other important points on the route are thus in communication.

The return feeder is of .33 sq. in. section, and is drawn into Doulton casing, and spare ways have been laid for extension. The whole of these cables are insulated with vulcanized bitumen.

The rolling stock comprises ten motor cars. The bodies are of the double-deck type, and have a seating capacity of forty-four; i. e., twenty inside and twenty-four outside. The length of the body is 16 ft., and over all 26 ft. 6 in. The trucks are of the Peckham type, with wheels 30 in. in diameter, and wheel base 5 ft. 6 in. Two inclosed motors are used and are suspended in the usual manner direct from the axle and from crossbars on the truck with springs. The motor pinions are of forged steel and the spur wheels of cast-iron, the ratio being 4½ to 1. The wheels, of course, are fitted with oil-tight gear cases.



CAR HOUSE



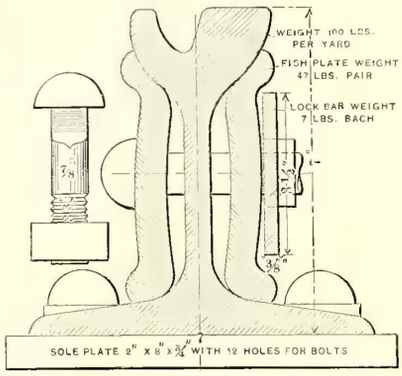
GENERATORS

VIEW ON COMMERCIAL STREET—HALIFAX

The motors, which were manufactured by the Electric Construction Company, were guaranted to have a tractive effort on each side of 1000 lbs. at the periphery of the 30-in. wheel at 8 miles per hour. The series-parallel controllers are of the G. E. type. The trolleys are of the Dickinson type, and allow of a variation of about 12 ft. in the relative positions of the car and the trolley wires. The lighting of the cars is carried out by ten lamps. In addition to the wheel brake and electric emergency brake, a slipper brake is used on steep gradients. This is also

worked from the driver's platform, and allows a wooden slipper block to be pressed against the rails. This has been found to be of great service in greasy weather.

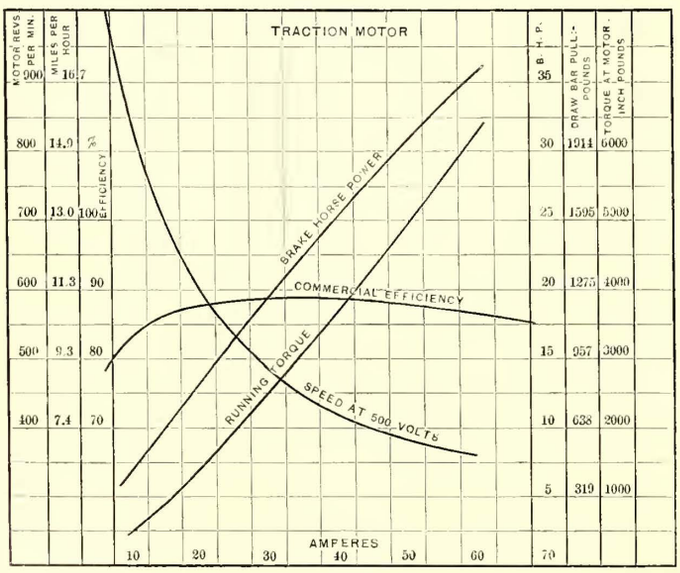
The lighting is carried out on the high tension alternating system, hence, some alterations and additions to the power plant were rendered necessary. Two four-pole generators have been installed. Each is of 120 k. w. capacity, and gives 220 amps. at 500 to 550 volts. The machines are compound wound, but, as a rule, are run plain shunt, as they are coupled in parallel with a battery of accumulators. One of these machines is rope driven from an existing engine, the alternator which it drove having been taken away.



SECTION OF RAIL

The engine is of the horizontal compound condensing type. The cylinders are 12 in. and 27 in. x 24 in. stroke, and speed 110 revolutions. The flywheel has a weight in the rim of 12 tons.

The alternator which was mentioned as having been taken out is now used to drive the second traction generator, the former thus running as a synchronous motor from



MOTOR CURVES

the alternating current bus bars. As a battery is used in this system, the load on the dynamo can be kept fairly steady.

A large battery has been fixed above the boiler house, and forms an ample reserve to the system. This consists of 270 chloride cells. Each cell contains sixty-three plates and is capable of discharging 200 amps., for six hours. It is thus possible during the peak of the lighting load to entirely shut down the traction generators and run the present service of cars from the battery alone.

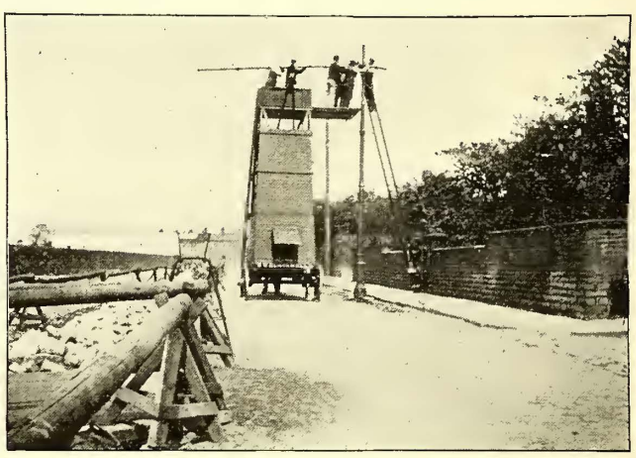
The switchboard is of a very simple character. Slate panels are used, fixed on iron stands, and nothing of a combustible nature is allowed on the board. The first panel controls the two feeders, the second and third the generator and motor-alternator respectively, the fourth the accumulators, the fifth is the Board of Trade panel, and the sixth contains the voltmeters, which can be switched on to any machine or the battery. Weston instruments are used throughout, and the automatic circuit-breakers are of the Cutter type.

In conclusion I may add that the committee has appointed F. Spencer, late of the South Staffordshire Tramways Company, to be traffic manager, and the principal contractor, the Electric Construction Company, has been ably represented in Halifax by N. H. White. The illustrations are from photographs by H. E. Gledhill, Halifax.

Electric Construction in Bradford, England

The Corporation of Bradford, England, owns as yet only 5 miles of the tramway system of the city, but in the course of three years will become the owner of no less than 80 miles.

Electric traction is being introduced on the 5 miles on the overhead trolley system, and will be extended as other sections are secured. Westinghouse motors and Peckham



TOWER WAGON AT BRADFORD

Standard trucks have been adopted, and there are to be sixteen cars at present.

Power is supplied by the corporation from its electric lighting station, which has 500-volt continuous current dynamos, charging accumulators. When used for traction a series winding can be put in circuit, compounding the

TOWER WAGON AT BRADFORD

machines, which then work direct on the traction and are entirely disconnected from the accumulators. A special switchboard has been put up for the traction work.

The contractor for all the above work is Robert W. Blackwell. The illustrations show the erecting of the poles and lines.

Papers and Committees at Boston

The following is the list of papers to be read at the Boston Convention of the American Street Railway Association:

1. "Maintenance and Equipment of Electric Cars for Railways," by M. S. Hopkins, Electrician Columbus Street Railway Company, Columbus, Ohio.

2. "To What Extent Should Railway Companies Engage in the Amusement Business?" by W. H. Holmes, General Manager Metropolitan Street Railway Company, Kansas City, Mo.

3. "The Carrying of United States Mail Matter on Street Railways," by W. S. Dimmock, General Superintendent Omaha & Council Bluffs Railway and Bridge Company, Council Bluffs, Ia.

4. "The Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use," by Richard McCulloch, Electrical Engineer, Cass Avenue and Citizens Railway Companies, St. Louis, Mo.

5. "Inspection and Testing of Motors and Car Equipment by Street Railway Companies," by Frederick B. Perkins, Electrical Engineer Toledo Traction Company, Toledo, Ohio.

6. "Cost of Electric Power for Street Railways at Switchboard; Both Steam and Water," by R. W. Conant, Electrical Engineer Boston Elevated Railway Company, Boston, Mass.

The following local committees have been appointed:

GENERAL COMMITTEE

C. S. Sergeant, 101 Milk Street, Boston, Mass., Chairman.
E. C. Foster, 333 Union Street, Lynn.
J. E. Rugg, 101 Milk Street, Boston.
C. S. Clark, 8 Oliver Street, Boston.
A. A. Glasier, 104 Ames Building, Boston.
C. Q. Richmond, North Adams.
John R. Graham, 280 Washington Street, Boston.
Robert S. Goff, Fall River.
P. L. Saltonstall, 28 Exchange Building, Boston.
E. P. Shaw, 316 Exchange Building, Boston.
F. H. Dewey, Wor. Cons. St. Ry. Co., Worcester.

COMMITTEE ON ENTERTAINMENT

P. L. Saltonstall, Boston, Chairman.
H. F. Eldredge, Portsmouth.
A. B. Bruce, Lawrence.
C. C. Pierce, Boston.
C. E. Barnes, Boston.
C. W. Wilson, Boston.
J. F. Shaw, Boston.
J. H. Goodspeed, Boston.
J. H. Cunningham, Boston.
B. J. Weeks, Quincy.
W. W. Sargent, Fitchburg.

COMMITTEE ON HALL, HOTELS AND REGISTRATION

E. C. Foster, 333 Union Street, Lynn, Chairman.
John F. Morrill, Quincy.
J. N. Akarman, Worcester.
J. H. Studley, Jr., Boston.
J. E. Rugg, Boston.
W. F. Pope, Boston.
R. N. Wallis, Fitchburg.
H. B. Parker, Boston.
A. E. Smith, Springfield.
George F. Seibel, Taunton.

COMMITTEE ON EXHIBITS

Charles S. Clark, Chairman.
H. F. Woods, Boston.
E. C. Foster, Lynn.
C. F. Baker, Boston.
E. P. Shaw, Jr., Boston.
Franklin Woodman, Haverhill.
R. S. Goff, Fall River.
J. H. Studley, Jr., Boston.
Maurice Hoopes, Lynn.
A. C. Gardner, New Bedford.
Edwin S. Webster, Boston.
W. F. Pope, Boston.

COMMITTEE ON TRANSPORTATION AND INFORMATION

Julius E. Rugg, Chairman.
N. H. Heft, Boston.
H. B. Rogers, Brockton.
J. F. Wattles, Boston.
Fred. H. Smith, Quincy.
A. E. Gordon, Boston.
N. E. Morton, Lawrence.
C. E. Woodward, Wakefield.
Winthrop Coffin, Boston.
H. H. Reed, Fall River.
H. F. Grant, Boston.

BANQUET COMMITTEE

A. A. Glasier, Chairman.
W. A. Bancroft, Boston.
Prentiss Cummings, Boston.
C. S. Clark, Boston.
E. P. Shaw, Boston.
E. C. Foster, Lynn.
S. M. Thomas, Taunton.

Standard System of Street Railway Accounting

By A. O. KITTREDGE, F. I. A.

If hard and exacting work, under the extremely trying conditions of torrid weather, upon the part of the committee appointed at the last convention of the Street Railway Accountants' Association, upon revision and further development of the Standard System of Accounts, may be taken as evidence of the importance of the report which is to be presented at the convention in September next, the members of the organization and street railway men in general may expect something exceptionally valuable. It has never been my fortune to encounter a committee composed of more industrious, painstaking and thorough men than are those who are engaged in this special work. They are keenly alive to the responsibilities that rest upon them and have a lively sense of the opportunity which is before them to do effective and advantageous work for street railway interests. While in a sense disappointed at the limited number of replies received from their associates in the organization to their recent circular letters, requesting criticisms upon what has already been made public, suggestions and special points for further investigation, they yet have the assurance from various sources that their work is appreciated, and that what in their wisdom they recommend for adoption will have most careful consideration at the general gathering.

The meeting of the committee was appointed for Monday, July 18, and the Waldorf-Astoria was the suggested place. At the last moment arrangements were made for transferring the work to the Oriental Hotel, Manhattan Beach. Accordingly the committee performed its labors where conditions were a little more tolerable than they would have been in the midst of the great city. There were present Messrs. C. N. Duffy, of St. Louis; W. F. Ham, of Brooklyn, and H. J. Davies, of Cleveland. W. B. Brockway, secretary of the organization, was also in attendance for the first three days of the week, but business of an imperative nature called him home before the deliberations of the committee were completed. The work was greatly facilitated by the able and intelligent co-operation of T. E. Crossman, official stenographer of the association. Messrs. H. L. Wilson, of Boston, and J. F. Calderwood, of Minneapolis, members of the committee, found it impossible to be present.

The work undertaken embraced first a general revision

and thorough editing of the report submitted at the Niagara meeting; second, a careful discussion of the terminology employed, by which discrepancies in names of accounts and other verbal inaccuracies in the original report were carefully corrected, and third, the grouping of the established expense accounts into three classes, namely, "Maintenance," "Transportation" and "General," in a way to place the subdivisions in correct logical sequence. The specification of charges to be made under each head was likewise carefully revised. The committee finally addressed themselves to the preparation of their formal report or accompanying message. The features of this report, of course, cannot be anticipated. It will constitute the leading feature of the coming convention. The committee gave attention incidentally to the question of depreciation, and the provision to be made for it in the accounts, to the forms of companies' annual reports and periodical statements, and to many minor features.

Those who have not devoted personal attention to work of a similar character are scarcely in position to judge of the amount of effort that such an undertaking involves, and the necessary self-sacrifice of those who engage in it. The association is to be congratulated upon its selection of men for this work, for while it is possible that others might have been found who could do as well, it is safe to say that there are none who could do better, or who could be more devoted to the undertaking. Those who go up to the accountants' convention in September may rest assured that in the report of this committee there will be found an important advance in the work from where it was left last October, and that there will be brought to their attention enough that is new to make the occasion one of great interest and importance.

Street Railway Accountants and Street Railway Advertising

The up-to-date street railway must be advertised the same as other enterprises which depend upon popular patronage for their success. It is not enough that a street railway runs through a populous section of country, or connects two terminal points, between which there is a constant traffic. The maximum of profit is to be obtained only by an enlarged patronage. The history of successful street railways in all parts of the country shows that the number of passengers carried can be materially increased by judicious advertising.

Comparatively few street railway companies have in operation definite plans of advertising or are equipped with properly arranged advertising facilities. It is true that a small number maintain advertising departments, in character analogous to those organized and employed by the steam railways of the country, but the majority are doing no advertising at all, or are conducting what little is being done under the supervision of one of the general officers. As companies are very commonly manned, the management of the advertising would seem to fall most naturally to the secretary.

In view of the fact that a considerable proportion of the membership of the Street Railway Accountants' Association is represented by secretaries, it has been suggested by one of the officers prominent in that organization and a gentleman who is also secretary of a leading street railway company that the consideration of advertising problems and methods could very properly be included in the work of the Accountants' Association. He suggests that in the absence of a special department, it would be well if the rule were to be established that the management of the advertising should be delegated to the secretary of the company. Since comparatively few organizations can afford to maintain passenger and advertising departments, this would have the effect of very generally making the secretaries of street railway companies their advertising representatives. In view of the fact that there is no national organization except the Street Railway Accountants' Association in which the secretaries are prominently and especially represented, it follows that it would be greatly to the advantage of all concerned if the subject of advertising were to come up for discussion in the annual meetings of this body.

What amount of money can be afforded for advertising is intimately associated with the accountants' work, and in the same sense comes under the auditor's supervision. The effect produced upon receipts by advertising in the sense of justifying the expenditure is something else that the accountant and auditor are called upon to answer. The manner and amount of advertising that a street railway company can afford to undertake can in no reasonable way be compared to the advertising of a mercantile business. By the very nature of the case, the advertising of a street railway is more in the line of steam railway advertising, covering newspaper display, reading matter, illustrated pamphlets, folders and the like, but the application of these principles and the use of these means is to be discussed along lines peculiar to street railway work, and the rules that govern can in no proper sense be derived from the experience of the steam railway of the country; hence the necessity, in the interest of judicious expenditure, of discussing this subject purely from the point of the street railway company's needs.

Much might be said concerning the arguments for letting people know what the street railway has, what it is doing, and what it can do. If, when we are traveling, we come to the front of a mountain that has a well-beaten pathway up its side, we are at once seized with a desire to ascend to the top for the sake of the view that may be had from the summit. If we approach a stream where an idle boat is moored, our impulse is to go aboard and enjoy the exhilaration of a sail; and, in the same way, if we come to a railway, of which it is said that it runs through verdant valleys, along sparkling streams, pure in the freshness of the country, crosses over gorges and skirts stately mountains, the wish that is uppermost in our mind is to journey through the enchanting landscape that is described. A well illustrated advertisement appeals to the person in quest of enjoyment, and places before him a source of pleasure not before thought of. In this day of photo illustrations, the most pleasing scenes may be presented in an advertisement at a trifling cost. People in general both admire pictures and desire to see the thing that is pictured. Many street railways have notable views along their routes, extend through most attractive sections and reach parks, public buildings and fashionable drives; they pass by woodlands, over hills and through valleys, of which many in the community know nothing of, but to which thousands would go if only the accessibility and the cheap cost of the trip were brought to their notice. The enjoyment of a pleasure trip does not always stop with the memory, but is frequently repeated. A thing often repeated becomes a habit, and this is the secret of increased travel over street railways, as well as over steam railways. The good features of travel, therefore, should be put so continually before patrons of a railway that something more is thought of than street cars as mere carry-alls.

LEGAL NOTES AND COMMENTS*

Edited by J. Aspinwall Hodge, Jr., and Robt. H. Ernest, of the New York Bar.

The Degree of Care Demanded of Street Railway Companies

A general discussion of this subject will not be attempted, but a somewhat notable decision has recently been rendered by the New York Court of Appeals which would seem to demand notice. One Xavier Stierle sued the Union Railway Company (156 N. Y., 70), and the evidence on his behalf showed that the car of the defendant upon which he was a passenger was "suddenly, negligently and carelessly driven around a curve in the track upon which it was being moved over a switch," whereby he was thrown from the car and sustained injuries. The trial judge charged the jury, at the request of the plaintiff, that "in respect to carrying passengers a railroad company is bound to exercise all the care and skill which human prudence and foresight can suggest to secure the safety of their passengers." To this the defendant excepted, and the Court of Appeals holds that the charge was erroneous, and promulgates the proposition that "the obligations of carriers of passengers to exercise the highest degree of care which human prudence and foresight can suggest only exists with respect to those results which are naturally to be apprehended from unsafe roadbeds, defective machinery, imperfect cars and other conditions endangering the success of the undertaking."

O'Brien and Vann, JJ., dissent on the ground that "the reason which requires the exercise of the highest degree of care by a carrier of passengers with reference to roadbed and machinery extends with equal force to the use of the roadbed and machinery in the operation of cars. There should not be a higher degree of care required in providing appliances than in using them."

The prevailing opinion of Gray, J., draws a distinction between the negligence of the driver in crossing the switch and the negligence in not having a proper roadbed, holding that in the latter case the highest degree of care is demanded, and in the former case only reasonable care. A further distinction seems to be drawn by him between those cases where, because of peculiar circumstances surrounding the case, there is an evident possibility of loss of life and limb to the traveling public and those cases where there is no such evident risk.

After the decision of the case a motion for reargument was made, and upon denying the motion the court rendered an opinion by Gray, J., in which a proposition is advanced not suggested in the original opinion. He says:

"It was said in Unger vs. Forty-second Street, etc., R. R. Co. (51 N. Y., 497), where it was held that the same degree of care and skill was not required of carriers of passengers upon street cars drawn by horses as upon a steam railroad, 'the degree of care required in any case must have reference to the subject-matter. * * * In some cases this rule will require the highest degree of care, and in others much less.' In the present case there was no situation of danger and the accident occurred, whether under the plaintiff's or the defendant's theory of its occurrence, while the driver was simply changing his car from one track to another, over a switch, in order to cross the bridge. In so doing the duty imposed upon the defendant by law was that of exercising reasonable care, as an ordinarily careful and prudent man would exercise under the circumstances."

He further seeks to distinguish the Maverick case (36 N. Y., 378) and the Coddington case (102 N. Y., 66), upon the theory that those cases were ones in which there was an obviously dangerous situation.

It is manifest that until some further adjudications are had upon the questions discussed by the Court of Appeals in this case, both the bar and the bench will have some difficulty in determining exactly when a railroad company, whether operating by steam, electricity, horses or cable, is bound to exercise the highest degree of care, and when it is only bound to exercise that reasonable care which is demanded of all, whether common carriers or not. But the tendency of this opinion seems to be toward relieving the street car companies from some of the obligations which were generally supposed to rest upon them. H.

CHARTERS, ORDINANCES, FRANCHISES, ETC.

