# Street Railway Journal

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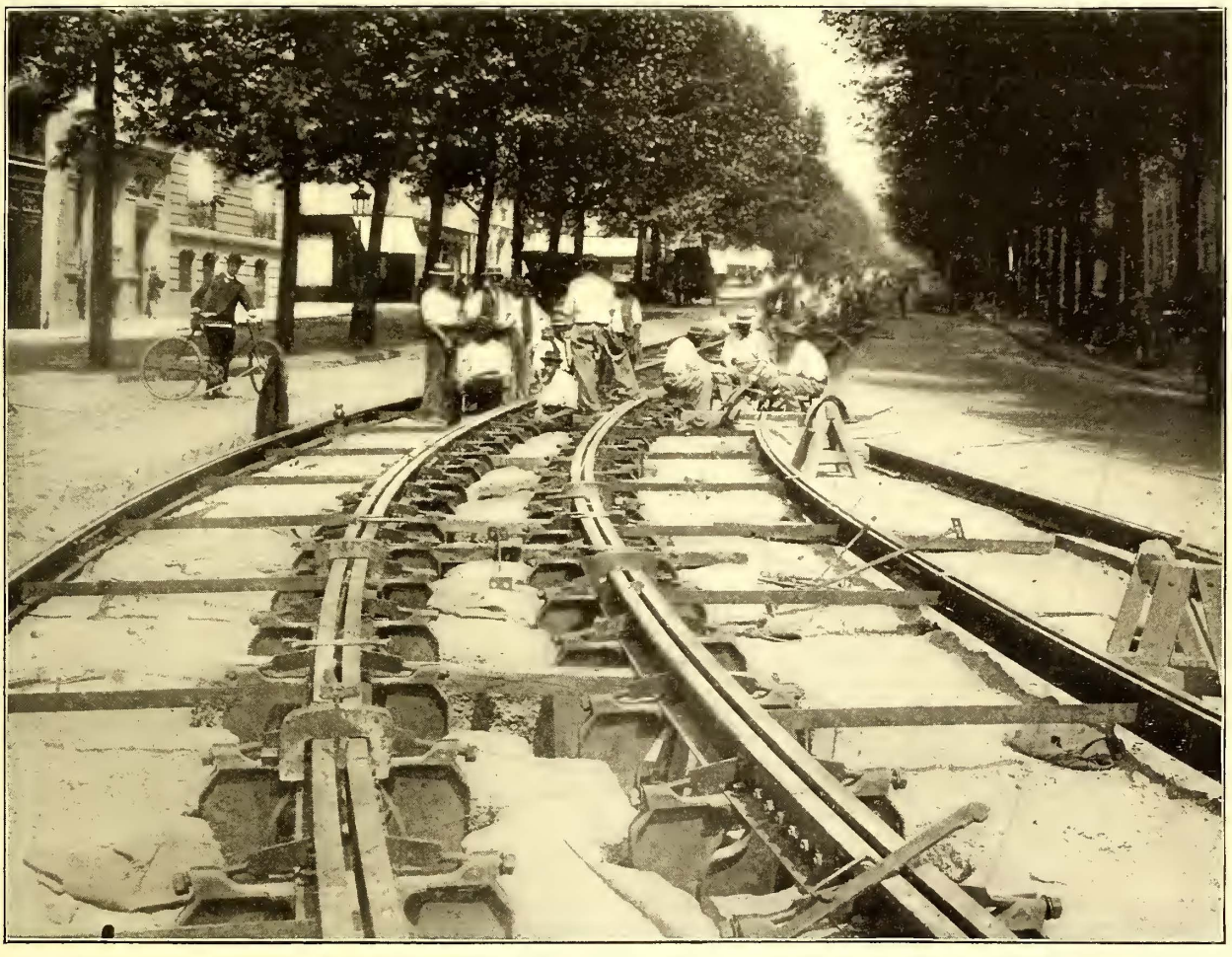
## ELECTRIC CONDUIT CONSTRUCTION IN PARIS

BY A. N. CONNETT

Your readers are probably well aware of the fact that the "trolley" has taken extremely well in France, and that now all cities are or are about to be equipped with it, Paris being the one prominent exception. In some of the larger cities certain streets have been excepted, and for relatively short districts the trolley is forbidden. The most prominent cases of this partial exclusion of the trolley are in Lyons, Bordeaux and Nice. In these three cities the French Thomson-Houston Company has built or is building the electric conduit system in place of the trolley upon the sections where the latter is not allowed.



CURVE CONSTRUCTION, SIDE SLOT CONDUIT—PARIS

In Lyons 3600 meters (2.23 miles) of conduit track is in operation; in Nice 6000 meters (3.72 miles) will soon be in operation, and in Bordeaux 4000 meters (2.48 miles).

It is not exactly true to say that the trolley lines are excluded entirely from Paris. The Cie. Generale Parisienne de Tramways put in electrical operation in November, 1898, its Bastille-Charenton line, and this is almost wholly trolley. Of its total street length of 6150 meters (3.81 miles) 3520 meters (2.18 miles) are in the city of Paris, and of this 2650 meters (1.64 miles) are trolley; the rest, viz., 870 meters (0.54 miles) in conduit, is divided into two short sections, each of about equal length, one at the Place Daumesnil and the other the Paris terminus at the Place Bastille and the Rue de Lyon.