NEW YORK.—Surrender to City—Validity of Ordinance.—In July, 1851, the Common Council of the city of New York, by resolution, granted to P. and his associates the right to construct a railroad in certain streets, upon the proviso that they should execute an agreement with the city, obligating themselves to perform certain stipulations; among others, to surrender the road to the city, upon its request, and upon payment of its cost and 10 per cent in addition, to pay certain license fees upon the cars on the road, and to organize themselves into a company under the name of the E. R. R. Co. P. and his associates executed the required agreement, and entered upon the construction of the road. In 1854 the Legislature passed the general act relative to railroads in cities (Laws 1854, c. 140), prohibiting Common Councils of cities from permitting the construction of street railroads without the consent of abutting property owners, but permitting the construction, extension, or use of any railroad already constructed in part, and "to that end" confirming the grants, licenses, and resolutions under which they were constructed. In the following year the E. R. R. Co. was incorporated under the general railroad act and the act of 1854. Held, that the Common Council having had, at the time of the passage of the resolution in 1851, no power to confer an exclusive franchise to use the streets, that resolution was void, and the consideration for the agreement of P. and his associates to surrender the road accordingly failed, and such agreement was of no force or effect; that the E. R. R. Co., upon its incorporation, came under no contract, except one with the State to fulfill the duty to operate its franchise, derived from its charter from the State, in consideration of the recognition and grant of the right to complete its road, subject only to the conditions imposed by the general railroad act and the act of 1854; and it never came under any legal obligation to surrender or transfer its railroad to the city upon its request.—(Mayor, etc., vs. Eighth Ave. R. Co., 23 N. E., 550; 118 N. Y., 389, distinguished; Potter vs. Collis, Commissioner of Public Works, et al., 50 N. E. Rep., 413.)

NEW YORK. — Transfers — Rights of Passengers. — Under Laws 1892, c. 675, § 104, which requires certain street surface railroad companies to give "transfers" to their passengers, without extra charge, for "one continuous trip," it is not a reasonable regulation for the company to adopt an arbitrary and brief time limit within which such a transfer must be used, irrespective of whether suitable accommodations are offered to the passenger for continuing his trip. He is entitled to wait until he can secure a seat.

Ejection of Passengers.—In an action to recover damages from a street car company for the act of the conductor of a car in unlawfully ejecting a passenger, evidence offered by the plaintiff that, upon the conductor's orders, he was arrested by a policeman and taken to court, but afterwards discharged, was excluded. Held error, as the evidence bore on the extent of plaintiff's damages.—(Jenkins vs. Brooklyn Heights R. Co., 51 N. Y. Suppl., 216.)

NEW YORK.—Reference—Extension of Streets—Proceedings of Council.—Even if an appeal lies at all from the action of a Common Council in authorizing the extension of a street across the tracks of a railroad, under section 61 of the railroad law, as amended by Laws 1897, c. 754, there is no authorization for an application by the railroad company to the Appellate Court for the appointment of a referee to take proof of the facts and circumstances upon which the Common Council passed the ordi-

*Communications relating to this department may be addressed to the editors, Johnson Building, 30 Broad Street, New York.

nance.—(In re Extension of North Third Avenue, 51 N. Y. Suppl., 353.)

NEW YORK.—1. Nuisance—Obstruction of Sidewalk.—A wall of masonry and an iron structure erected along the middle of a highway by a surface railroad company, to connect its tracks with those of an elevated railroad company, without any competent legal authority for such erection, constitutes a nuisance.

2. Railroads—Junction—Surface and Elevated Road.—Subdivision 5 of section 4 of the "Railroad Law" (2 Rev. St. [9th Ed.] p. 1252, c. 39), empowering railroad corporations to "join or unite" their railroad with any other railroad, does not authorize a connection between a street surface railway and an elevated railroad by an inclined plane, where the property owners have consented only to a surface road.

3. Nuisance—Injunction.—In an action by a property owner to enjoin a surface railroad company from maintaining upon a public highway a wall and iron structure constituting a nuisance, it appeared that, while the structure was not in front of plaintiff's premises, it began at or about opposite the side boundary line thereof, and that the highway led to the county town. Held, that the facts warranted a finding of special injury to plaintiff, and that he was entitled to maintain the action.—(Eldert vs. Long Island Elec. Ry. Co., 51 N. Y. Suppl., 186.)

NEW YORK.—Grant from Railroad Commissioners—Review of Decision.—An order of the Board of Railroad Commissioners granting a street railroad the right to change its motive power from horses to electricity, under the authority of the railroad law, § 100, after due notice by publication, and on a showing of the consent of over half the property owners on the line, is not reviewable by it, in the absence of any express authority given by the statute.—(People ex rel. Luckings vs. Board of Railroad Com'rs of State of N. Y., et al., 51 N. Y. Suppl., 781.)

PENNSYLVANIA.—1. Setting Aside Release—Fraudulent Representations.—Fraudulent representations, to be ground for setting aside a release, must be shown to have been the inducement to execute it.

2. One trying to settle a claim against him for damages will not be held to any stricter rule of honesty in his statements as to the delays and disadvantages of a lawsuit, and the small amount claimant might receive even out of a substantial verdict, than would one in depreciating the value of merchandise in the dicker for purchase thereof.—(Kane vs. Chester Traction Co., 40 Atl. Rep., 320.)

PENNSYLVANIA.—Bicycle—Right of Way.—A bicycle is not a vehicle, within an ordinance giving to vehicles the right of way on the tracks of the street railway companies in the direction in which the cars ordinarily run.—(Taylor vs. Union Traction Co., 40 Atl. Rep., 159.)

MICHIGAN.—Municipal Corporations—Grant of Street Railway Franchise—Exclusive Rights.

1. Municipal corporations have no original authority, independent of legislation, under the State constitution, to make grants of exclusive street railway franchises.

2. Legislative authority in a municipal corporation to make grants of street railway franchises which shall be exclusive does not exist, unless given in language express and explicit, or necessarily to be implied from other powers given.

3. Michigan Tram-Railway Act, §§ 33, 34, authorizing the organization of companies to operate street railways, but declaring that no such company or corporation shall be authorized to construct such a railway without the consent of the municipal authorities, and under such regulations, and on such terms and conditions as they may prescribe, does not authorize a town to pass an ordinance granting an exclusive railway franchise.—(Detroit Citizens St. Ry. Co. v. Detroit Ry. et al., 18 Supr. Ct. Rep. 732.)

MASSACHUSETTS.—Execution Against Street Railway—Property Subject.

Under Pub. St. c. 105, §§ 30, 31, providing that the franchise of a corporation authorized to receive toll, and all the rights and privileges thereof, so far as relate to the receiving of toll, and all other corporate property, may be taken on execution and sold at public auction, the remedy of a judgment creditor of a street car company is by levy of execution upon such franchise and other property, and sale thereunder.—(Williams v. East Wareham O. B. & P. I. St. Ry Co. et al., 50 N. E. Rep. 646.)

NEW YORK.—Eminent Domain—Remedies of Abutters—Burden of Proof.

In an action to restrain a street railroad company from building its road along a street, on the ground that the consent of the owners of half the value of the abutting property has not been obtained, the burden is on plaintiff to prove that fact.—(O'Brien v. Buffalo Traction Co., 52 N. Y., Suppl. 322.)

NEW YORK.—1. Second Appeal—Estoppel.

A defendant who secures a reversal of a judgment in favor of the plaintiff, upon the first trial of an accident case, on the ground that the question of defendant's negligence should have been submitted to the jury, cannot on a subsequent appeal, after a second trial involving substantially the same evidence, insist that the plaintiff should have been nonsuited.

2. Personal Injuries.—Inadequate Verdict.

At the trial of an action to recover damages for injuries sustained by the plaintiff through the alleged negligence of the defendant, it appeared that plaintiff, in consequence thereof, had undergone actual expenditures of nearly $400, and, in addition, that while he earned $2 a day prior to the accident, the injury had kept him out of work for more than two years, and had resulted in shortening one of his legs, making it impossible for him to endure heavy work requiring him to remain on his feet. The court charged that, if entitled to recover at all he was entitled to the amount expended, as well as for loss of time, for suffering, and for decreased earning power. Held, that a verdict of $500 was so small as to be ridiculous, and was properly set aside by the court below.—(Morrisey v. Westchester Electric Ry. Co., 51 N. Y. Suppl. 945.)

LIABILITY FOR NEGLIGENCE.

TENNESSEE.—Dogs Killed by Street Car—Negligence—Damages—Pedigree.—1. It is not error to charge, in an action for the killing of a dog by a street car, in which the motorman, who was serving as motorman and conductor, had given as a reason for not seeing the dog sooner the fact that he was looking around to see if any of the passengers wanted to get off, that the company must have sufficient employees on its cars to operate them in a careful manner, so as to prevent injury to persons and animals on the track.

2. An action being for the injury and killing of a dog, recovery may be had for the injury, even if plaintiff in killing him was mistaken as to his being fatally injured.

3. A motorman cannot rely on the alertness and quickness of a dog on the track, so as to relieve himself of all duty to try to prevent an accident.

4. The pedigree of a dog killed may be shown on the question of damages.

5. Pedigrees of dogs may be shown by books kept to register the same.—(Citizens' R. T. Co. vs. Dew, 45 S. W. Rep., 790.)

TEXAS.—Contributory Negligence.—Where plaintiff is guilty of contributory negligence in attempting to cross a street-car track, he cannot recover, even though the servants of defendant, operating the car, could have, by the exercise of diligence, discovered his peril in time to have prevented running him down.—(Austin Dam & S. Ry. Co. vs. Goldstein, 45 S. W. Rep., 600.)

PENNSYLVANIA.—Accident on Track—Contributory Negligence.—One struck by a street car from behind is guilty of contributory negligence, having walked on the track, knowing that the car was due, though frequently looking behind her for it.—(Gilmartin vs. Lackawanna Valley R. T. Co., 40 Atl. Rep., 322.)

PENNSYLVANIA. — Accident on Track — Negligence. — A street railway company is not liable for death of boy, sixteen years old, occasioned by his suddenly running against, or immediately in front of, the car, so that the motorman had no opportunity to prevent collision.—(Mulcahy et ux. vs. Electric Traction Co., 39 Atl. Rep., 1106.)

TEXAS.—Death—Negligence—Pleading and Proof.—The parents of a child may recover for his death through negligence, on proof, as alleged, that a motorman saw the child on the track in time to stop, that he failed to do so, and that his negligence was the proximate cause of the child's injuries, regardless of whether there is proof of the allegations that the child was deaf, and that the motorman, on approaching him, pushed him so that he fell upon the track.—(Gutierrez et ux. vs. Laredo Electric & Ry. Co., 45 S. W. Rep., 310.)

Foreign Notes

The report of the Buenos Ayres Grand National Tramways Company for the year ending March 31, 1898, is not so encouraging as the weekly traffic reports have indicated. Although the gross receipts increased over £19,000, the net revenue was only £3,400 larger. The extra cost of horse keep was £4400, while taxes and official imposts, already £5645 in 1897, rose to £6961. The increase in revenue was 0s. 12d. and the increase in expenses was 0s. 15d. per mile run.

An extension of the Bristol tramway system has recently been completed to Arno's Vale. The rails are laid on a bed of concrete and connected with copper bonds, so that they may be used by the electrical cars as soon as the posts and wires are in position. Meanwhile horse cars will run over the line.

The County Council of Southampton (Eng.) has appointed a tramways committee preparatory to taking over the tramway system. Twelve councillors were elected to form the committee.

The Electric Tramways Committee of the Cardiff (Wales) Town Council have chosen a small deputation to visit several places and report to the committee, who will then decide upon two or three typical places and visit them before definitely recommending overhead or underground system of traction to the Council. The deputation will commence its duties at once.

Manchester (England).—As the result of an experimental trip, it is understood that negotiations are pending for the introduction of a number of Eades electric cars on the various routes of the existing tramway system. The cars will be fitted with two 15-h.p. motors, until the overhead trolley system is adopted.

The London Tramways Company will redeem on Dec. 31 next its mortgage debenture stock for £180,000, issued in pursuance of a resolution passed at a general meeting of the company on April 29, 1880. Payment will be made at the registered offices of the company.

The ninth annual report of the Electric & General Investment Company, Ltd., shows a gross profit for the year of £31,946 13s. 8d. The directors recommend dividends which, with interim dividend, make a total distribution of 35 per cent for the year on the capital paid up on the ordinary shares. The total distribution on each founder's share is £70 for the year.

London (England).—It is stated that the prospectus of the Brompton & Piccadilly Circus Electric Railway will make its appearance very shortly. Looking at the details, the new concern has a decidedly strong board. The chairman, Mr. Mott, is also the chairman of the City & South London, and is a director of the Great Western Railway. Other directors are the former general manager of the Great Western, the former superintendent of the North Western, a director of the City & Waterloo, and Sir Joseph Dunsdale. The capital of the company is £400,000 per mile. There are to be intermediate stations at Brompton Square, Tattersalls, Hyde Park Corner, and Down Street, Piccadilly. The electric generating works will be on the river bank, with a view to obtaining a cheaper coal supply.

The Streets, Buildings & Improvement Committee of the Barnsley Town Council have been considering the question of tramways for the town, and have expressed the opinion that it is desirable that such tramways be established and worked by a company and not by the corporation, and recommend the Council to invite companies to submit schemes of tramways for the town. The Lighting Committee propose to give Mr. Miller instructions to prepare plans and details of the proposed electric lighting scheme and recommend that application to borrow £23,322 to pay for such works be made.

Two proposals have been made to the Cheltenham (Eng.) Town Council to construct a railway from the town to the suburbs. A special committee has been appointed to consider and report on the proposals.

The Metropolitan & District Railway Companies, of London, Eng., have decided to test the efficacy of supplanting by electricity the present motive power in use upon their lines. The trials will embrace all the resources in the field of applied science, and the sum of £50,000 has been voted for the preliminary experiments. When the results have been satisfactorily established, the thirteen mile radius of the inner circle will probably be selected for the inaugural introduction of the new system.

The Light Railway Commissioners have decided to recommend the Board of Trade to grant the application of the London United Tramways Company, of London, Eng., for permission to extend their system by constructing an electric railway from Hanwell to Uxbridge.

The Light Railway Commissioners have decided to recommend the Board of Trade to grant powers for electric railways on the overhead system near Portsmouth, Eng., and Bournemouth.

Tenders are called for by the City of Edinburgh, Scotland, for steam engines, rope drives and tension machinery, required for installing the cable system of traction.

The Bristol, Eng., tramways, electrical power and extensions bills have proved compliance with the standing orders of the House of Lords and have been sent for second reading.

At the last meeting of the Rochdale Town Councils resolutions were passed unanimously that the Corporation should take steps to acquire and work the tramway lines within the borough. Further, that it was desirable to ascertain if suitable arrangements could be made with the surrounding local authorities for acquiring and working the tramways of the district.

A special meeting of the Council of Kirkcaldy, Scotland, is to be called to decide whether the Corporation shall undertake the proposed introduction of electric light and tramways. The total length of the route is to be 6½ miles. The cost would be at least £100,000.

At a recent meeting of the Southend, Eng., Town Council, the General Purposes Committee recommended the following resolution, which was carried: "That the committee be empowered to make investigations and to have such plans prepared as may be necessary to enable them to submit a scheme to the Council for the construction of tramways."

West Bromwich, Eng., proposes placing the whole of the tramway lines in the district, when the leases shortly expire, under municipal management.

As soon as the Leith, Scotland, Corporation completes the purchase of the tramway system in their boundary, it is proposed to operate the systems of Leith and Edinburgh as one, which will greatly decrease the operating expenses of the roads.

The Drumcondra, Ireland, Commissioners have adopted and forwarded to the Drumcondra Tramway Company the report of their engineer, that "nothing short of a reconstruction of the existing lines would fulfill the conditions as to their state of repairs which the company admitted they were bound to maintain."

Accumulators have been decided upon for the motive power of the Ghent Tramway System. About 30 k.m. will be equipped.

The Belgian Government has decided upon the electrical equipment of its railroad from Mons to Boussu. The line is 13-k.m. in length and will employ the overhead system. The power station will be at Quaregnon and will contain three 250-h.p. generators.

The General Council of the Ain, France, has granted a concession for an electric railway from Lyons to Chalmont.

The General Omnibus Company of Paris, has announced its plans for the further equipment of part of its lines with mechanical power, according to the Paris papers. There will be an electric power station of 4000 h.p. at Vincennes, and a compressed air station at Billancourt. The former will be used for storing the accumulators used on the Cours-de-Vincennes, Le-Louvre et Vincennes, and Le Louvre lines. La Société Alsacienne will build the station and the accumulators will be partly of the Blot and partly of the Tudor types. The Billancourt station will be equipped with compressors for a pressure of 80 atmospheres. The

Dujardin Company, of Lille, will supply the engines; the Babcock & Wilcox Company the boilers, and the Farcot Company the compressors.

On July 8 the Grosse Berliner Strassenbahngesellschaft celebrated the twenty-fifth anniversary of the opening of its lines with horse-power.

La Compagnie de Traction et d'Electricité is the title of a new company recently organized in Belgium for operating electric lights and tramways in Sebastopol, Russia. The new company has a capital of 2,000,000f.

La Société Pour la Creation et la Developpement des Affairs d'Electricité en Italie is the title of a new company recently formed to undertake the development of large electrical enterprises in Italy. It is understood that among the plants in which this company will be interested are: the long distance power transmission plant at Tivoli; the electric lighting of the city of Bologna, an electric plant at Cherasco, near Alexandria, and several tramways. Among the companies and firms interested in the company are: Le Credit Mobilier, le Credit Hongrois, Ganz & Co., and the Union Elektricitäts Gesellschaft.

The Belgian company which has recently been granted the concession for an electric tramway from Naples, Italy, to Miamo has been authorized to proceed with the construction.

An electric light and traction company is said to have been formed in Buenos Ayres, Argentina, with a capital of $5,000,000, and to have acquired some electrical railroad privileges. The company proposes to construct a central station which will cost about $800,000. Gaster Fredersking is said to be interested.

A company is in the course of formation in Rome, Italy, to construct an electric tramway between Como and Lecco. The line will be about 30 km. long.

Societa Nazionale per Industrie ed Imprese Elettriche is the name of a company which has just been formed in Milan, Italy, with a capital of $1,000,000, to undertake electrical work in that section.

Diatto Bros., of Turin, Italy, are said to be in the market for twenty-two passengers and six baggage cars for the Adriatic Railroad authorities.

McIntosh, Seymour & Company are said to have received orders for two 700-h.p. horizontal cross-compound electric railway engines to be used in the city of Mexico. The engines are to be directly connected with two 452-k.w. General Electric generators.

A company has been formed in Berlin, under the title of the Electric Power Company of Santiago de Chili, with a capital of 24,000,000 marks. The company proposes making extensive electrical improvements in Chili. Werreher, Beit & Company, 120 Bishopgate Street, Within, London, E. C., are said to be interested.

E. Theophilus Siefield, U. S. Consul at Freiburg, Baden, Germany, writes us that the time for estimates, etc., for the construction of the proposed electric railway and the erection of a central power station in Freiburg had been extended.

The Brush Electrical Engineering Company have recently received orders from the Mount Lyell Mining & Railway Company, Tasmania, for five 120-h.p. engines, to be coupled direct to blowers.

Favorable reports concerning the Cape Electric Tramways, Ltd., South Africa, are announced by a London financial paper. This company, which has only been in existence since October, 1897, is an amalgamation of all the Cape Town and Port Elizabeth tramways, and owns in Cape Town 22 miles of track, running through 18 miles of streets, and in Port Elizabeth 11 miles of track, covering 6 miles of streets. The number of cars are respectively 42 and 19 for the two towns, all of them being of the latest and most approved pattern, and the motive power being electricity, supplied from central power stations in each case to overhead wires.

It is probable that Budapest will soon have an underground tubular dispatch system for transmitting letters and parcels to different parts of the city. The details of the system have not been made fully known as yet, but it is understood that it will be operated by electricity. It is the invention of two engineers, Alfred Brunn and Victor Takács.

The opportunities for the sale of electrical railway equipments in Japan are becoming evident. The Tokio Electric Railway Company and the Tokio Electric Car Railway Company, which were organized some time ago, propose to re-equip the existing horse car lines in Tokio and build new electrical railways. The first named company will control all the lines in the eastern half of the city, aggregating 100 miles of track. Twenty miles of horse car line is to be changed to electricity, The latter company will operate the lines in the western portion of the city. Additional roads, aggregating about 200 miles, will be taken up by each company upon the completion of the first 120 miles by each. A central power station will be built about five miles from the center of the city, and power will be delivered to the lines by eight transformer stations, placed at convenient points in the city. The roads are to be double-track.

The electric railway system of the principality of Monaco, which was built by the French Thomson-Houston Company, was put in operation recently. The lines extend along the principal streets of the principality, and are equipped with a surface contact system, a description of which was recently published in the Street Railway Journal.

NEWS OF THE MONTH

An unfortunate runaway accident occurred on the lines of the Capital Railway of Washington, D. C., on July 10. A motor car belonging to that company was leaving Congress Heights for Washington and was part way down a steep hill when the brake chain gave way and the car rushed to the bottom, colliding with a horse car at the foot of the hill. The motor car was heavily loaded with passengers, many of whom were badly injured. One man was killed.

The indictment against the Toronto & Mimico Electric Railway Company for running cars on Sundays has been declared faulty by County Judge McDougall. The indictment was based on a section which is an amendment to the Lord's Day Act, and then asks for a penalty as provided under the criminal code, which the judge holds cannot be consistent.

The Niagara Falls Park & River Railway Company of Niagara Falls, Ont., opened its international line on June 30. This line crosses the Niagara River into New York State at Niagara Falls on the new upper steel arch bridge. The first car to cross the bridge was decorated with the Stars and Stripes and the Union Jack, and contained a select party of street railway officials and invited guests. The car has been in regular service since the opening day and carries a large load of passengers nearly every trip.

The officials of the St. Louis street railway companies had a hearing before the State Board of Equalization at Jefferson City on July 12. The companies do not desire to evade the new tax, but think they should be taxed only on the value of their real estate, rolling stock and equipment, and not on the estimated value of their franchises.

An unusually well-organized attempt to defraud a street railway company was recently brought to light among the employees of the Consolidated Traction Company of Pittsburg. It was found that a number of conductors had been in the habit for some time of giving each other transfer tickets and turning in these tickets in place of fares.

The city authorities of Springfield, Mass., have made an arrangement with the street railway company for the transportation over the company's lines of the car built to carry fire apparatus. The city agrees to take charge of running the car in all respects, except in the furnishing of electric power, and will defend the company in case of suits arising against it on account of the transportation of the car.

The Mayor of Chicago has signed the new ordinance requiring the street car companies to provide the cars with basket fenders before September 1. After that date the companies which fail to equip their cars with basket fenders will be liable to prosecution. The penalty provided is a fine of not less than $25 nor more than $100 for each car operated without the safety device. The traction companies have decided to fight the ordinance in the courts, as they take the position that their cars are already equipped with fenders, and that the city cannot legislate in favor of any particular style of fender.

The annual afternoon and evening picnic and games of the Third Avenue Railroad Employees' Mutual Relief Association will be held at Harlem River Park and Casino, New York City, on August 3, 1898.

The Cleveland (Ohio) Street Railway employees had their annual outing July 9. It was a picnic at Forest City Park under the auspices of the Cleveland Electrical Street Railway Men's Benefit Association. A good time was enjoyed by all present.

The directors of the street railway companies in Pittsburg have decided to have the ordinance relating to expectorating in street cars, railway coaches and stations enforced. They announce that if the ordinance does not prove effective by September they will ask Councils to amend the law so as to make all conductors on street cars special officers, with authority to arrest offenders on view.

The fare on the street cars between Marion and Gas City has been reduced from 10 to 5 cents. It is thought that the travel will be greatly increased by this action.

The Baltimore (Md.) Consolidated Railway Company has awarded the contract for the construction of a new car house to take the place of the one recently destroyed by fire at Irvington. The new barn will be one of the largest buildings for storing cars in the country. It will be 140 ft. wide and 588 ft. 8 ins. deep, and will be divided into four compartments, separated by brick walls, and so cut off from each other that a fire in one can be prevented from reaching the others. The walls will be of brick, and the roof of slate, with wooden girders of slow-burning construction. It will take about four months to build the new barn, and its cost will approximate $70,000.

Through the generosity of the Nassau Electric Railroad Company of Brooklyn, three of its large cars were loaned for the transportation of the children of the South Third Street Industrial Home to and from Coney Island on July 12. About 230 children were carried in the party.

One of the resolutions adopted at the recent convention of the Washington County Republicans of Vermont reads as follows: Resolved, That we, the Republicans of Washington County, in convention assembled, do request that our Senators just nominated use all honorable methods to further the development of this county, particularly in voting for all bills that tend to establish new electric railroads leading to the now more inaccessible localities, so rich in agricultural products, lumber and minerals, passing through scenery unsurpassed in this State, which we believe will tend to the building up and increasing of the material prosperity of the county.

Charles T. Yerkes, of Chicago, in a speech made some time ago before the Civic Federation of that city, made the following forcible statement: "I have heard that street railroads had very little to do with the making of a city; that the city was here before the street railroads came. I do not agree with the statement that the city was here before the street railroads came. At the time of the coming of the street railroads, in 1858, there was very little city. State Street at that time was a country road. There was no pavement of any account, and the way State Street came to be paved was that when the street railway company got its franchise the ordinance was passed and the street was paved. The street railroads have done more to extend the city and build it up than all the rest of the influences combined. They have spread the city out so that it now extends for miles and miles. It spreads out on the prairie and over, because the street railroads are here to carry people. Cut those street railroads off and where would Chicago be to-day?"

At a recent meeting of the Common Council of Greater New York a resolution was introduced to compel the surface and elevated railroad companies operating within the city of New York to provide seats for every passenger carried. The resolution, which was referred to the Committee on Law, calls upon the railroad companies to display a sign whenever a car is full, and not to take on any more passengers than can be seated, under a penalty of $25 for each offense. It also provides that when a passenger boards a car he need not pay his fare unless accommodated with a seat. The New York daily papers have taken considerable interest in this resolution, and have printed a number of interviews with street railway men on the subject. H. H. Vreeland, president of the Metropolitan Street Railway Company, said, in an interview: "Even if we had the right to refuse passengers the privilege of getting on the cars when the seats are filled, you know as well as I do that it would be an utter impossibility for any conductor to keep the people from crowding aboard if they could find a place to stand, and, if they are once on board, what are we going to do? Eject them by force? We would need a police force for our cars bigger than the whole police force of the city at present. You say we might put on more cars, cars enough to give everybody a seat. That might apply on some of the outlying and cross-town roads, but practically everybody gets a seat on them now. It would not apply to our Broadway, Columbus Avenue, Lenox Avenue, Madison and Fourth Avenue, Lexington Avenue and Second Avenue lines during the rush hours. Cars are now run down Broadway during the rush hours under six seconds' headway. What is the use of talking of relieving the overcrowding by putting on more cars under such conditions?"

Edward Lauterbach, speaking for the Third Avenue Railroad Company, said: "The question is not one of making the companies do something that they are unwilling to do, but of making them do something which they cannot do. If you pass a law imposing a penalty on any company that permits passengers to get on its cars when they have no vacant seats, then you must put a penalty on passengers who insist on crowding upon them. If you do that, it simply means that tens of thousands of people every day will have to wait their turn for seats in getting up and down town, and then there would be a howl."

It is officially stated that the system of the Union Traction Company, of Philadelphia, was operated for the year ending June 30, 1898, at 40 per cent of the gross receipts.

A court at Trenton has handed down a decision setting aside the verdict of $5000 obtained by Abraham L. Graham against the Consolidated Traction Company of Jersey City for the killing of his child. The judge holds the damages to have been excessive, and he makes the declaration: "It is the universal rule that children are expensive, and not a pecuniary benefit to the father, and yet on the theory on which this verdict is based the larger a man's family the richer he will die."

The United Traction Company of Pittsburg, has added to its equipment an elegant private car for the use of the president of the road. This car will also be used as a pay car and can be chartered by private parties.

The Springfield (Mass.) Street Railway Company has been obliged to discharge several conductors for turning in transfer tickets in place of cash fares.

Joseph C. Bonner, of Toledo, has recently been given permission to use the street railway tracks in Doylestown, Pa., upon which he may run a patented "rail wagon" for one year. This wagon is a combination vehicle on which it is proposed to carry farm wagons loaded with produce and other vehicles. The wagon is so constructed that it can be used on the ordinary roadway and on the railway tracks as well.

The Brooklyn Heights Railroad Company is having considerable trouble with trolley-wire thieves. About 875 ft. of feed wire was stolen from the poles during the morning of July 20, this being the second robbery within a week. The wire was stolen at North Beach.

The Akron Street Railway & Illuminating Company has voluntarily agreed to reduce its fares by selling twenty-five tickets for a dollar, instead of twenty-two, as formerly.

The Hartford Street Railway Company has recently discovered a plan formed by several conductors to knock down fares. Eleven employees were discharged as a result.

It is expected that a through package and freight service will soon be instituted over the lines of the Central Railway & Electric Company from Hartford, Conn., to New Britain, and from that city to Plainville.

The Metropolitan Street Railway Company, of New York, has discontinued the running of horse cars on Sixth and Eighth Avenues in order to facilitate the construction of the conduit on those thoroughfares.

The Consolidated Traction Company, of Pittsburgh, has been granted permission to carry express and freight matter, and it will at once place in operation a very extensive system of carrying and delivering packages, produce and freight from one section of the city to the other.

Newspaper reports state that Joseph Leiter, of Chicago, whose recent speculation in wheat made his name widely known, has been in New York and is forming a plan whereby all the Chicago street railway companies will be consolidated into one system. It is stated that ex-Governor Flower, of New York, and Anthony Brady are interested in the deal.

The Milwaukee Electric Railway & Light Company has just issued a pamphlet called "Scenic Trolley Rides." This book beautifully illustrates and describes some of the many charming and interesting points that may be reached by the Milwaukee street railway system. The descriptive matter and illustrations are so arranged as to give suggestions for several different days' outings on land or water, and by consulting this pamphlet a person in Milwaukee can spend a number of very pleasant days at a very trifling expense. The pamphlet contains a large bird's-eye view map of the territory covered by the Milwaukee Electric Railway & Light Company's system.

Test of Maximum Traction Truck

An interesting test of the new Peckham maximum traction truck No. 14D2 was made July 27 under car No. 1008 of the Metropolitan Street Railway Company, of New York. A run was made from the Brooklyn Bridge terminus of the Madison Avenue line to the One Hundred and Forty-sixth Street power house and return to Thirty-fourth Street, where the party was entertained at lunch at the Waldorf-Astoria by Mr. Peckham. The easy riding qualities of the truck were very noticeable, particularly on curves. Among those present were Messrs. Rossiter, Brackenridge, Brown, Robertson, Millen, Rounds, Pearson, Beetem, Clark, Beach, Taekaberry, Pugh, Sullivan, Peckham, Wilkinson and Long.

Visit of a Prominent London Tramway Capitalist

Mr. George Richardson, chairman of the Board of Directors of the North Metropolitan Tramways Company, of London, has been making a tour of the world, and has just passed through America from the Pacific Coast eastward, sailing for England on July 13. Mr. Richardson was accompanied on his trip by his son, who remains in this country for a short time visiting relatives. Mr. Richardson made quite a careful inspection of the street railways of San Francisco, Chicago, Niagara Falls and New York. He is much impressed with the liberality of the transfer systems given by street railway companies in these cities, and with the length of ride possible for a five cent fare. He concedes that better value is given for the street car fare in America than in Great Britain considering the length of the ride, and would be glad to see a uniform fare adopted in Great Britain, though not, of course, upon the basis of a penny. Mr. Richardson has been much impressed, too, with the way in which the cable system has been displaced by electricity in America, and with the great growth of the latter.

It is not probable, in Mr. Richardson's opinion, that any arrangement can be made at present between the County Council and the North Metropolitan Tramways Company (which is the lessee, for fourteen years, of the lines recently taken over by the Council), looking to the electrical equipment of these lines, the reason being that in so short a period as the term of the lease the company could not recoup itself for the cost of the equipment with the underground conduit electric system, which the Council would probably specify, nor would the Council probably be willing to pay a reasonable price for such equipment at the end of the lease period. In other words, the difficulty of getting to a common basis of understanding between the Council and the tramways companies of London is exceedingly great and quite possibly cannot be overcome.

An Act Relative to Street Railways

The Massachusetts State Legislature at its last session passed an act which is of very great importance to all the street railway companies in that State, and is also of interest to street railway managers throughout the country. The act is intended to settle a number of vexing questions which have constantly arisen for several years between the municipal authorities throughout Massachusetts and the street railway companies. A digest of this law follows:

In addition to the return to the tax commissioners which the street railway companies had been required to make each year, each company is now required to give in its report to the commissioners a statement, under the oath of the treasurer, giving the length of track operated by it in each city and town in the commonwealth on the 30th day of September next preceding the date of the return. Each company is also to state the amount of the capital stock and the dividends paid thereon during the previous year, and also during each and every year from the organization of the company.

Whenever a street railway company has paid during the year ending on the 30th day of September next preceding the date of the return dividends exceeding in the aggregate 8 per cent upon its capital stock, said company shall, in addition to the taxes upon its corporate franchise, pay to the treasurer of the commonwealth a tax equal to the amount of such excess, provided, however, that no company shall be liable to pay such additional taxes which has not from the date upon which it commenced to operate its road paid dividends equivalent to at least 6 per cent per annum upon its capital stock from year to year.

The moneys received from the above tax are to be divided among the several cities and towns in proportion to the length of track operated in said cities and towns.

Each street railway company is also required to file on or before the 15th day of October in each year, in the office of the board of assessors of every city and town in which any portion of its railway is situated, the length of the track operated by it in public ways in such city or town, and also the total length of track operated by it in public highways, and also the amount of its gross receipts during the year ending September 30th next preceding, said gross receipts to include all amounts received except income derived from sale of power or rental of tracks.

The assessors of every city and town in which any street railways are operated shall assess on each company operating such railways therein an excise tax of an amount equal to such proportion of the following percentages of the gross receipts of such company as the length of the tracks in such city or town bears to the total length of tracks operated by the company; in case of companies whose annual gross receipts per mile of track operated are $4000 or less, 1 per cent of the total annual gross receipts; in case of companies whose annual gross receipts per mile of track operated are more than $4000 and less than $7000, 2 per cent of the total annual gross receipts; in cases where the

gross receipts per mile of track are more than $7000 and less than $14,000, 2¼ per cent; where they are more than $14,000 and less than $21,000, 2½ per cent; where they are more than $21,000 and less than $28,000, 2¾ per cent; and where they are $28,000 or more, 3 per cent of the total gross receipts. The excise tax provided by this section shall be in addition to the tax now provided by law.

Provision is made for the submission every three years to a board of arbitration of any questions which may arise between the street railway companies or the municipal authorities regarding the amount of the excise tax.

It is also provided that the cities and towns shall use the moneys derived from this excise tax for the construction, repair and maintenance of the public ways and also for the removal of snow therefrom.

By this new law street railway companies shall not be required to keep any portion of the surface material of streets, roads and bridges in repair, but they shall remain subject to all legal obligations imposed in original grants of locations. The companies, however, are responsible for the replacement of all materials, etc., which they remove for the purpose of building new tracks or replacing old ones.

Provisions are made for the granting of location of tracks for any street railway company by the board of aldermen of a city, or the selectmen of a town. In granting said location the municipal authorities may prescribe the manner in which said tracks shall be laid and the kind of rails, poles, wires and other appliances which shall be used, and they may also impose such other terms, conditions and obligations as the public interest may in their judgment require. If, however, any property owner along the line of the location shall file a written protest with the Board of Railroad Commissioners, such location shall not be valid so far as such portion as passes the protesting property is concerned until approved by the Board of Railroad Commissioners.

Any street railway company whose petition for an original location made necessary in order to connect two towns or cities, or a city and a town, has in whole or in part been granted or refused, or has been neither granted nor refused in such connecting town or city within three months after the filing thereof, may at any time within thirty days from such grant or refusal of a location, or of the expiration of said three months, apply to the Board of Railroad Commissioners for such location. If it is found that the company has already been granted locations for a street railway in two towns or cities adjoining the city or town in which such location has been asked for, and that a location is necessary to connect such existing locations, the board may, if it finds that public necessity and convenience so require, grant a connecting location.

The board of aldermen of a city or the selectmen of a town are also given authority to grant extensions of existing tracks, subject to the same provisions as govern the granting of an original location.

The municipal authorities may also demand the removal or change of location of any street railway tracks within the municipal limits. They cannot do so, however, without the approval of the Board of Railroad Commissioners.

Street railway companies may provide cars for special service and may make special rates therefor. They are also empowered to make special rates for working men and women and for school children, but are not permitted to give free tickets or passes except in a very few cases.

Provision is also made for street railway companies to pay half the cost of widening streets upon which their tracks are laid.

Upon petition to the Board of Railroad Commissioners, a hearing may be given for the purpose of revising and regulating the fare charged by any street railway company, but such fares shall not without the consent of the company be reduced below the average rate of fare charged for similar service by other street railway companies.

The Boston Elevated Railway Company is placed in a class by itself and this act does not apply to that company.

The Volunteer Engineers

The Engineers' Club, of 374 Fifth Avenue, New York, is sending out the following letter:

To the Members of the National Engineering Societies and of the Engineers' Club.

Gentlemen—The first of the three regiments of volunteer engineers, which are being recruited under authorization of Congress, has enlisted about 1100 men, and is now in camp at Peekskill, N. Y. The first battalion may be ordered to the front within a week.

Many of the officers are members of the Engineers' Club, and of one or more of the national engineering societies, and all are engineers.

The file is composed of junior engineers, artisans, mechanics and best grade of laborers. Their caliber was thus tersely expressed by the regimental quartermaster: "These men have exhausted the regulation quota of large size hats and small size shoes."

It seems needless to point out the relative efficiency of such a brigade of engineer-artisan soldiery or to intimate that patriotism and the advancement of the engineering profession may be quite properly considered in this connection.

The Engineers' Club, by the unanimous vote of a largely attended regular meeting, and subsequently by its Board of Management, tendered to the regiment, under command of Col. Eugene Griffin, a stand of colors, which offer was promptly accepted with a cordial expression of appreciation. The flags will be paid for out of the Club's treasury; their cost may approximate $500 and presentation will be made as soon as possible. The committee appointed by the board comprise the officers of the club and the chairmen of its general committees.

The enthusiasm with which the proposal to present the colors has been received is responsible for the following suggestion, namely: *To make of this episode a general engineering function in which all persons connected with the technical engineering societies may become identified.*

This brigade should also be outfitted with several appliances for which no Government appropriations are now available and for which action cannot be secured without serious delay. It is especially desired, under the sanction of Col. Griffin, to provide portable electrical searchlight equipments. One such apparatus can be procured, complete, in single self-contained units, for about $3,000. The employment of a searchlight in the army would be a novelty; but its success would be assured in the hands of engineer officers. Its field of application is wider than that of the navy; as, say, in bridge and track construction or destruction, earth work, road making, repairing, searching the field for wounded, for use at hospitals in surgical operations, at headquarters for draughting and the like.

The presidents of three of the national societies have personally signified their approval of this undertaking. But as time is limited and action must be taken promptly to be effective, and particularly as it is not practicable at this season to submit a proposal for joint action of the societies, the undersigned have assumed to extend the scope of the action originally contemplated and offer to act as a general committee for the members of the several national engineering societies as well as for the members of and in behalf of the Engineers' Club.

Our judgment is that a fund ought to be contributed whose origin should be as widely representative as possible. And, moreover, that if every gentleman who receives this circular will immediately remit whatever amount may be convenient, whether $1 or $100, a sum will be realized which will enable your committee to give fitting expression, by material evidence, that the good will and moral force of the non-combatant engineers of America follow their active representatives at the front.

The execution of this plan is designed to illustrate the practical patriotism of engineers and the application of modern engineering science to the execution of military work, and to the amelioration of distress among the sick and wounded of our army.

Mr. O. F. Nichols will act as secretary and Mr. S. W. Baldwin as treasurer of the committee.

Inclosed herewith is a subscription blank and an addressed envelope. If reply is made promptly, the committee will be able to have the proposed plant in service within a few weeks.

Respectfully submitted by the Volunteer Regiment Committee of the Engineers' Club, 374 Fifth Avenue, New York.

JOHN THOMSON,
President.
JOHN C. KAFER.
A. G. MILLS,
Vice-Presidents.
A. C. RAND,
Treasurer.
O. F. NICHOLS,
Secretary.
S. W. BALDWIN,
Chairman Committee on Membership.
C. KIRCHHOFF,
Chairman Library Committee.
WM. A. REDDING,
Chairman Auditing Committee.

New Equipment in Chicago

The Chicago City Railway Company is installing seventy new "49 C" Westinghouse motors, the standard having been slightly changed to suit special conditions.

On July 9, at 10 o'clock, bids were opened by the Chicago City Railway for 100 new motor cars, the specifications requiring that they be practically duplicates of a model on exhibition at the company's shops. This car is an improvement over anything now running on Chicago roads. The seats are upholstered and platforms vestibuled in front; the ventilator windows are moved by levers at the end and so connected that one set opens one way and the alternating set in the opposite direction. They can be adjusted so as to ventilate without producing draft in winter, and in warmer weather, by turning in the opposite direction, will direct a cool blast into the car. The cars are all to be painted green on the outside, but a system of seven different shades will be used which gives a very rich effect. Inside the finish is of natural wood, bird's-eye maple and stained cherry. The John Stephenson Company of New York was the successful bidder for this contract and received the order for the entire 100 cars. Sixty-five of the bodies will be mounted on McGuire trucks and the remainder on the new truck invented by Mr. Moore, master mechanic. The company is also fitting all motor cars with vestibules designed by Mr. Moore; these do not inclose the platform entirely, extending only across the front; they are of glass set in substantial wooden frames, and immovable except for a door about 2½ ft. square in front of the motorman. A canvas accordion connection fastens the top of the vestibule to the hood of the car, allowing for movement between the two. The cost of the vestibule complete is about seven dollars. It is believed that these vestibules will attract many smokers, who would otherwise go by the elevated or steam lines in cold weather. In the repair shops there has recently been installed a bending roll for curving rails, and which has reduced the cost of rail bending from thirteen cents to one cent per foot.

Portable Lights in War Service

Since war operations have begun, the Wells Light Manufacturing Company, of New York, has been busy making shipments of its lights to various places to meet the needs for brilliant and efficient illumination at fortifications, for coast line defense, etc., which they completely fill. This company has also made a large consignment of its lights to Cuba within the past few weeks, as the Wells light has proven itself to be one of the very necessary outfits of war.

Handsome Cars for Dayton, Ohio

The Dayton & Western Traction Comany, of Dayton, Ohio, has recently put in service some handsome vestibuled cars, views of which are shown herewith. The cars were built by the G. C. Kuhlman Company, of Cleveland, and measure 42 ft. 8 ins. over all. The length of body is 32 ft. and width 8 ft. The seating capacity is forty-two passengers.

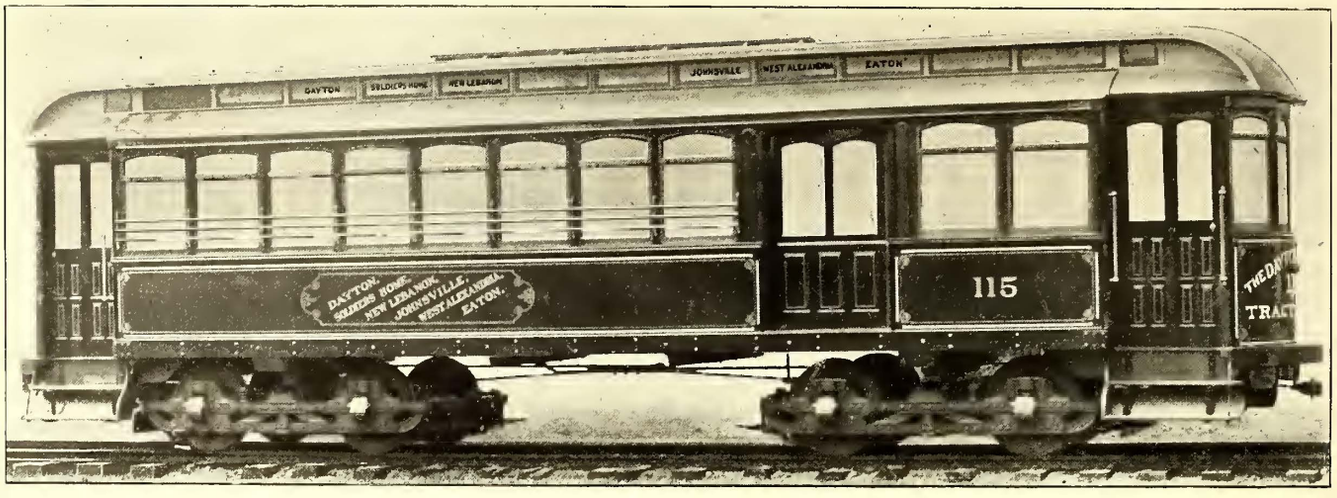


FIG. 1.—COMBINATION PASSENGER AND BAGGAGE CAR—DAYTON

The interiors are finished in cherry and head-linings in bird's-eye maple, handsomely decorated. The saloon contains wet hopper closets, as well as ice water tanks for drinking purposes. The doors in the car bodies are of the double "twin" style. Those in the vestibules are of the folding pattern, there being two pairs for each vestibule. Each car post is connected with a push button for signaling the conductor.

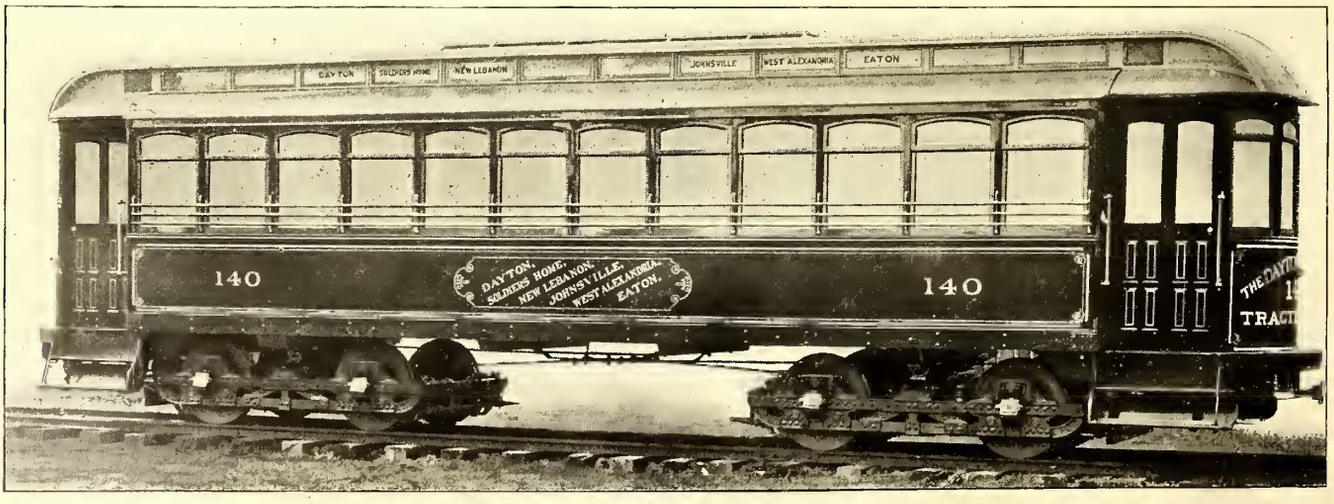


FIG. 2.—PASSENGER CAR—DAYTON

The outside bronze window guards are arranged in sections, three to each side of a car, and are made to lift out in order to wash the windows. The ventilators are arranged to swing in sections. Each section consists of six ventilators, which are arranged to open and close with a worm and gear frame. This worm and gear arrangement was recently invented by G. C. Kuhlman, and has already proven itself very popular.

The glass in these cars is all laid in rubber cushions. The seats were furnished by the Hale & Kilburn Company, have bronze ends and are covered with a wine colored Moroccoline. The cen-

ter aisle is covered with cocoa matting. All trimmings about the cars are of solid bronze, highly polished. The curtains were furnished by the E. T. Burrowes Company, of Portland.

The floors of the vestibules are 7 ins. lower than that in the car bodies. This makes it very convenient for passengers entering and leaving the car. Another important feature of the car body is the care taken in its construction and in that of the vestibule to prevent sagging at any point. The cars are painted a solid color of Ensign Blue, with lettering, striping and scroll work in gold, a beautiful and striking combination.

The cars are mounted on the No. 14A "extra strong" double truck built by the Peckham Truck Company. This truck is similar in general construction to the Peckham No. 14A double truck described in the STREET RAILWAY JOURNAL for February, 1898, except that it is made stronger and heavier to adapt it to heavy interurban work. The journal boxes are M. C. B. type and sufficiently large for 4-in. journals.

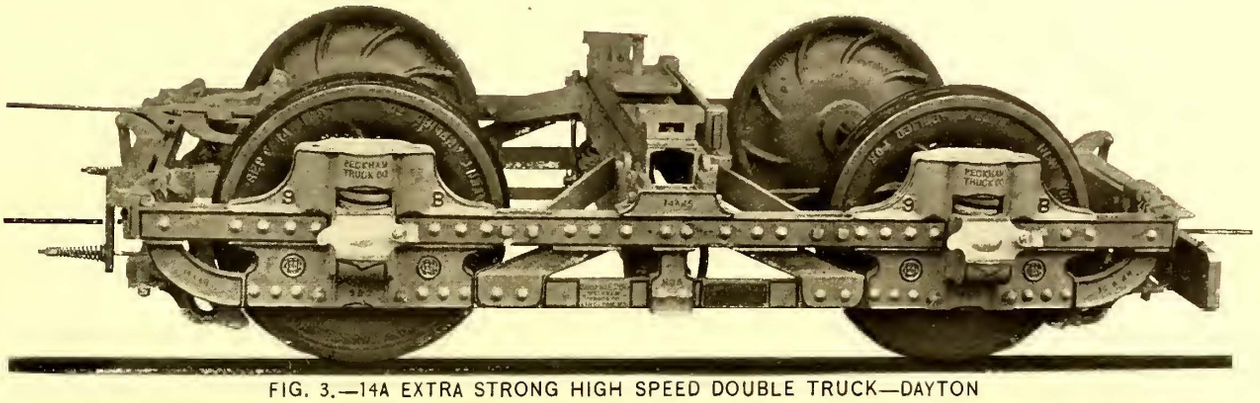


FIG. 3.—14A EXTRA STRONG HIGH SPEED DOUBLE TRUCK—DAYTON

As will be remembered, the truck contains a center bearing swivel bolster, with three sets of springs or cushions between the car body and the truck. The bolster is composed of channel irons and is carried on a spring plank by means of a spring system, consisting of half elliptic and two spiral nest springs. The spring plank is supported by four links through the medium of square rubber cushions which take up the vibration transmitted from the track to the truck frame and deaden the sound caused by the successive blows of the wheel upon the inequalities of the track. The truck frame is the standard Peckham form of double upper and single lower bar, forming a cantilever bridge truss.

This truck is also used on the cars of the St. Louis, Belleville & Suburban Railway, described elsewhere in this issue, and upon a number of other roads, and is giving satisfaction for heavy high-speed interurban electric railway service.

FIG. 4.—INTERIOR OF LONG CAR—DAYTON

Axle and Wheel Tests

A pamphlet of especial interest to tramway managers has recently been issued by the New York Car Wheel Works of Buffalo, N. Y., showing tests on wheels of special quality made by them and comparative tests on the special axles they furnish for electric service and the standard axle used by the railroads in this country. The axles were tested for elasticity by bending them an inch out of line and allowing them to spring back and then measuring the permanent set, and in every test their axle for electric service showed the better results. The same axles were then bent cold until the ends touched with no sign of fracture, showing conclusively that the strength and toughness of the axle were equal to its elasticity.

The tests that were made on wheels were made particularly to demonstrate the strength that this company is able to obtain by the use of special irons in their mixtures, and the very remarkable results obtained demonstrated the advance that they had made in this very essential quality in a wheel.

The wheel now used in electric service is so designed that it combines maximum strength with the greatest lightness of section possible, and the New York Car Wheel Works, by increasing the strength of their wheels, show their appreciation of the greater demand being made upon them by the increase in weight and speed of electric cars.

A Fine Parlor Car

The accompanying illustrations show exterior and interior views of a directors' car recently built for the Coney Island and Brooklyn Railroad by the J. G. Brill Company. An unusual amount of care was expended not only in design, but in construction and decoration. The body of the car is a dark green relieved with gold. The hardware throughout is solid bronze.

The following are the leading points: Length over end panels, 25 ft.; length over dasher rail, 36 ft.; length of platforms, 5 ft. 6 ins., which gives ample width for seats, ice-box, etc. The steps are at the diagonally opposite corners. The width of the car over all is 8 ft., and the height from track over trolley board is 11 ft. 4½ ins. The body is finished with round corners and the end sash is bent to conform to the sweep. As shown by the reflection, the glass in this sash was a very perfect piece of bending. The grill work around the platforms is particularly artistic.

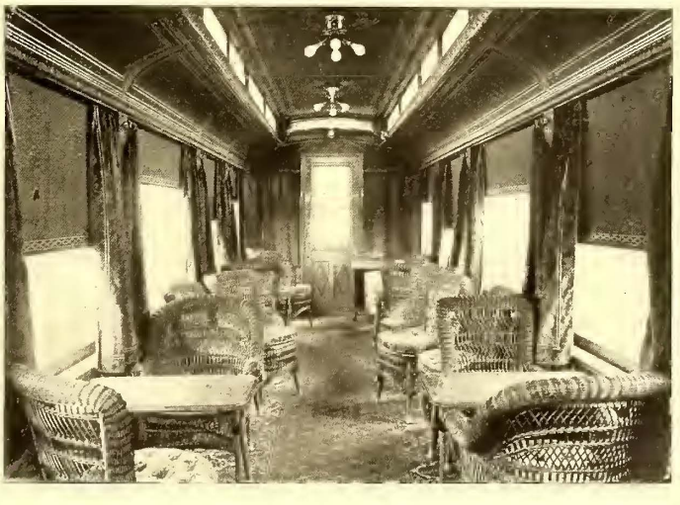


FIG. 1.—INTERIOR OF PARLOR CAR—BROOKLYN

The car is mounted on a pair of Maximum Traction Trucks. These have Westinghouse No. 49 motors. The wheels are 33 and 20 ins. in diameter. The inside finish of the car is quartered oak highly polished. There are two single doors at each end of the car. They are 24 ins. wide. There are five windows on a side, of polished plate glass; they are arranged to raise 3½ ins.

The seating of the car is furnished by twenty wicker chairs with plush cushions. There are four card tables, as shown in foreground of the interior view. These fold and stow behind movable panels under the windows. In the corner is a movable buf-

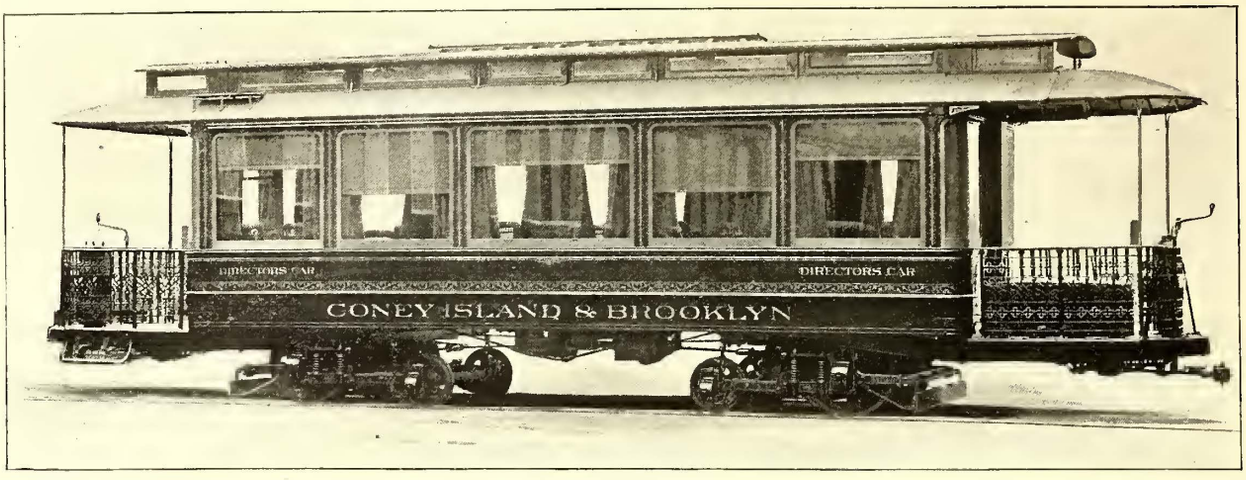


FIG. 2.—PARLOR CAR—BROOKLYN

fet. The floor is of parquetry covered by a loose Wilton carpet. There are electric bells and lights, together with an electric heater. Taken altogether, the car is a fine example of palace construction applied to street railway work.

It is stated that the company proposes to run a line of parlor cars regularly to and from Coney Island and the New York end of the Brooklyn Bridge.

Mechanical Draft in Manufacturing Establishments

The chimney has so long stood as one of the evidences of the existence of a manufacturing plant that it surprises one to look out on a vast area of buildings evidently devoted to manufacturing purposes, and not see the tall shaft of brick pointing heavenward and usually capped with a cloud of smoke. The chimneyless establishment of the B. F. Sturtevant Company, at Jamaica Plain, Mass., however, serves to awaken such surprise, for it is equipped with a mechanical draft plant, and the otherwise useless chimney has just been torn down for the sake of the bricks it contained. The accompanying illustration shows the appearance of the works as they now are.

When the tracks of the N. Y., N. H. & H. R. R. were recently elevated, it became necessary to make extensive changes in the arrangement of these works, which are adjacent. Among other alterations, the location of the boiler plant was changed to a point so far distant from the chimney, which had produced the draft, that its further use was precluded. This condition proved, however, a most excellent opportunity for the introduction of mechanical draft, in the success of which this company has been deeply interested. Accordingly, a Sturtevant fan was installed on top of the boilers, the gases drawn through it and discharged through a short stack extending but a few feet above the top of the boiler house. The arrangement is simple, economical and convenient. Above all, it forcibly illustrates the adaptability of this method.

One of the incidentals of economy, independently of the less first cost of the mechanical draft apparatus, has been the gain in floor area on the floors through which the chimney passed. The fan occupies no valuable space, being located on top of the boilers, and no expensive foundations were required.

Although the present stack does not extend above the level of the surrounding buildings, no inconvenience has resulted therefrom. In fact, smoke is scarcely ever visible, and then only for an instant, the positive and ample supply of air resulting from the operation of the fan serving to promote perfect combustion. By means of a special automatic device the speed of the fan is exactly regulated to the requirements of the fire, and the steam pressure is maintained absolutely constant.

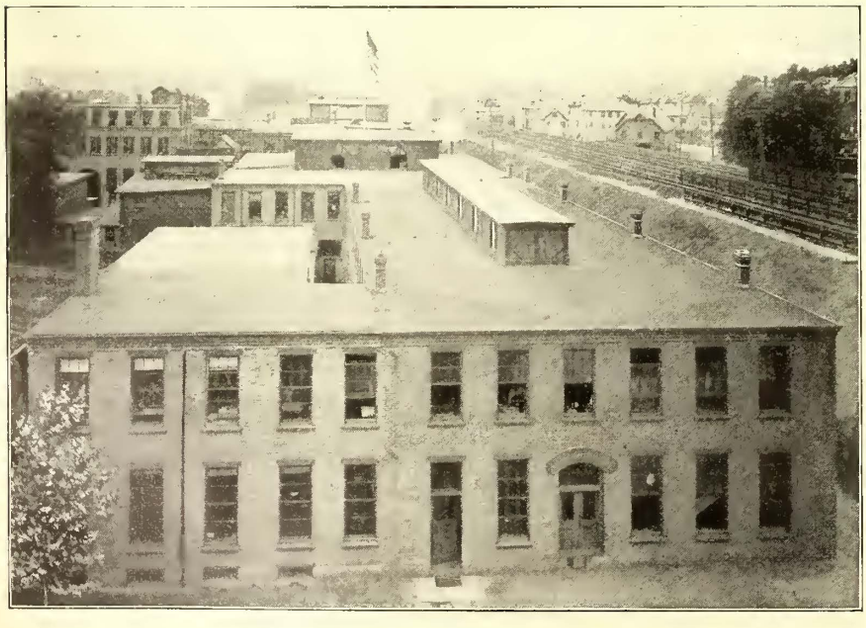


FIG. 1.—BUILDINGS EQUIPPED WITH MECHANICAL DRAFT

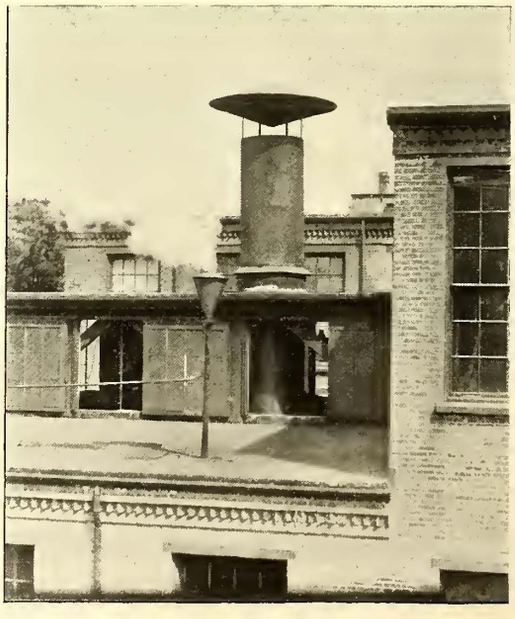


FIG. 2.—TOP OF STACK

G. E.-58 Narrow Gage Motor

The operation of a narrow gage road demands a railway motor occupying a more restricted space than one built for standard gage roads, while giving the same power. The General Electric Company has manufactured narrow gage motors for some time past, and many are in actual service. One type of narrow gage motor now built is the G.E.-58, which resembles in outer appearance the standard gage motor, and has an output of 37 h.p., based on the standard General Electric rating, i. e., a maximum rise of 75 degs. C. in the temperature of the windings after a run of one hour at rated load, the temperature of the surrounding air not exceeding 25 degs. C. This motor is built for comparatively heavy service, in which the G.E.-52 motor would be too light, and is especially desirable in cases of combined city and interurban service, with moderately high speeds and heavy traffic. While designed for a minimum gage of 1 meter (39¼ ins.), the G.E.-58 may be used with wider gage roads.

The magnet frame is made of soft steel of high magnetic permeability, cast in two bowl-shaped halves. The frame is divided in a horizontal plane, and the two parts when bolted together completely inclose and protect the armature, commutator, brush-holders and field coils. Extension pieces are cast on the top at each end, and extend over and partly inclose the car axle. To the under side of these extension pieces are bolted the axle bearing caps, bored out to support and inclose the axle linings. The armature supports are made by bolting the bearing caps to the under side of the top frame at each end and boring them to receive the linings. The bottom frame is secured to the top frame by bolts so hinged that when the rear bolts are removed the lower frame will swing down, exposing the armature and field coils for inspection and cleaning. In this position the bottom of field coils may be easily taken out, while by removing the armature caps and the bottom half of the gear case the armature and top field coils may be easily removed.

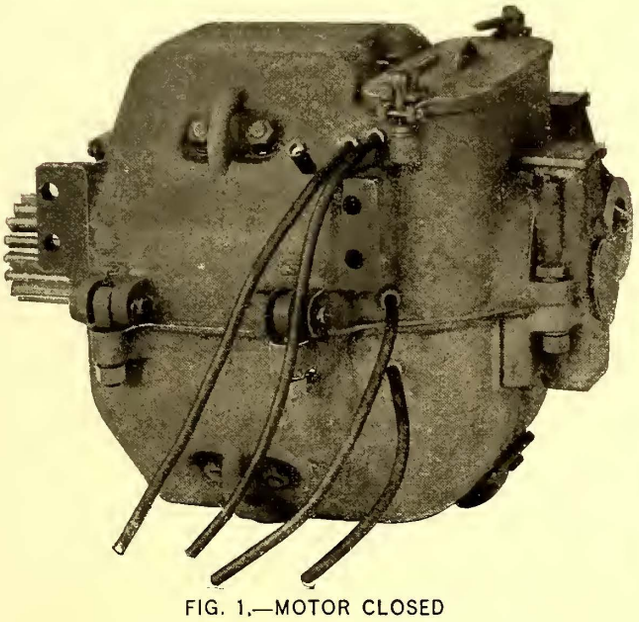


FIG. 1.—MOTOR CLOSED

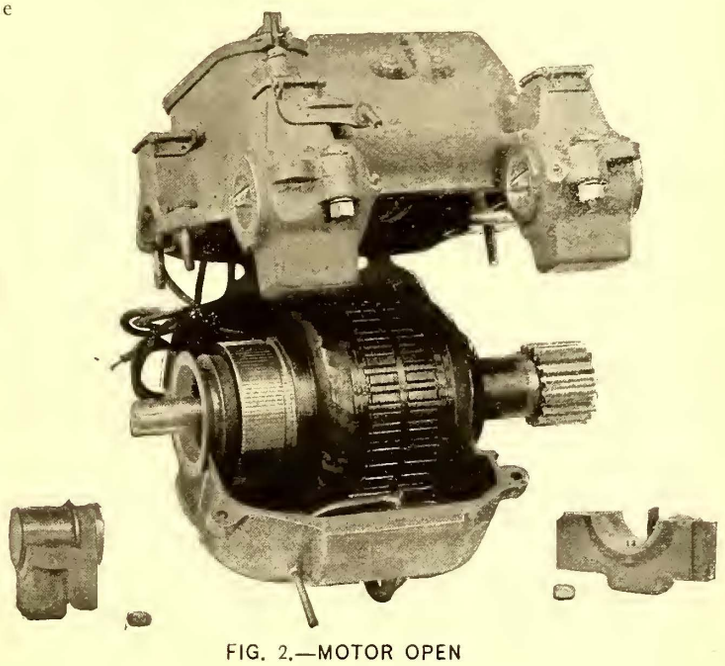


FIG. 2.—MOTOR OPEN

A large opening is provided in the top frame just over the commutator, through which the commutator, brush-holders and brushes can be inspected and worn-out brushes replaced. Through the same opening it is possible to remove the brush-holder yoke and brush-holder bodies. A malleable iron cover is securely held in place over this opening by an adjustable cam locking device, and is easily and quickly removed. A hand hole, fitted with a gasket and cover plate, is provided in the bottom frame, directly under the commutator, permitting easy access to the bottom of the motor for inspection and removal of foreign substances.

Appreciating that the renewal of linings is frequently the principal item of maintenance cost of a motor, particularly when designed within the limitations of narrow gage, much attention has been given to the design of the linings and the bearings. The armature bearing linings are made of machined cast iron with 3-16 in. Babbitt metal swaged hard and bored to the proper size to fit the shaft. The bearing of the commutator end is 2⅝ ins. x 6 5-16 ins., and on the pinion end 3 ins. x 7⅞ ins. The supports for the linings are constructed on the outboard plan, which renders the bearings easily accessible and prevents oil or grease from working into the motor frame. The support for the upper half of the armature shaft lining is cast as a part of the upper half of the frame, and is provided with a large cored recess between the inner end of the lining and motor frame. This space is utilized for a thrust collar so designed that its outer edge acts as an oil guard and turns in the recess between the motor frame and the bearings. The support for the lower half of the lining is a cap bolted to the upper frame in such a way as not to inclose the lower half of the oil guard, thus allowing free egress for the lubricant after it has passed through the bearing. The axle bearing linings are similar to the armature bearing linings, and are 8 ins. in length and of the required diameter to fit the car axle. The upper supports for these linings are cast with the upper frame; the lower supports are caps bolted to the upper support. All bearings on the motor are provided with grease boxes and oil cellars of sufficient capacity for thorough lubrication. The grease boxes are cast with the upper frame and are covered with flanged lids held down by springs to exclude the dust and dirt. Oil cellars of ample capacity are provided in the bearing caps. The oil is fed by felt wicks or wipers, which come in contact with the shaft through holes cut in the linings.

The motor has four field coils, two in each frame, placed at an angle of 45 degs. from the split and held in place by pressed steel flanges, or spool holders, clamped by projections on the laminated pole pieces. The pole pieces are held in place by through bolts with nuts on the outside of the frame, the coils being placed in position when the pole pieces are bolted to the frame. The field coils are wound with round wire insulated with asbestos, and are substantially insulated over all with wrappings of varnished cloth and tape. The insulation between field coils and motor frame is tested by 5000 volts alternating—sufficient to thoroughly prove the quality of the insulation. The field coil leads are brought out through the frame in a convenient manner for connecting to the car wiring, and it is not necessary to disconnect any leads inside of the motor frame when dropping the lower half for cleaning.

The armature is of the well-known ironclad type, and is 14½ ins. in diameter, with a spread of 6½ ins. The core is built up of well annealed laminations, and is assembled directly on the shaft. There are thirty-three slots, and each slot contains three coils, collected together and insulated so as to form one triple coil. Hence there are thirty-three triple coils connected with ninety-nine commutator bars. A small number of coils is of especial advantage when an armature has to be repaired, and the method of forming the coils into groups of three admits of substantial insulation of high quality. The insulation of the coils consists of specially prepared tape and cloth, which has high insulating qualities and is impervious to moisture. When the coils are in place on the armature core they will withstand without injury a high potential test of 2500 volts between the windings and core. The terminals of each coil are brought directly into the commutator segments and soldered so as to properly connect the armature coils, and at the same time form the connections between the

armature windings and the commutator. The end windings are effectually protected from mechanical injury and carbon dust by the metal core heads and by a canvas dressing. The coils are held in place in the slots and on the ends by tinned steel wire bands, held together by clips, and securely soldered.

The commutator is 10 ins. in diameter. Its segments are 4⅜ ins. long, with a wearing depth of 1 in., and are insulated from the shell by cone clamping insulations of the best quality of pressed mica. The segments are of the highest grade drawn copper, of uniform hardness, and are slotted at the back for the armature leads. The mica between the segments is of a somewhat softer quality than that used in the clamping insulations, to insure an even wear with the copper segments. The completed commutator is tested by 500 volts between segments and shell and 500 volts between adjacent segments. Particular attention has been given to the matter of commutation, and under normal conditions the commutator will run with practically no sparking.

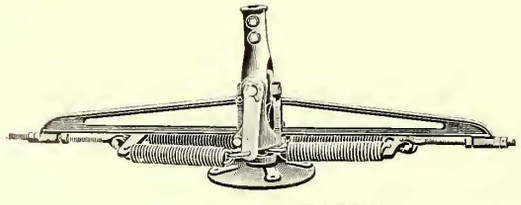
The brush-holders of cast brass are constructed to receive two carbon brushes per holder. The brushes are 1⅜ ins. x 2¼ ins. x ½ in. They slide in finished ways, and are held in place against the commutator by independent pressure fingers, which give a uniform pressure to the brushes throughout their entire working range. The brush-holders are clamped to a hardwood yoke, carefully treated with a moisture-proof insulating compound. The brush-holder yoke is bolted to the top magnet frame, and is so arranged that it may be removed through the opening in the frame over the commutator. All the leads from the motor to the car body are brought out through the rubber bushed holes in the magnet frame at the front of the motor, thus facilitating wiring of the car.

G.E.-58 motors are adapted to nose, yoke or side bar suspension. The yoke suspension is especially recommended, as the weight of the motor is carried on springs placed upon the side of the truck frame. Lugs are cast on the upper magnet frame, to which the suspension bar is bolted; the lower half may, therefore, be swung down into the pit without disturbing the upper half, which remains suspended from the axle and yoke. When the motor is mounted on 33-in. wheels, the clearance between the bottom of the motor frame and the top of the rails is 4¼ ins.; the clearance between the bottom of the gear case and the top of the track is 4¼ ins. The motor without gear or gear case weighs 1865 lbs., and complete, with both gear and gear case, weighs 2150 lbs.

Duplex Trolley Base

The trolley base shown in the accompanying illustration was invented by a mechanic who for many years has been employed in the repair shops of a prominent electric railway company. The device is known as the Moyer duplex trolley base. A number of these bases have been in constant use for the past six months and have withstood all the tests made under every possible condition of hard service in a highly satisfactory and successful way.

The base is made of carefully selected material, and the various parts are strong and designed to meet severe wear and tear. It swings on a pivotal pin and is sensitive to every deflection of the trolley as it follows the line, and it can be used where bridges and arches bring the wire to within 10 ins. of the roof of the car. The two distinct sets or pairs of coil extension springs can be easily



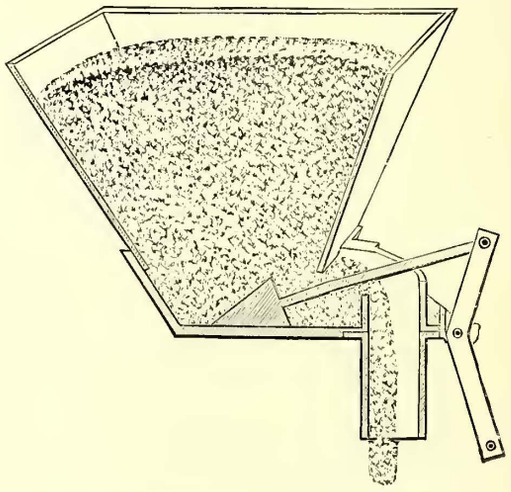
DUPLEX TROLLEY BASE

adjusted and regulated, permitting the stretch of spring to be taken up and corrected when necessary. The springs used are sufficiently strong to maintain a tension of 1400 lbs. at the foot of the pole, and this provides a reliable contact under all conditions between trolley and line. By a simple mechanism the reserve duplex set of springs can be put into immediate service by swinging the base round into position. When not in use, the duplex springs are always in readiness to take up any sudden tension that may be put upon them; the jumping of the trolley from the wire, releasing the pole, brings them into action as soon as the pole swings forward and is past the perpendicular, and the springs without sudden check or jar restrain and lessen the force of the blow which the pole would otherwise give to any interposing object.

Patents for this device have been applied for in the United States of America, Canada and all the important countries of the world. F. Conlin, who has an office in New York City, is general selling agent.

Sand Boxes for Electric and Cable Cars

The Ham Sand Box Company, of Troy, N. Y., has recently brought out a new sand box which embodies a number of novel features. This device is known as the Ham sand box, style 4, and is designed to be located inside the car, free from danger of flying water and ice. The spout and lever project through one hole in the floor of the car and the lever connections can be easily made, as shown in the accompanying illustration. The parts are few in number and the motion is direct. The pressure of the foot pushes the hoe to the rear of the box and a spring draws it forward and delivers the required quantity of sand. The force required is



SAND BOX FOR ELECTRIC AND CABLE CARS

slight and the delivery of sand is positive. By alternately pressing and releasing the spring a continuous but small stream of sand can be delivered to the rail and this feature will be found of great advantage in hill climbing. The sand flows only when the lever is in motion and waste is therefore impossible.

The principal points that the manufacturers call attention to in this box are the following: It has no valve or worm mechanism; it will not leak; the outflow of sand is completely controlled; the sand spout is not connected with the sand chamber and water cannot be driven up the spout to wet the sand, neither can dampness draw into the box; it is very simple, having but few parts.

Meeting of the Canadian Electrical Association

The Canadian Electrical Association, the pioneer organization of its kind in Canada, held its regular annual meeting in Montreal on June 29. At the morning session the association was welcomed to the city by the Mayor, after which John Yule, of Guelph, the president of the association, delivered the customary presidential address. Papers were read by A. A. Wright, of Renfrew, Ont., on "How to Overcome Some of the Difficulties Encountered by Central Station Men"; by L. D. W. Magie on "Electrical Utilization of Water Powers," and by W. T. Bonner on "A Plea for the Introduction of Goods Traffic on Our Suburban Tramways." The papers were fully discussed, that of Mr. Bonner's especially receiving the closest attention from the delegates.

Several other sessions of the association were held and the members and visitors enjoyed a number of pleasant outings and excursions which were arranged by their Montreal friends.

Recent Patent Decision

The Thomson-Houston Electric Company has been successful in its suit against John George Buehler, Frank H. Platt and the Columbia Machine Works, for alleged infringement of letters patent No. 424,695 for improvements in suspended switches in traveling contacts for electric railways, which was granted to Chas. J. Van Depoele on April 1, 1890. The court grants the plaintiff an accounting and also an injunction restraining the defendants from making, using or selling any of the apparatus covered by this patent.

Guide to Columbus

The Columbus (Ohio) Street Railroad Company has recently issued an exceedingly artistic and valuable pamphlet giving the principal points of interest in the city of Columbus, and containing directions as to the most desirable way and means of reaching them. The pamphlet is fully illustrated with views of the principal buildings and the most important places in and near the city, and an outline map shows the relative location of all points to Capitol Square. This map also shows the street railway system of the city and the best line to take to reach any particular spot. The pamphlet is one of the best examples that have appeared for some time of the up-to-date methods employed by street railway companies for attracting and creating travel.

American Cars in Manila

In view of recent events, it is interesting to note that all of the street cars in the city of Manila, the capital of the Philippine Islands, were made in America. The cars were built by the J. G. Brill Company, of Philadelphia, and are shown in the accompanying illustrations. The closed bodies are 12 ft. over all, and weigh about 2700 lbs.; the open cars are 13 ft. 6 in. long over dashers and have a seating capacity of twenty passengers.

These cars are drawn by Philippine horses, which are about the size of a Newfoundland dog, and it was therefore necessary to make them extremely light, and at the same time of the required strength. These equipments have been in service for some time and have given entire satisfaction. The street railway company is known as the Transvias de Filipinas.

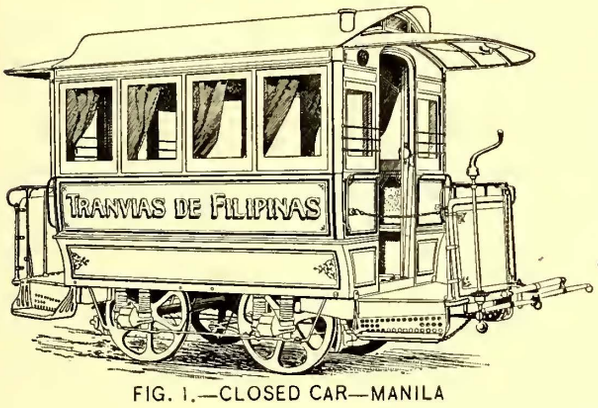


FIG. 1.—CLOSED CAR—MANILA

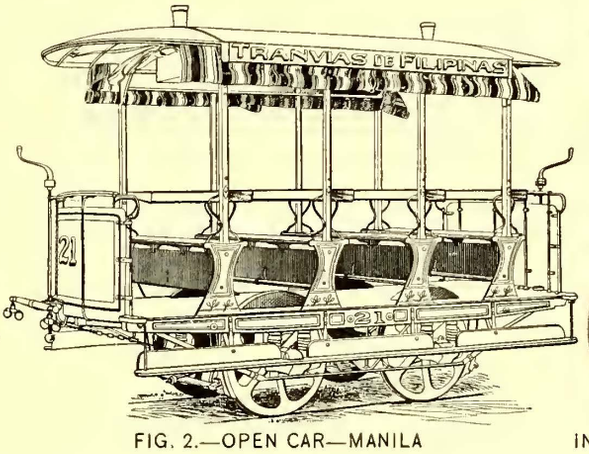
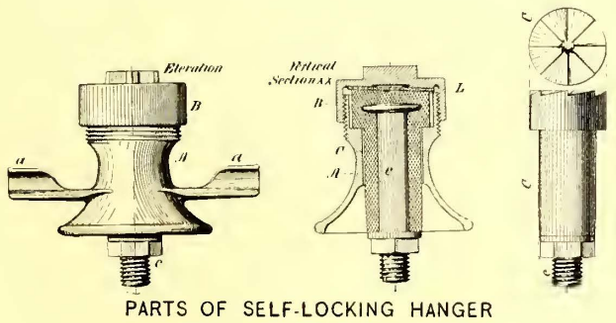


FIG. 2.—OPEN CAR—MANILA

Self Locking Hanger

A new type of hanger in which the cap is in a sense self-locking has recently been brought out by the Electric Railway Equipment Company, of Cincinnati, Ohio. The general construction of the hanger is shown in the engravings herewith. As will be seen, the hanger is in several parts, consisting of an insulated bolt, bell and cap. The thread on the bolt by which it is attached to the car is made right handed and that on the cap is left handed. The result is that when the bolt starts to work loose it tightens the cap, making it impossible for that to become loose. The upper part of the insulation on the bolt, as shown in the third engraving, is serrated, and a hanger with corresponding radial teeth is placed between the upper end of the bolt and cap, as shown at L in the cut. This helps to keep the insulated bolt in place. The New York agent for the Electric Railway Equipment Company is Elmer P. Morris.



PARTS OF SELF-LOCKING HANGER

Decision in the Van Depoele Trolley Case

In the United States Circuit for the Southern District of New York, a decision upon final hearing was rendered by Judge Lacombe in the case of the Thomson-Houston Electric Company vs. the Union Railway Company, of New York, and the Walker Company, for the infringement of the Van Depoele trolley patents. It will be remembered that the Circuit Court of Appeals held that claims 6, 7, 8, 12 and 16 of this patent were null and void, and the present suit was upon claims 2 and 4. Judge Lacombe decides that the ruling of the higher court upon the validity of the patent covers claims 2 and 4 as well as the others, and that as to these claims also, therefore, the patent cannot be sustained. Judgment is accordingly rendered for the defendants.

Well Known Arc Lamp

In the accompanying illustration is shown the Monarc inclosed arc lamp, which is manufactured by Albert & J. M. Anderson Manufacturing Company, of Boston, Mass. This lamp is but 22 ins. over all and in designing it to occupy this small space nothing in the way of strength, ample insulation or large radiating surface for the resistance has been sacrificed. Special attention has also been given in making this lamp to providing good facilities for cleaning and trimming. The magnets, and in fact all the different parts, can be readily removed and replaced. The shape of the inner globe has been adopted after many experiments and the arc is so thoroughly inclosed that the combustion of carbon is reduced to a minimum.

INCLOSED ARC LAMP

The Monarc lamp burns 150 hours and is adapted for use on street railway circuits. Owing to its simplicity of construction and the fact that all mechanical details have been carefully worked out, the manufacturers claim that there is the least possible deterioration through wearing of parts.

The First Regiment Volunteer Engineers at Peekskill

The recruiting of the First Regiment of the United States Volunteer Engineers by Col. Eugene Griffin was completed early in July, and the drill of the men has been actively going on ever since. In private letters and conversation, Col. Griffin says that never in his army experience has he seen a force of men take hold of drill, and in fact of any kind of work, with as much spirit, energy and endurance as this regiment at Peekskill. They have drilled regularly six hours a day, and in many cases bodies of the men have gone to their officers to ask for additional drill outside these regular hours, so anxious are they to become perfected in all essential movements as rapidly as possible. Major Louis Duncan, more commonly known as Prof. Louis Duncan, of Johns Hopkins University, is also at Peekskill in charge of his battalion in Col. Griffin's regiment. On July 27, the Engineers regiment was ordered to Porto Rico.

Engines for London

The Westinghouse Machine Company is now building ten 3000-h.p. engines, to be direct-connected to 2000-h.p. dynamos built by the Westinghouse Electric & Manufacturing Company, for the Metropolitan Electric Light & Supply Company of London.

Large Power Transmission Plant at the Sault Ste. Marie

The Union Carbide Company, whose works for the manufacture of calcium carbide will be located at Sault Ste. Marie, has recently awarded to the Walker Company, of Cleveland, Ohio, what is said to be the largest order for electrical apparatus of the alternating type ever placed at one time. The order consists of twenty 500-h.p. alternating generators, single-phase, 60 cycles, to deliver a current of 2500 amps. at 200 volts. Besides these there will be five 100-h.p. direct-current generators as exciters and a complete switchboard for all these machines. The plant will be run entirely by water power, turbines of the Stilwell-Bierce & Smith-Vaile type being employed. A general view of the type of generators to be installed is shown in Fig. 1.

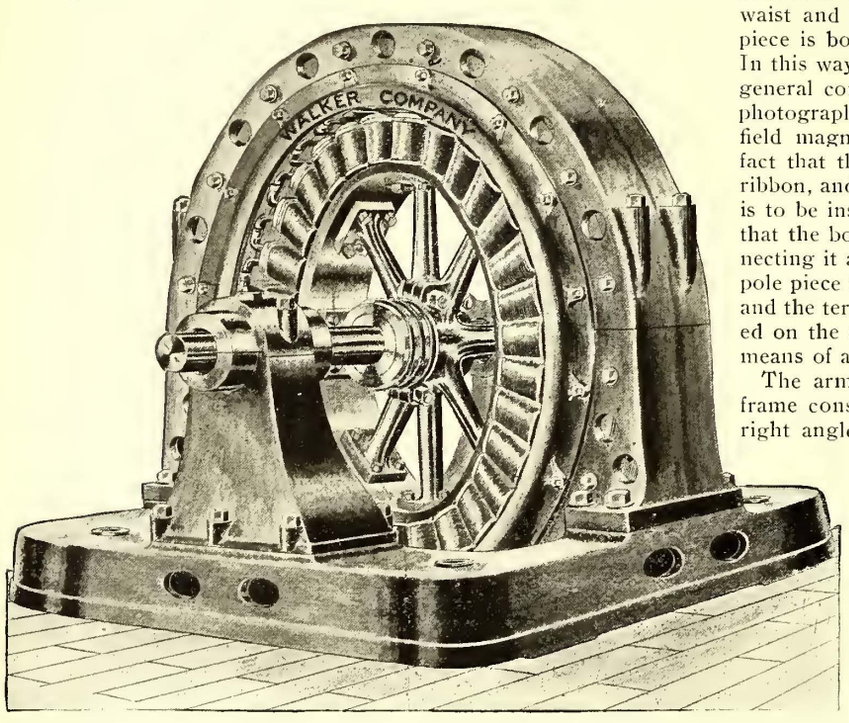


FIG. 1.—GENERAL VIEW OF ALTERNATOR

The generators have stationary armatures and rotating fields. Each machine has thirty poles on its field magnet and can deliver 375 k.w. at 240 r.p.m. The field magnet poles are all salient, each carrying a coil, as shown in the general view. The construction of the field magnet is as follows: A massive cast-iron hub is provided with rotating arms. This hub is divided on a diameter, and the two halves strongly bolted together. Two finished hub castings are shown in Fig. 5 and it will be seen that the arms are not connected together by a continuous rim. In this way there is no danger of strain from expansion or contraction, such as might obtain if the rim was continuous. Mounted upon the ends of the arms are massive steel rings, which form a surface on which to mount the pole pieces, and also a return magnet circuit for them. These rings, which are very strong, are securely bolted to the cast-iron arms of the hub, and to them the pole pieces are secured also by bolts. The pole piece has a T-shaped section and is constructed of rather thick laminæ of iron, which are tightly compressed together and securely riveted, enabling them to be drilled and countersunk like a solid mass of iron. The pole pieces before drilling are shown in Fig. 3. It is to be noted that the polar surface is sloped away from the armature coil at the tips, thus shading the magnetic field and rendering the current wave less jagged. The winding on the pole pieces consists of flat copper ribbon, wound edge on with shellacked paper between. The winding is a somewhat difficult one to accomplish, but the bending is readily done by a special tool used by the company, and the result is extremely compact and mechanically secure, a very important consideration this, for moving wire. The bobbin is mounted on a spool with brass heads and a sheet-iron waist and the spool is sufficiently long, so that when the pole piece is bolted in place it compresses it very tightly in position. In this way there can be no shift nor movement. An idea of the general construction of the field magnet can be obtained by the photograph, shown in Fig. 4, a picture of a Walker alternator field magnet of a smaller machine. Attention is called to the fact that this machine is wound with square wire instead of flat ribbon, and in that respect differs from the type of machine which is to be installed at the Union Carbide Works. It is easy to see that the bobbin is readily removed for repairs, by simply disconnecting it and withdrawing the two or more bolts which hold the pole piece in place. The field magnets are all connected in series and the terminals are brought down to two collector rings mounted on the shaft of the machine, the excitation being provided by means of a small standard Walker generator.

The armature construction is very simple and effective. The frame consists of four castings. It is divided both vertically at right angles to the shaft and horizontally parallel to the shaft.

FIG. 3.—LAMINATED POLE PIECES

The vertical division of the frame serves to hold the laminæ in place. These are exceptionally large stampings of iron, deeply notched at proper intervals to receive the coils of the armature. These laminæ in sizes up to and even exceeding 100 k.w., consist of but a single piece for a half circumference. They are stacked together with the slots coincident and with suitable separator plates at intervals to provide for ventilation. The cast-iron halves of the frame are cored out sufficiently to admit of an air chamber behind the outer circumference of the laminæ. The ventilating holes in the side of the casting, which appear in the photographs, give access to the outer air. The laminæ are insulated with paper and a sufficient number of them are placed in the armature frame, so that when the latter is set up by bolts parallel to the shaft they will be tightly clamped together. These bolts are never intended to be removed, and so they are set up with great pressure and the ends are closely filed off to the nuts. Fig. 2, an engraving of the lower half of an armature frame, displays its construction to good advantage. This frame is that of a single phase machine and is similar in construction to those to be used at the Carbide Works. If the machine were to be two phase, there

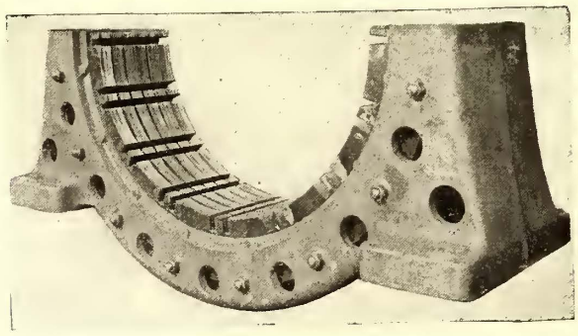


FIG. 2.—SHOWING CONSTRUCTION OF ARMATURE RING

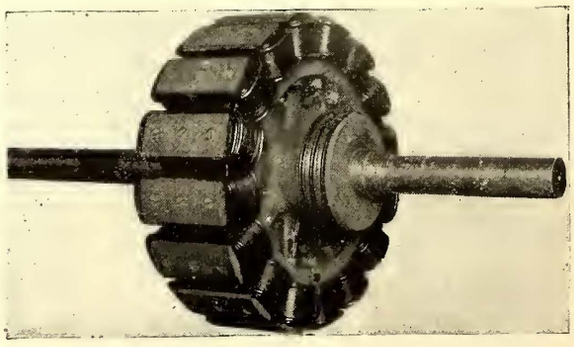


FIG. 4.—REVOLVING FIELD MAGNET

would be intermediate notches at 90 degs., with slots for the single phase coils, and both sets of coils would have to be slightly bent in order to avoid each other.

The coils are wound on forms and are very heavily insulated, so heavily, indeed, that there is no necessity of insulating the armature core in any way; the coils are slipped on directly. This construction renders the rapid removal and renewal of a coil very simple. The bolts securing the two halves of the armature frame together are external, thereby facilitating the dismantling of the machine and making all the parts easily accessible. The ends of the protruding armature coil are protected by cast-iron plates on either side, as shown in the general view of the machine.

This latest essay of Prof. Short has proved remarkably successful. The first alternating machines, as designed and built at the Walker Works, immediately and satisfactorily responded to the demands for which they were built, and were sold at once, and the construction of others has been rapidly going forward.

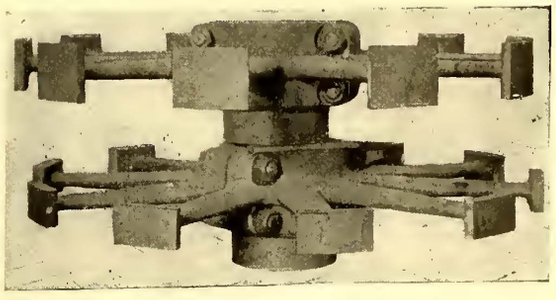


FIG. 5.—FIELD SPIDERS

New Type of Electric Heater

The accompanying engravings show a new type of electric heater recently placed on the market by the Gold Car Heating Company of New York. As will be seen, the heater bears a general resemblance to the well known heaters of this company, but a number of improvements have been introduced which, it is claimed, give a better circulation of air through the heater and divide the air into smaller particles than in the old arrangement. These two features are claimed by the Gold Company to lie at the foundation of all proper heating systems, and have been consequently embodied in its heaters.

As will be seen from Fig. 1, the method of supporting the resistance coil is quite novel and is radically different from anything which has heretofore been attempted. The supports consist of a ¼-in. steel rod which is thoroughly covered with insulating enamel. The enamel is burned on the rod at over 2000 degs. F.—it is therefore not affected by any heat to which it will ever become subjected, and at the same time is a non-conductor. This rod is shaped in a zig-zag form and the resistance coil when slipped on in place assumes the position shown in the illustration. The wire forming the coil is the company's own product and the result of long and careful experimenting. It is designed to combine a high resistance and absolute non-corrosive qualities. The resistance coil is wound on an open pitch, so that when it is placed on the zig-zag rod it is in its natural condition and is not subject to any strain whatever. It has only tension enough to keep it firmly in place. The object of manufacturing the support in the form shown is to give better circulation of air over the heated surfaces, as the air can easily pass in and out and around the support. It will also be seen that as there is no tension on the wire there is no tendency of the coil to pull apart, and even in the case of the inequality in the temperature of the different parts of the coil and in the improbable event of the wire breaking the coil will be held fast on the supporting rod and will not unwind or short circuit with the heater casing.

FIG. 3.—FRONT VIEW OF HEATER

Fig. 3 is an exterior view of a panel heater. This heater sets into the panel under the seat, the front of the heater being flush with the panel. The case is lined with asbestos and an air space is provided at the top as shown. The coils are so arranged that the upper sets are in multiple and the lower sets in series. Six of these heaters are usually used in a 24 ft. car and the heater is graduated to three degrees by the use of a special switch. When the switch is turned to the first point the current passes through the lower set of coils all over the heater. At point No. 2 the lower set of coils is cut out and the current passes through the upper sets in every heater in series parallel. At point No. 3 the current passes in multiple series through all the coils of every heater in the car. In this way a uniform temperature is secured independent of the degree in either of the three positions of the switch.

Fig. 2 is an interior view of the company's smaller sized panel heater. It is lined with asbestos and has an air space at the top. This heater contains but one set of coils and when used, ten or twelve of these heaters are employed in cars from 20 ft. to 30 ft. in length. For smaller cars six of these small heaters can be used with good effect. A two-point switch can be used with these heaters, supplying two gradations of heat. The company also applies the same heaters to cross-seat cars.

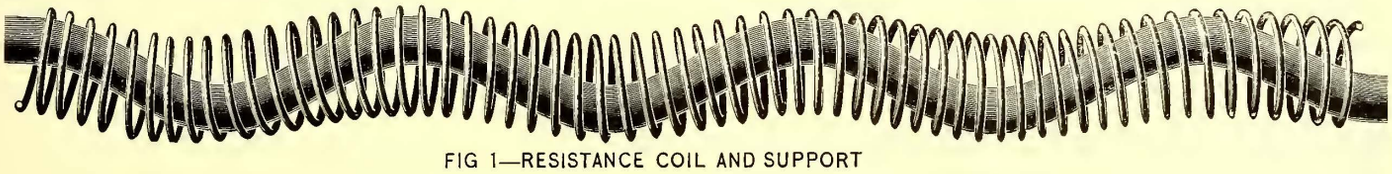


FIG 1—RESISTANCE COIL AND SUPPORT

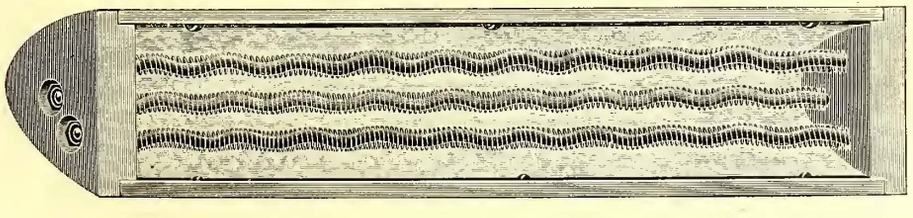


FIG. 2.—INTERIOR VIEW OF HEATER

A Decision on Advertising Racks

Last August Judge Putnam, in the United States Circuit Court in the District of Massachusetts, rendered a decision in the suit of the American Street Car Advertising Company against the Newton Street Railway Company, et al., for infringement of United States letters-patent No. 380,696, granted in 1888, to I. H. Randall, for advertising racks in the street cars. In this decision Judge Putnam sustained the patent and ordered an injunction against the use of the racks. An appeal was promptly taken to the United States Circuit Court of Appeals fer the First Circuit of Massachusetts, and was argued early in the year. A number of car builders and street car advertising concerns interested themselves in the case and concerted action was taken to defend the appeal. On July 19 a decision was handed down reversing that of Judge Putnam, and holding that the patent was not infringed. The decision in itself is short and conclusive, the Judge saying:

"While we entertain doubts where the complainant's device involves invention or patentability, yet admitting that both were found in it, the patent must be held so close and narrow that it is not infringed by a structure that cannot be described in the

language of the patent as an article complete in itself adapted to be readily attached to the car at the place specified,' or in the language impressed upon the patent office, a rack 'complete and in condition to receive the cards when not fastened to the car.' We are clear, therefore, that the respondent's structure does not infringe.

"The decree of the Circuit Court against this appellant, the Newton Street Railway Company, is reversed, and the case is remanded to that court with directions to dismiss the bill with costs, the appellant to recover the costs of this court."

This decision probably settles the matter for all time and there will be no more litigation as far as the advertising mouldings in the cars are concerned.

The Brooklyn Elevated Railway Motor

The new motors used on the Bridge Division of the Brooklyn Elevated Railroad for switching the trains at the termini and carrying them to the point where the cable takes hold of the grips, as well as for running the shuttle service during the night, are built by the Walker Company and are of what is known as its 15L type. A detailed description of these motors will be of interest to both designers and managers, as they appear to be remarkably efficient and mechanically well constructed.

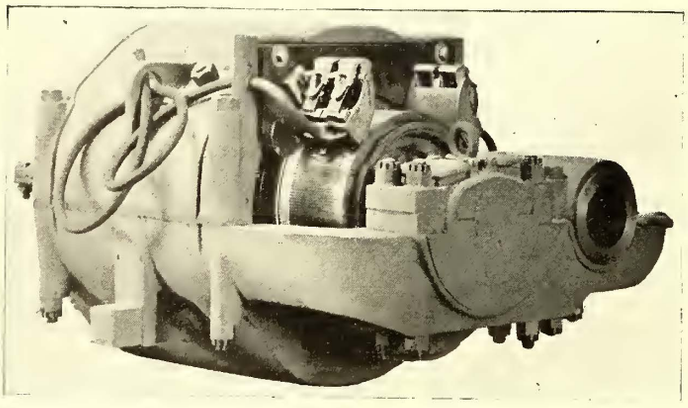


FIG. 1.—GENERAL VIEW OF MOTOR

A general view of the motor is shown in Fig. 1. It will be seen that it is designed on similar lines to the No. 20L motor. The case is open at the sides, for the motor is to be used for elevated railway work and does not need the complete inclosure that is required of motors for street railway service. The halves of the case are held together by long bolts, which pass through appropriate sockets cast on the side of the case and hold the magnetic joint tightly together. A solid cubical lug is cast on an appropriate projection to engage with the suspension. The axle bar brackets are cast on the lower half of the case, forming an extension of the main bearing brackets. They consist of heavy brass shells and are provided with efficient means of lubrication in the shape of a grease cup immediately beyond the axle. The main bearings are lubricated with oil instead of grease and, as the motor is intended for elevated work, the bearing has to be exceptionally tight and otherwise well made. It is bolted by four bolts into an appropriate socket cast on the lower half of the casing. The nuts on these bolts are secured by spring cotters. The diameter of the shaft both at commutator and pinion is 3 ins. The pinion bearing is 8½ ins. long and the commutator bearing 6 ins. long. A detailed view of the bearing cap is shown in Fig. 2.

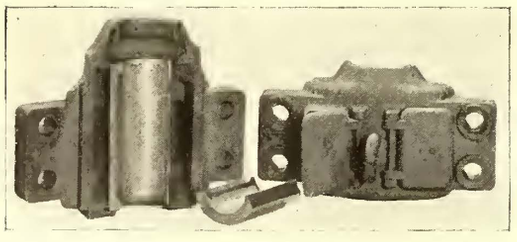


FIG 2.—DETAILS OF BEARING CAP

The oiling is accomplished by heavy felt wicks, which wipe the bearings through appropriate apertures between the edges of the shells. As the available space on this motor is limited, the bearing extends within the commutator, which is suitably recessed for the purpose. An exceptional provision has been made against flying oil by means of a hook shaped lip on one side of the bearing. The outer end of the bearing is closed by a thrust plate. Two leads are provided on either side of the high bolt on the top of the bearing for the introduction of additional oil and an inspection of the bearing from time to time. On the rear of the motor, as can be seen in Fig. 3, is provided a cable sheave to engage with the cable on the Brooklyn Bridge in case it comes in contact with the motor. The axle bearing passes entirely through the motor case, this being necessitated by the compact construction of the motor. Fig. 3 shows this to good advantage, and in Fig. 4, a picture of the upper half of the motor, it can be seen in additional detail. The pole pieces of the motor are laminated, being built up of many moderately thick iron plates, and the stack is capped with substantial end plates and securely riveted together. In this form it can be drilled and countersunk like a solid block of iron to receive the screws, which hold it to the seats on the inside of the casing. This laminated construction shows to good advantage in Fig. 4. The field coils, which are shown in Fig. 5, consist of two parts, each of which is made up of a single coil of flat ribbon with asbestos wound in between. The two halves of the coil are wound in opposite directions and their inside ends are connected together and then the pair are securely taped in position. This forms an extremely compact coil, which is practically a necessity on a motor of such light weight and so large output.

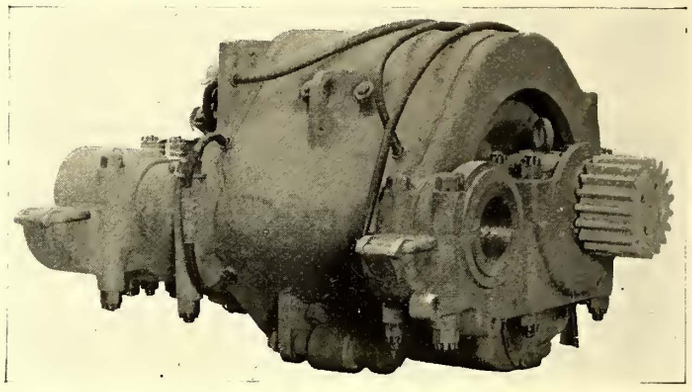


FIG. 3.—REAR OF MOTOR

The brush holders are mounted on an insulating board bolted to the casing on a piece provided for that purpose. The motor uses the regular Walker motor brush holder, which is a most substantial affair, consisting of solid composition casting with powerful spring-actuated fingers pressing the brushes down upon the commutator. A suitable socket is provided in which one end of the cable terminal is sweated with solder. The commutator is of generous proportions, nearly equal in diameter to the armature. It is made from dropped forged copper and is set up under great pressure and heat by the well known Walker methods. It may be seen to good advantage in Fig. 6, a view of the completed armature. The armature core is ventilated, an innovation in railway motors, which heretofore have been built with solid cores. Three ventilating slots are provided. The armature coils

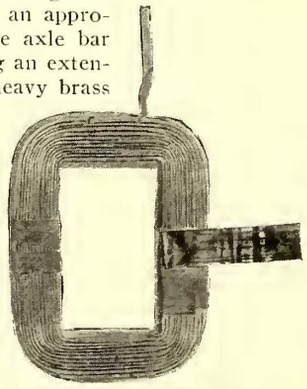


FIG 5.—FIELD COILS

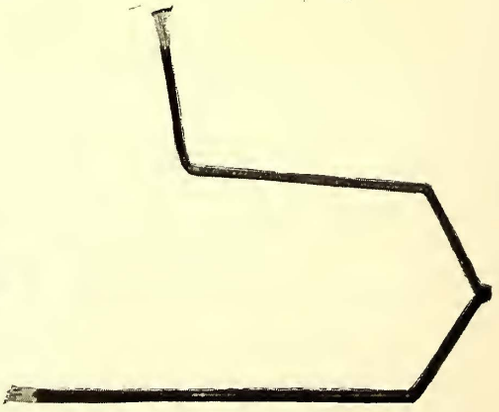


FIG. 7.—ARMATURE COILS

are formed of flat copper ribbon and are shown in Fig. 7. Although Fig. 7 suggests a winding without lead, such is not the case. The coils are led a proper amount to throw the brushes on an angle of 45 degs. with the horizontal. In the winding of this armature the Walker Company has abandoned its favorite method of insulating the slots, and instead has put extra heavy insula-

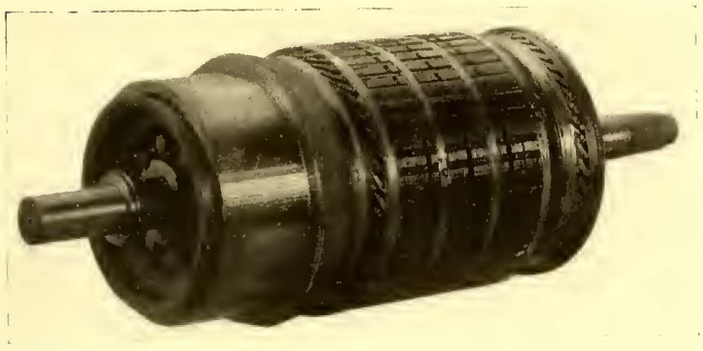


FIG 6.—COMPLETED ARMATURE

tion on the coils. This makes the insulation of the core easier and cheaper, as only the ends and the bottoms of the slots now need to be covered. A shallow trough is turned on the teeth of the armature to accommodate band wires, four of which are placed on the armature proper and two more on the end connectors. These latter two are the strongest bands and do the

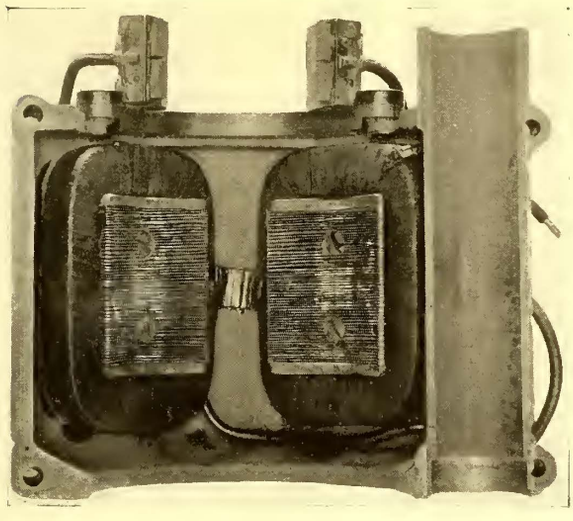


FIG. 4.—UPPER HALF OF MOTOR

most of the holding. The characteristics of this motor are reproduced in Fig. 8. The high efficiency curve has created a great deal of comment among designers, who appreciate the difficulties of making a railway motor even approach these values, and Prof. Short is entitled to no little credit for the proportioning of a machine which has produced these admirable results.

Car Journal Lubric nts

The journal lubricants manufactured by the Hanna Solid Oil Company, of Chicago, Ill., have made an excellent record in several recent tests which were made to determine their lasting qualities. This oil or lubricant forms a quicksilver luster plating of great endurance on the journal, and one application of the oil will serve until this plating is worn through to the metal. It is stated that brasses which were practically worn out have been kept in service for two years with the use of the Hanna lubricant, thus proving that by its use friction is reduced to a minimum. This oil has been applied to hot boxes on both steam and street cars, and boxes were cooled while the cars were running.

The Chicago General Railway Company has been using these lubricants for two years, and W. F. Brennan, superintendent of the road, gives the following record of cars treated with them:

"Car 110, wheel boxes pere packed with Hanna solid oil July 26, 1896, ran 54,000 miles with the one greasing, and it only required a small amount to renew the packing; wool waste was used with the oil in packing the wheel boxes. Car 103, wheel boxes were packed with Hanna solid oil Sept. 17, 1896, and up to the time the records were discontinued the car had run 27,000 miles on the one packing. Car 106, wheel boxes were packed with Hanna solid oil July 31, 1896, and up to the time the records were discontinued the car had run 28,000 miles on the one packing. Car 108, wheel boxes were packed with Hanna solid oil on Oct. 14, 1896, and up to the time the records were discontinued the car had run 19,000 miles on the one packing."

A Patent Controversy

In a recent circular issued by the Walker Company attention is called to a circular letter, dated June 1, 1898, and widely circulated by the General Electric Company among street railway companies, which the Walker Company claims to be misleading. The General Electric Company calls the attention of the recipient to a decision of the United States Court of Appeals for the Second Circuit upon the second and sixth claims of Sprague Patent No. 324,892, reading as follows:

"2. The combination of the wheeled vehicle and an electric-dynamic motor mounted upon and propelling the same, the field magnet of said motor being sleeved upon an axle of the vehicle at one end, and supported by flexible connections from the body of the vehicle at the other end, substantially as set forth.

"6. The combination with a wheeled vehicle supported upon its axles by springs, of an electro-dynamic motor flexibly supported from such vehicle and centered upon the driving axle thereof, substantially as set forth."

The letter states that the Walker Company is now under in-

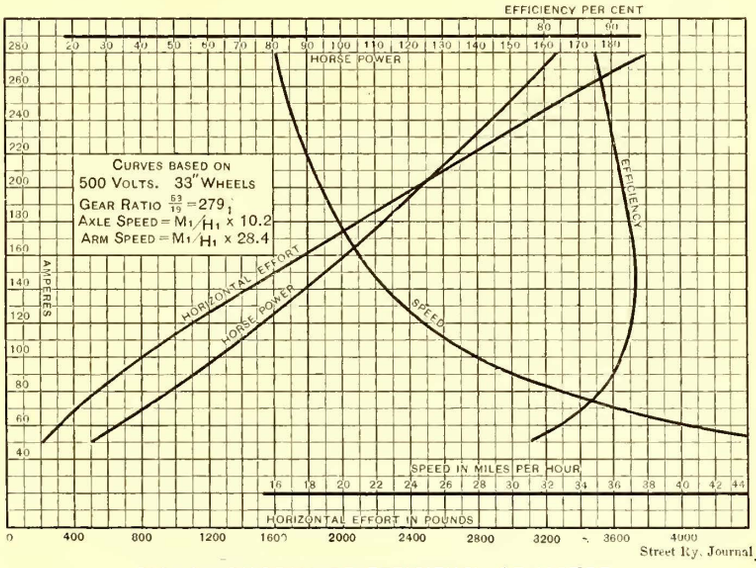


FIG. 8.—DIAGRAM OF EFFICIENCY OF MOTOR

junction, by the terms of which it is forbidden from using any apparatus covered by these claims.

In the Walker Company's circular, attention is called to the radical differences between the Sprague suspension covered by these claims and the Walker suspension, and the statement is made that the latter is not in any way covered by the Sprague claims. The Walker Company holds that to this extent the General Electric Company is willfully misrepresenting the patent situation.

Meeting of the New York State Association

The sixteenth annual convention of the New York State Street Railway Association will be held at the Hotel St. George, Brooklyn, on September 13 and 14. The following is a partial list of the papers which will probably be presented:

Points on the care of dynamos.
The use and abuse of transfers.
How can we increase our receipts?
Low joints; how to prevent them.
The power station from an economic standpoint.
The office; suggestions for record, reports, etc.
Track bonding; how can we obtain the best results?
Street railroad versus the State; the relation to each system for single track roads.
General track construction; the most approved method of freight and express service on suburban and interurban lines.

Are air and power brakes on electric cars practicable?

The most approved plan of long distance power transmission.

The best method of preventing accidents.

Pleasure resorts as a means of stimulating travel; are they profitable?

The effect upon street railroads of the application of electricity to steam; possibilities and advantages from an up-to-date street car service and why the rate of fare should not be reduced.

Daily inspection of car equipment and how can we accomplish the best results?

Receipts from other sources.

How to obtain best results from sale of advertising privileges, power, etc.

A Remarkable Report on Cuba

Perhaps the most interesting and valuable book upon Cuba ever written is a private (type-written) report made by W. J. Clark, general manager of the railway department of the General Electric Company, to Col. Eugene Griffin, of the First Regiment United States Volunteer Engineers. With characteristic energy, Mr. Clark collected in a very short space of time an immense amount of the most valuable data and material bearing upon the principal problems connected with the conducting of the war in Cuba from a variety of sources at his command, much of this material being obtained by Mr. Clark in the course of a vacation trip to the island some two years ago. It is well known that Mr. Clark is a close observer, and equally well known that he has numberless friends and connections who are always glad to give him any information in their power, but it is none the less remarkable that he should have been able to get together so large a variety of photographs, original surveys, maps, plans of fortifications and data showing the most intimate acquaintance with the island, which are found in this book. One of the three or four copies of this book made by him has been inspected by the President, the Secretary of War and Gen. Miles, and Mr. Clark has been warmly complimented upon the completeness of his information and has received a special letter of thanks from Gen. Miles. Such a work as this is surely of a value equal to that of the soldier in the field, if not of greater.

Special Catalogue

The John A. Roebling's Sons Company, of Trenton, N. J., has issued a souvenir catalogue which is certainly one of the finest examples of an up-to-date trade catalogue that has appeared for some time.

The catalogue is issued to the customers and friends of this company with the hope that it may mark in the minds of many people the fact that this concern has been in business for fifty-eight years, fifty of which have been spent at the present site of the works, John A. Roebling having moved his business in 1848 from Saxonburg, Pa., to Trenton.

In preparing this catalogue the idea has been to illustrate, to a certain extent, the growth of this company's business by illustrations and descriptions of its works as they are to-day. In addition to this there has been added some interesting data in regard to the large bridges with which the name of Roebling has been identified. The list of bridges where the Roeblings' material has been used exclusively includes such famous ones as the International Railway Suspension Bridge at Niagara Falls, the Allegheny Bridge, the Ohio Bridge and the New York and Brooklyn Bridge. The main body of the catalogue refers principally to wire rope and electrical wires. The tables have been thoroughly revised and brought up to date. They represent a great deal of labor and offer the best information obtainable to-day on the subject of wire rope and electrical wires, from the standpoint of the consumer.

Anyone interested in any way in the use of ropes for suspension bridges, cable ways or the transmission of power by rope for any purpose whatsoever, or in the use of electrical wires, should secure a copy of this catalogue and give it a prominent place in their library.

Personal

MR. GEO. C. EWING, of Boston, Mass., is now sergeant in Company F, First Regiment Volunteer Engineers, U. S. A.

MR. WILLIAM S. TOWNSEND has resigned as superintendent of the Woronoco (Mass.) Street Railway and will enter the employ of a large construction company in New York.

MR. J. A. BRILL, of Philadelphia, has found it necessary to withdraw his name from the directorate of the General Electric Automobile Company on account of extreme rush of business.

MR. W. F. SADLER, JR., has severed his connection as superintendent of the Greensburg (Pa.), Jeannette & Pittsburg Street Railway.

MR. GEORGE J. PAUL, manager of the Ottawa (Ont.) Street Railway, has resigned his position to accept a very desirable position in St. Louis.

MR. M. C. L. BRINSER, of Harrisburg, will have charge of the Greensburg, Jeannette & Pittsburg Street Railway, taking the place of Mr. W. F. Sadler, Jr., resigned.

MR. J. H. FISHER, who has been secretary of the Southern California Power Company, has been duly installed as secretary and general manager of the Redlands (Cal.) Street Railway Company.

MR. ROBERT T. LEE, of Newport, R. I., has been chosen by the directors of the Woonsocket (Mass.) Street Railway Company to fill the vacancy caused by the recent resignation of Superintendent Townsend.

MR. W. H. WIANDS has been appointed superintendent of the Ringing Rocks Electric Railway Company, of Pottstown, Pa., to take the place of Mr. J. Wallace Spicer, who has gone to the front with his regiment.

MR. CHESTER P. WILSON has resigned from the general managership of the Sioux City (Ia.) Traction Company. Mr. Wilson has made a good record, while connected with his company, as constructing engineer and manager.

M. MARCEL DELMAS, manager of the Compagnie Nouvelle d'Électricité de France, who is interested in several electric tramway companies, has sailed in the "Lucania" for a two months' trip in the United States and Canada.

MR. J. O. HADDOX has resigned his position as superintendent of the Louisville Railway Company, of Louisville, Ky. Mr. Haddox has been connected with the above company for the past sixteen years, rising from the position of office boy to that of general superintendent.

MR. JOHN C. DOLPH, eastern agent for the Forest City Electric Company, was married June 8 to Miss Rena Dickerson, of Brooklyn. The many friends of Mr. Dolph throughout the street railway field extend to him and his wife their heartiest congratulations.

COL. S. J. WICK, of the Electric Railway Equipment Company, Cincinnati, spent nearly a week at the Bluffs, on the St. Louis, Belleville & Suburban Railway. Having furnished through the Mason & Richards Company all the overhead material necessary, he was naturally interested in this most successful suburban proposition.

MR. W. D. SARGENT, president of the International Brake Shoe Company and the American Brake Shoe Company, left July 6 for Europe to make arrangements for the manufacture of the Diamond "S" shoe in several European countries, including Russia. The success of this shoe since its introduction last fall has been very marked, and it will undoubtedly find a ready market in foreign cities.

MR. WM. S. BRAYTON, of the New York office of the General Electric Company, was married May 3 last to Miss Alice Wait, of Ithaca. Mr. Brayton is a graduate of Cornell, and passed through the works at Schenectady before assuming his duties at the New York office. He is a favorite among all his associates, who testified their appreciation by presenting him with a handsome souvenir of their esteem.

MR. A. K. BAYLOR, manager traction department of the British Thomson-Houston Company, is in America on a combined business and pleasure trip, and returns to Europe August 6. While here Mr. Baylor will superintend the tests at Schenectady of the electric locomotives ordered by the Central London Underground Electric Railway Company, the first of which is now completed.

LIEUT. W. D. WEAVER, editor of the "American Electrician," and a graduate of the Annapolis Naval Academy, has enlisted in the navy and has been appointed chief engineer of the United States supply ship "Glacier," which will probably accompany Commodore Watson's squadron to Spain, with a cargo of fresh meat, vegetables, etc., preserved by the elaborate refrigerating apparatus with which this boat, formerly in the Australian meat service, is equipped. Lieut. Weaver sailed with his ship for Hampton Roads on July 20.

MR. H. P. BRADFORD, who was recently engaged as manager of the tramways in the City of Mexico, appears, from recent

reports, to have effected a decided transformation in the organization of the system and in its efficiency. The road is still operated by horses and mules, but under Mr. Bradford's superintendence and that of A. E. Warswick and W. B. Rommel, the engineers of Werhner, Beit & Company, of London, who own the Mexico City tramways, the equipment of one of the principal through lines is being rapidly carried out.

MR. S. B. McLENEGAN, who for many years has been connected with the San Francisco & San Mateo Electric Railway Company, has resigned his position as superintendent. It is practically settled that the present secretary, Mr. W. Clayton, will be appointed chief executive officer under the title of secretary, and will have entire charge of the railroad in all departments under the immediate supervision of the general manager, Mr. John A. Buck. G. A. Loring is to be the new superintendent, to take charge of the road subject to the authority of the secretary, Mr. Clayton.

MR. GEORGE W. MANSFIELD, formerly chief engineer of the Thomson-Houston Company's railway department, but in late years interested in a number of street railway enterprises, has just returned to active work, after a year's vacation taken for the benefit of his health. Mr. Mansfield was for five years with the Daft Electric Light Company, of Jersey City, as chemist. For one year he was electrician of the Cleveland Electric Motor Company, and in 1888 became connected with the Thomson-Houston Company, being placed in charge of its railway construction work. He left this company in 1894 and having previously purchased the charter of an electric railway at South Norwalk, Conn., he devoted his energies to building and equipping this road, which is now in successful operation. Mr. Mansfield is desirous of again taking up work in street railway lines.

LIEUT. THOMAS C. WOOD, president of the Ball & Wood Company, has been distinguishing himself in Cuban waters during the past month. It will be remembered that Lieut. Wood, who is a graduate of the United States Naval Academy and has seen many years of active service, applied in the early days of the war and was taken into the line—a very unusual honor to be paid one who has been so long in civil life. Lieut. Wood was immediately assigned to the "Gloucester," formerly J. Pierpont Morgan's yacht "Corsair," which is commanded by Lieut. Wainwright, executive officer of the battleship "Maine," Lieut. Wood being third in command of the "Gloucester." At the time on July 3, when Admiral Cervera's squadron was attempting to escape from the harbor of Santiago, the "Gloucester" covered herself with glory by completing the work of destroying the two Spanish torpedo boats "Furor" and "Pluton," and sustaining almost alone the joint attack during the engagement. Lieut. Wood was in charge of the stern battery of three guns, and at times personally worked these guns himself. On the surrender of the torpedo boats, he went out with the boat's crew to obtain the Spanish colors of the boats, and to pick up the survivors of the wrecks, of whom some fifty were obtained, and brought on board the "Gloucester." Later Admiral Cervera and his principal officers were received on board the "Gloucester" after their surrender.

MR. HENRY M. THOMPSON, formerly secretary and treasurer of the Brooklyn City Railroad Company, was born in New York in 1841. Upon graduation from school Mr. Thompson was appointed assistant librarian of the Athenaeum, now the Brooklyn Library. He stayed in this position but a comparatively short time, leaving it to go into Wall Street, where he remained for twenty years. At the end of that period he became interested in the railroad business through his friend, General McClellan, who at that time was president of the Atlantic & Great Western, now known as the N. Y., P. & O. R. R. Of this road Mr. Thompson was general accountant for ten years, and was then appointed secretary of the Railroad Commission of the State of New York, and afterwards accountant in charge of the accounts of the commission, which included those of all the railroads in the State. While occupying this responsible position Mr. Thompson wrote a book of instruction showing how to keep accounts and make reports to the Board as required by law, which work is still an authority upon the subject. In March, 1887, he accepted the secretaryship and treasurership of the Brooklyn City Railroad.

Mr. Thompson is now entering the field of railroad accounting and investigation of railroad affairs in an independent capacity. He is ready to take up the work of reporting on cost of construction and operation, classification of expenditures from capital and earnings, general financial condition of railroads, etc., and will also make special or periodical audit of accounts, open and close books, systematize, condense and simplify bookkeeping for railroad companies or any other corporations or firms. Mr. Thompson has opened an office at 23 Park Row, New York.

Obituary

MR. WILLIAM H. BLOOD, Superintendent of the Eastern Division of the Brooklyn Heights Railroad, died on July 14. He was forty-six years old, and leaves a widow, two sons and two daughters.

CORPORAL EDWARD DEXTER BROWN, of Troop C, National Guards of New York, died on July 2, at the post hospital at Fort Myer, of typhoid fever. Mr. Brown was widely known in electrical circles, particularly in the branch of telephony. He was a graduate of the Massachusetts Institute of Technology, class of 1890, and a member of several engineering and social clubs. He was one of the volunteers in the first call in the war with Spain, and was mustered in on May 22 last.

AMONG THE MANUFACTURERS

THE WESTERN ELECTRIC COMPANY, of Chicago, has recently mailed to the trade copies of its tool catalogue No. 3. If any reader of the STREET RAILWAY JOURNAL failed to receive a copy one will be sent on application.

THE WEBER RAILWAY JOINT MANUFACTURING COMPANY, of New York, at a recent meeting elected the following officers: Emil Greeff, president; Edward Y. Weber, vice-president and treasurer; George A. Weber, secretary; Percy Holbrook, general manager.

THE SARGENT COMPANY, of Chicago, announces the largest month's business in patented brake shoes in the history of the company, for June, 1898. The company is extremely busy in the steel department and running to the full capacity, with prospects of heavy business throughout the year.

THE WALKER COMPANY of Cleveland has received one of the largest single orders which it has ever received. The order came from Paris and is for equipment for 500 electric street cars. This includes 1000 motors, 1000 controllers, 500 trolleys, and other details. The order will amount in value to over $500,000.

THE AMERICAN IMPROVED RAIL-JOINT COMPANY, Monadnock Block, Chicago, has taken a contract for cast-welding the rail-joints on the Eighteenth Street and Leavitt Street lines of the West Chicago Street Railroad Company. The company has also two welding outfits working on a large contract in Kansas City.

THE SPRAGUE ELECTRIC RAILWAY & MOTOR COMPANY has been granted an injunction against the Steel Motor Company, restraining the latter company from making or selling apparatus covered by U. S. Letters Patent No. 324,892, issued August 25, 1885, to Frank J. Sprague, for an electric railway motor.

THE JOSEPH DIXON CRUCIBLE COMPANY, of Jersey City, N. J., the well known importers and manufacturers of graphite in its many forms, have issued a new catalogue entitled "Graphite as a Lubricant." The subject is treated scientifically and practically, and the value of graphite as an accessory for engineers and machinists is discussed and clearly proven.

THE HAM SAND BOX COMPANY, of Troy, N. Y., reports that the South Chicago City Railway Company has adopted its style No. 3 sand box as standard, and the cars of that company will be equipped with four boxes each. This action on the part of this street railway company speaks well for the popularity and staying qualities of the Ham sand boxes.

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, claims to be the largest manufacturer of oil filters in the world. A very neat catalogue describing the Cross oil filter which this company manufactures has recently been issued and contains a number of illustrations of the filter. It also contains a number of testimonials from customers who have used this device for a number of years.

PATTERSON, GOTTFRIED & HUNTER, LTD., of New York, are agents for the Springfield Machine Tool Company, the Whitney Manufacturing Company and the Builders' Iron Foundry, and are prepared to fill orders for machinery, metals, hardware tools and supplies. This firm has just issued a fully illustrated catalogue of the different types of tools and machines for which it is the agent.

The WASHBURN & MOEN MANUFACTURING COMPANY'S price list of wire ropes and cables for every description is very complete, giving both information and prices for cables and ropes for suspension bridges, inclined planes, ships' rigging,

yachts' rigging, etc. This company's works are at Worcester, Mass., and the company's factory has been well filled with orders during the past month.

THE CHRISTENSEN ENGINEERING COMPANY, of Chicago, through its Eastern selling agent, Frank C. Randall, has secured a number of orders recently for air brakes. Among these may be mentioned one equipment for the Brockton & Taunton Street Railway Company and one for the Lowell, Lawrence & Haverhill Street Railway Company; also several equipments for the electric cars on the three divisions of the New York, New Haven & Hartford Railroad.

EUGENE MUNSELL & CO., of 117-119 Lake Street, Chicago, are sending to their Western customers a very neat blotter, on which are embossed the Cuban and American flags, under which are the words, "Victorious on Sea and Land!" The printed matter beneath these words refers to the rapid development of a great business in a great city, and to the fact that this company does not need any better advertisement as to the superiority of its "Mica."

GEORGE A. PARMENTER, of Cambridgeport, Mass., manufacturer and dealer in life guards for street cars, reports that his fenders are making splendid records. A large number of them have been in use for a long time in different parts of the country, and it is stated that not a life has been lost or a bone broken by a car equipped with the Parmenter guard. Mr. Parmenter states that he is preparing to make a special exhibit at the Boston Convention and he will be glad to have all delegates call and inspect his devices.

THORNTON N. MOTLEY & COMPANY, of New York, have recently been placed in the hands of a receiver as the result of a suit brought by Mr. Motley against his partner, Francis Farmer Fox, for a dissolution of the partnership on account of dissensions between the partners. Albert Cardozo was appointed receiver and his bond was fixed at $25,000. Mr. Motley states that the assets far exceed the liabilities and that the business is large and profitable. The business will be continued under the name of Thornton N. Motley at 62 John Street, New York.

THE CLEVELAND ELECTRIC COMPANY has recently been organized for the purpose of manufacturing specialties in the way of electrical appliances, with offices at 14 Middle Street, Cleveland, Ohio. The company is fortunate in having secured for its general manager F. A. Rogers, for many years connected with the Card Electric Company, Mansfield, Ohio, whose many friends wish him every success in his new enterprise. The other officers of the company are W. J. Morgan, president; F. C. McMillin, vice-president; O. P. Fisher, treasurer, and N. C. Stevens, secretary.

WM. WHARTON, JR., & COMPANY, of Philadelphia, who installed the special work for the car house of the Springfield (Mass.) Street Railway Company, described elsewhere in this issue, have received many favorable comments for the character and appearance of this installation. This, it should be said, is the largest installation of T-rail special work with hardened steel centers ever made. It is also interesting to note that the old car house of the same company is equipped with Wharton unbroken main line switches, which add much to the easy riding of the cars when passing this building.

ROSSITER, MAC GOVERN & CO., of New York City, have recently secured and are now offering a number of railway generators of Westinghouse and General Electric manufacture, of modern types, that have seen very little use. They have been able to acquire these generators by reason of the consolidation of several plants in the vicinity of New York, making it necessary to operate from one power house instead of several small ones. It is very exceptional for such modern apparatus to get on the market, and this company states that it is willing to sell the generators at a very low price.

THE HAZARD MANUFACTURING COMPANY of Wilkesbarre, Pa., supplies wire rope of steel and iron for shafts, quarries, elevators, ferries, suspension bridges, ships' and yachts' rigging, dredges and derricks, transmission of power, tramways, underground and surface haulage, cable railways, etc. These ropes are made of the best brands of Swedish charcoal iron, English and German crucible cast steel and plough steel wire, the wire being drawn in the company's own mills. The catalogue and price list of the Hazard Manufacturing Company should be in the library of all rope users, and it will be sent on application.

THE BALDWIN LOCOMOTIVE WORKS, of Philadelphia, Pa., and Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa., have jointly issued a pamphlet describing electric mining motors for underground haulage. The extended experience of the Baldwin Locomotive Works in the manufacture of steam and compressed air mining locomotives insures careful design of the mechanical features of the locomotives, while the well known excellence of the electric railway apparatus of the Westinghouse Company guarantees that the specially designed motors for these locomotives embody the latest improvements in electric practice.

BRODERICK & BASCOM ROPE COMPANY, of St. Louis, in order to meet the large and increasing demand for its ropes, in 1897 erected a new and commodious factory which was thoroughly equipped with the latest and most improved machinery. By reason of these changes this company is enabled to manufacture ropes of any size and length, up to 100 tons weight, in one continuous piece without splicing either the strands or rope, and with absolute uniformity of lay under equal tension on each wire and without twisting the individual wires. Broderick & Bascom's catalogue and price list gives full information regarding the different kinds of wire ropes and the uses to which they can be put.

THE CHARLES MUNSON BELTING COMPANY, of Chicago, has found it necessary to enlarge its headquarters. This company will hereafter occupy the entire ground floor at 22 to 36 Canal Street, Chicago, in addition to the upper floors which it has occupied for a number of years. All of the departments are very busy, and a number of large shipments have recently been made, among them being two 60-in. belts to the United Electric Company, of Washington, D. C., and one 60-in. belt to the street railway at Danville, Ill. A. E. Groetzinger is in charge of the Chicago office of this company, and J. H. Shay has the management of the electrical and railway departments.

THE MASON & RICHARDS COMPANY of No. 314 Security Building, St. Louis, is the name of a new company in the street railway supply business. In addition to the agency of the Walker Company, represented by Mr. Mason, the company will act as selling agents for the Electric Railway Equipment Company, Cincinnati; Forest City Electric Company, Cleveland; Keystone Electric Company, Erie, and other desirable concerns, and will also conduct a general supply business, particularly in railway supplies. The connection of W. R. Mason, so well known as one of the pioneers in the street railway field, is a guarantee of prompt and careful attention to all wants of managers of street railways.

THE C. W. HUNT COMPANY, of New York City, is meeting with great success in the manufacture and introduction of the Hunt industrial railway. These railways are usually 21½ ins. in gage for use in manufacturing establishments, and every part is especially designed with the idea that a railway for these purposes is as much a machine as a lathe or steam hammer, and requires the same care in design, and the same quality of machine work. The track is made up complete, ready to lay, with the steel crossties securely riveted to the rails, and with the switches, curves, crossings and turn-tables, makes a perfect permanent way. The Hunt Company furnishes cars, tracks and every part required for the installation of the railway.

THE BALL ENGINE COMPANY, of Erie, Pa., has recently issued one of the finest catalogues of the year. The catalogue describes the Ball automatic cut-off engines for electric lighting, electric railways and general manufacturing plants. This company's motto is, "Merit is the supreme test," and it has therefore continued to make such improvements as its extended experience and the requirements of modern electric lighting have suggested. It has recently increased the facilities of its many departments and adopted the advanced methods of superior mechanics, which, combined with skill and systematic method of manufacture, enables it to build an engine that for general merit it is claimed cannot be excelled. Quality rather than low cost has always been the aim of this company.

THE MICA INSULATOR COMPANY, of New York and Chicago, reports a gratifying demand for its "Micanite" segments for electric light and power generators. Some heavy orders are being executed at the factory in Schenectady, N. Y. Many of the large generators now under construction have for their commutator insulation "Micanite." The heavy increase of the company's business during the last few months is largely due to the improved process of manufacturing a perfect commutator segment. This company offers to send free to any machinery builder or electrical repair concern a set for any one of the smaller machines free of expense. Parties interested in the economical insulation of electrical machinery will do well to write the company at its office, either in New York or Chicago.

THE CLOOS ENGINEERING COMPANY, Milwaukee, Wis., has lately been organized and thoroughly equipped for do-

ing a general electrical contracting business and will make a specialty of complete electric light and power plants. This company controls exclusively the Cloos patents on high potential dynamo and feeder switches, single and double coupling boxes, alternating and direct junction boxes, etc. The company is exclusive selling agents in the Northwest for the apparatus manufactured by the Northern Electric Manufacturing Company, consisting of both belted and direct connected dynamos and motors of all sizes and is prepared to make prompt delivery of switchboards, dynamos, motors, arc and incandescent lamps, etc. The officers of the company are Herman W. Falk, president; Jacob Cloos, vice-president and general manager; E. A. Wurster, secretary; C. R. Falk, assistant secretary; H. R. King, treasurer.

ELMER P. MORRIS, 15 Cortlandt Street, New York, has just established a new branch of business. He offers his services to foreign users for the purchase and shipment from the United States of materials used in the electrical trade, and for any description of mechanical appliances. The purchaser's interests will be looked after by Mr. Morris with the greatest possible care, merchandise will be inspected and properly marked and no charge made for clearance papers. As compensation for this work a small commission will be charged the purchaser, and the benefit of the lowest net prices, including commissions or rebates offered by the manufacturers, will be given to Mr. Morris' clients in Europe. Mr. Morris has been in the electrical business since 1879, and has superintended the construction of a large number of electric light and railroad plants. He is well and favorably known, and his ability in securing low prices is unquestionable.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, of Pittsburg, has installed a very large amount of apparatus for electrolytic processes. One of the principal installations is at the refinery of the Anaconda Copper Company, Anaconda, Mont., where ten generators of 270 to 300-k.w. capacity have been installed. Another very large installation is that of the Boston and Montana Consolidated Copper and Silver Mining Company, Great Falls, Mont., where two 810-k.w. Westinghouse engine type generators are in service. The latest comer in this field is the Raritan Copper Works, of Perth Amboy, N. J., who are about to erect the largest copper refinery in the East. They have contracted with the Westinghouse Electric and Manufacturing Company for three 600-k.w., 150 volt, engine type generators, 150 r.p.m., with a 9-section switchboard for electrolytic service and the operation of two 75-k.w., 220-volt, engine type generators, which will be used for lighting and power service. The installation will be the most complete of its kind in the world.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., has received from the New Haven Gas Light Company, of New Haven, Conn., a contract for a new fireproof coal shed. The building is 60 ft. wide and 500 ft. long. The framework is steel, so arranged that the coal cars are brought into the building on a track supported by the roof trusses, the idea being to provide the maximum storage at the least expenditure of power and room. The Berlin Iron Bridge Company has also recently received an order from the Syracuse Construction Company, of Syracuse, N. Y. This company is erecting new buildings in connection with its electric railroad plant. One building consists of a boiler house 60 ft. x 90 ft., which is an all-fireproof building, having steel framework covered with corrugated iron on the sides and roof. There is also an engine room 65 ft. wide x 80 ft. long, having a steel framework and brick sides. The other building is a car barn and repair shop 65 ft. wide and 170 ft. long. This building also has steel framework construction, with corrugated iron sides.

THE BABCOCK & WILCOX COMPANY, of New York, report sales for the first six months of 1898 in excess of the first ten months of 1897. This is an exceptionally fine showing, and the officers and managers of the company are to be congratulated upon the success of their efforts. A notable order which this company is now filling is that for the Ninety-sixth Street power house of the Metropolitan Street Railway Company of New York. This order for 15,000-h.p. wrought steel boilers is the largest contract for stationary boilers ever placed. Previous sales to the Metropolitan Street Railway Company amount to 7500 h.p. The sales of the Babcock & Wilcox Company to electrical concerns thus far in 1898 aggregate 37,511 h. p. This company has recently issued the thirtieth edition of its book known as "Steam." This book has been for years one of the standard works on water tube steam boilers and on boiler practice generally. The present edition contains much new matter. It is beautifully arranged and illustrated and substantially bound, and is sent free to anyone in any way interested in the generation of steam.

LAING, WHARTON & DOWN, Ltd., of London, Eng., have received the following orders for traction work: The trucks for the twenty additional cars for Bristol Corporation tramways, the trucks for the twelve new cars for the Hull Corporation tramways, the car bodies and trucks for the Liverpool Corporation new tramways, these being very special cars with center entry only, and isolated position for the motorman. They have also done considerable business in tramway supplies. In their electric lighting department they have secured orders from the County Council of the West Riding of Yorkshire, for a large asylum, including two 60-h.p. direct-coupled, and two 80-h.p. direct-coupled plants and balancing apparatus. The asylum equipment consists of about 2600 incandescent lamps, 60 arc lamps and 60-h.p. of motors, and will be run on the three-wire system at about 208 volts on each side. They have also received the order from the Hertford County Council for an asylum at Hill End, carried out to the specification of Prof. W. E. Ayrton, F. R. S., consulting engineer. This plant consists of three large belt-driven dynamos and steam engines, an extensive storage battery, various electric motors, and about 1200 incandescent lamps. Laing, Wharton & Down, Ltd., have also in hand the electric lighting of two theatres, one the Grand Theatre at Hanley, Staffordshire, and the other the Granville Theatre, in the West End of London; also the electric lighting of a large country house, consisting of several hundred lights; also several motors, together with underground mains, with dynamo and storage battery worked from a petroleum engine; also another country house in Devonshire, where the electric lighting plant will be driven from a waterfall; also a large hotel at Weymouth, one of the oldest and most fashionable watering-places in England, and various other works of more or less importance in all parts of England. They are also doing a very large business in ordinary electrical supplies, such as "Callow-Eck" patent launch controllers, switchboards, switches for central stations, and other products.

New Publications

Trips by Trolley and Awheel Around Hartford. Published by Elmer M. White and Herbert A. Warner, of Hartford. 84 pages. Illustrated.

This is a very aristically arranged pamphlet giving the location of and the best means of reaching all the points of interest in and near Hartford, Conn. The book contains a large number of fine engravings showing many of the principal buildings and views in the different parks. The book also contains a map of the system of the Hartford Street Railway Company.

Trade Catalogues

Catalogue. Published by Patterson, Gottfried & Hunter, Ltd., of New York. 32 pages. Illustrated.

The Cross Oil Filter. Published by Burt Manufacturing Company, of Akron, Ohio. 12 pages. Illustrated.

Electric Mine Haulage. Published by the Baldwin Locomotive Works, of Philadelphia, Pa., and the Westinghouse Company, of Pittsburg. Illustrated.

Graphite as a Lubricant. Published by the Joseph Dixon Crucible Company, Jersey City, N. J. 32 pages. Illustrated.

Automatic Cut-off Engines. Published by the Ball Engine Company, of Erie, Pa. 38 pages. Illustrated.

Wire Ropes. Published by the Hazard Manufacturing Company, Wilkesbarre, Pa. 60 pages. Illustrated.

Price List. Published by the Washburn & Moen Manufacturing Company, of Worcester, Mass. 36 pages. Illustrated.

Catalogue. Published by John A. Roebling's Sons' Company, of Trenton, N. J. 142 pages. Illustrated.

List of Street Railway Patents Issued

U. S. PATENTS ISSUED FROM JULY 5, 1898, TO JULY 19, 1898, INCLUSIVE.

JULY 5.

Electric Railway.—John C. Henry, Denver, Colo. No. 606,663.

The method of changing the two motors of a car equipment from series to parallel relation which consists in short-circuiting the field-magnets of one of said motors, subsequently short-circuiting the armature of said motor, breaking the series connection

and closing a connection placing said armatures in parallel, and breaking the short-circuit through its field-magnet.

Electric Railway.—John C. Henry, Denver, Colo. No. 606,664.

Car-Fender.—Otto W. Norling, Brooklyn, N. Y. No. 606,679.

Trolley-Head.—Charles Grover, Kansas Ciy, Mo. No. 606,711.

In a trolley-head, the combination with a fork of a tubular spindle mounted therein, a trolley-wheel mounted to rotate upon said spindle, said spindle provided with an opening through the wall thereof, and a contact-plug arranged within said tubular spindle and projecting through said opening and into contact with said wheel.

Contact Device for Electrically Propelled Vehicles.—Harry P. Davis, Pittsburgh, Pa. No. 606,819.

A contact device for engagement with overhead electric conductors, comprising a roller, a supporting head or frame therefor, formed of two sheet-metal strips of different shape rigidly fastened together and provided with suitable bearings for the roller.

Contact Device for Electric Railways.—Charles A. Terry, New York, N. Y., and Harry P. Davis, Pittsburgh, Pa. No. 606,825.

A contact device for electric railways consisting of a revolving cylinder or roller, a fork carrying the same, stationary pieces at the end of said roller constituting continuations thereof and tapering outwardly, and a supporting arm rigidly joined at its upper end directly to said fork.

Current-Collecting Apparatus for Electric Railways.—Charles A. Terry, New York, N. Y., and Harry P. Davis, Pittsburgh, Pa. No. 606,826.

Overhead Construction for Electric Railways.—Charles A. Terry, New York, N. Y., and Harry P. Davis, Pitsburgh, Pa. No. 606,827.

Traveling Contact Device for Electric Railways.—George Westinghouse, Pittsburgh, Pa. No. 606,828.

Car-Truck.—Edgar Peckham, New York, N. Y. No. 606,938.

In a car-truck the combination with the side frames including yokes or pedestals connected together by longitudinal beams, of half-elliptic springs mounted on said beams, abutments for the ends of said springs arranged on said beams between the pedestals and on a plane below their tops, a car-body-supporting bolster secured to said springs and bearing upon the same, appliances connected to the beams and continuously maintaining the bolster in a vertical plane and at right angles to the side beams and half-elliptic springs, and means for maintaining the ends of said springs at constant elevations in relation to the longitudinal beams.

Motor-Truck.—Edgar Peckham, New York, N. Y. No. 606,979.

In a car-truck having a short wheel-base, a center bearing-bolster, electric motors sleeved at one end on the axles, bars supported by brackets, bars supporting said brackets and they in turn supported by inturned ends of duplex end beams, other ends of the motors being supported by bars first mentioned.

July 12.

Trolley for Third Rails.—Lowell M. Maxham, Boston, Mass. No. 607,065.

In combination, the plane-surfaced third rail, the trolley-wheel running thereon, bearings for said wheel adapted to resistingly permit a slight canting of the same, and means whereby such canting automatically guides said wheel toward the center line of the third rail.

Car-Fender.—William H. Martin, Los Angeles, Cal. No. 607,118.

Trolley.—William H. Russell, Chicago, Ill. No. 607,194.

The combination with a trolley arm or pole, of a base, comprising a tubular portion fitting over the trolley arm or pole, a flaring portion extending from such tubular portion upward and outward and a table at the upper end thereof, and a fork having a trolley-wheel rotatably mounted therein, such fork comprising a tubular portion fitting over the table on the base, a pivot extending, in a vertical plane, through such fork and base, an arm on the under side of the fork, extending under the base and a spring on the trolley-pole engaging with such extension.

Electric Railway.—William W. Doty, New York; James A. MacKnight, Mount Vernon, and Charles Grauten, New York, N. Y. No. 607,351.

Trolley for Electric Railways.—Henry Van Hoevenbergh, New York, N. Y. No. 607,387.

A trolley provided with a plurality of wheels set at an angle to bear upon a supply-conductor at their peripheries, said wheels being mounted in a frame provided with projections lying close to their sides to prevent spreading.

July 19.

Car-Fender.—James H. Lewis and Joseph M. Courtney, Kansas City, Mo. No. 607,444.

Car-Fender.—Andrew L. Lawton and David L. Macaffree, Colorado Springs, Colo. No. 607,514.

Hand-Strap for Street-Cars.—William R. Sands, Newark, N. J. No. 607,592.

An adjustable hand-strap which consists of a supporting-strap; a clip arranged to slide thereon, and to which is attached a hand-strap, and means for automatically returning said clip to the upper end of said supporting-strap when said hand-strap is released.

Electric-Railway System.—Sidney H. Short, Cleveland, Ohio. No. 607,610.

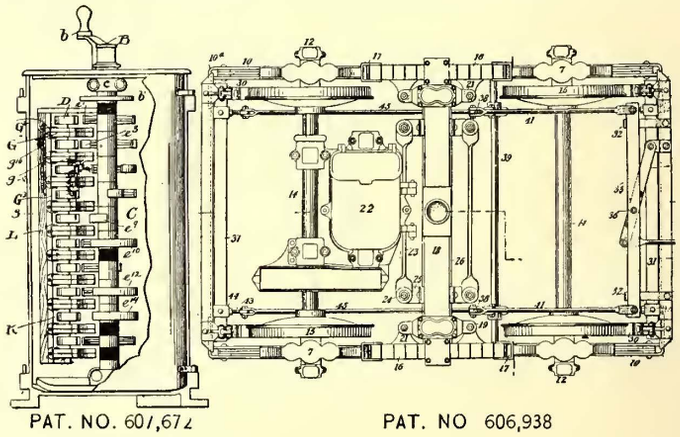
In an electric-railway system, an auxiliary circuit adapted to carry a current of low potential, a series of insulated surface contacts alternately connected to the positive and negative wires of said auxiliary circuit, said connections including an electromagnet, a shoe carried by the car and adapted to make successive contact with a plurality of said contacts, whereby circuit is simultaneously completed through a plurality of said magnets, a main circuit, a second series of insulated surface contacts connected thereto through switches forming armatures for said magnets, means for normally maintaining said armature-switches open, a second shoe caried by the car and adapted to make electrical connection with said surface contacts of the said last-mentioned series, for completing the main circuit through the translating devices on the car.

Electric-Railway System.—Sidney H. Short, Cleveland, Ohio. No. 607,611.

Trolley-Base.—Harrison G. Tabor, Montreal, Canada. No. 607,612.

Controller.—Thorsten von Zweigbergk, Cleveland, Ohio, assignor to the Walker Company, same place. No. 607,672.

In a controller, in combination, the strip G, the metallic bars H and H′, boxes carried by said strip, coils g within each box, some of said coils being connected together in series in different



PAT. NO. 607,672 PAT. NO 606,938

sets, and the sets having one of their terminals connected to the bar H and the other terminal to the bar H′.

Electric Railroad.—Clarence A. Myers, Atlantic City, N. J. No. 607,697.

A track-rail, comprising two sections spaced apart and forming opposite walls of a conduit, the tread of one section being below the plane of the other section-tread, an insulating material arranged in a groove in the under side of a section-tread and a conductor for electricity supported by said insulating material.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of fifteen cents. Give date and number of patent desired. The Street Railway Publishing Company, Havemeyer Building, New York.

One of the finest pieces of steel engraving which has recently appeared is that prepared by John A. Lowell & Company, the well known Boston engravers, for the Grand Trunk Railway Company. It is a view of Niagara Falls and the Great Gorge from the new Grand Trunk viaduct at Suspension Bridge. The Gorge Railway running down the side of the cliff from Niagara Falls to Suspension Bridge is clearly seen at the left. The plate is a very valuable one, and the engraving is well worth a place in a private library.