This line was built by the French Thomson-Houston Company, and has been deservedly very much praised, no expense having been spared in the construction and equipment to make it a model road. In appearance, at least, the overhead construction has never been excelled or even equaled elsewhere, as can be seen from the engraving on page 852. The service also has been excellent, comparing favorably with the best lines anywhere and far superior to any existing line in Paris.

But even with this splendid example of what service a well-built and well-equipped line can give, the prejudice

against the overhead construction still continues, and no other trolley lines are in construction or even projected at this moment. Apparently the question of good street car service must be solved otherwise. It must not be understood that mechanical traction is unknown in Paris, for in reality it is quite the contrary. There are more systems in use here than in any other city, but none of them combines the necessary attributes of a rapid, frequent service to the public, with operating expenses inviting to the shareholders.

The experience of Buda-Pesth, Washington, New York, Berlin and Brussels with conduit construction was not unknown to engineers here, but a natural desire to construct the trolley on a number of lines where the local conditions seemed ideal for this system, has hindered the construction of conduits up to now.

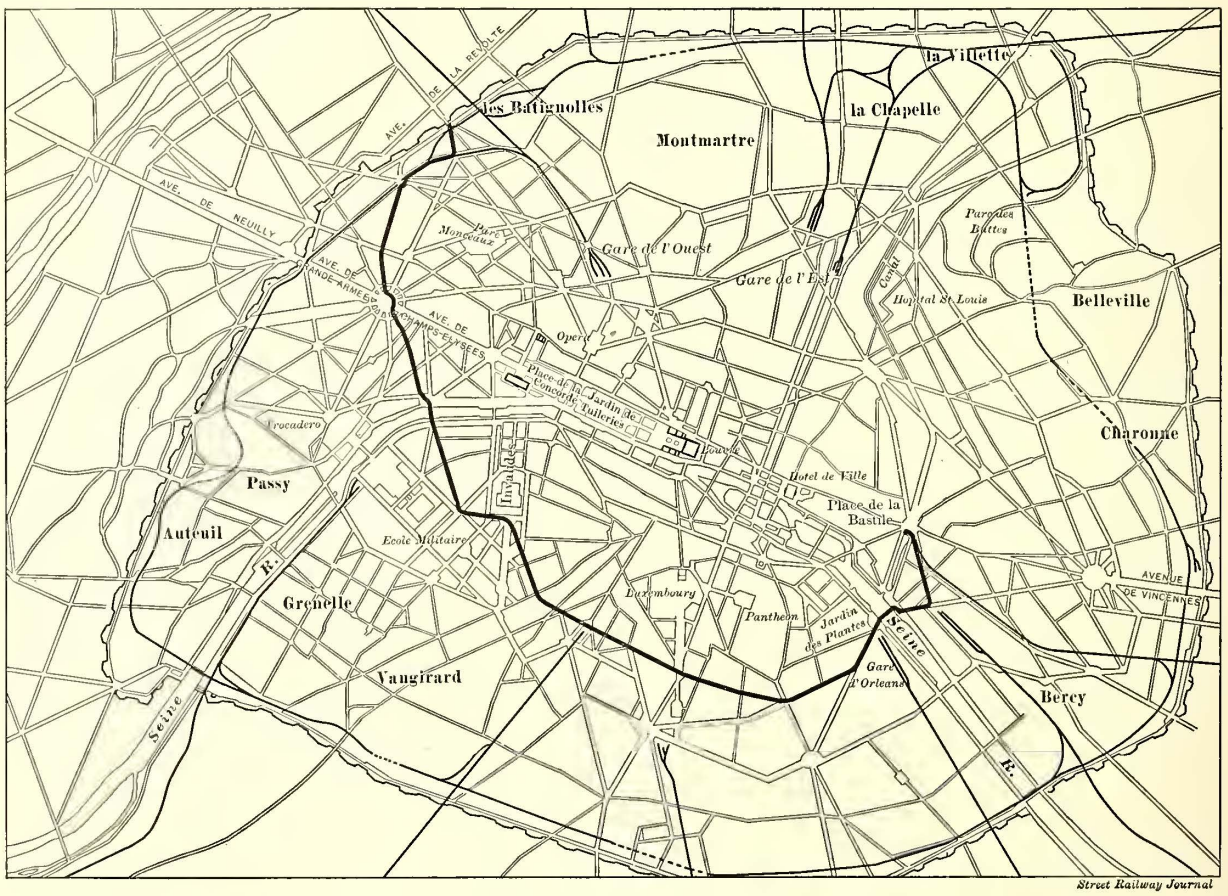
The Cie. Generale Parisienne de Tramways was given a new concession of a line called "St. Ouen-Champ de Mars," which will run from the Porte d'Asniéres to the Ecole Militaire, within the city limits of Paris. The concession being explicit that the system in Paris must be one of "underground electrical conductors" the company decided to equip this section of the line with conduits. The authorities also accorded the company the privilege of extending the conduits to the company's depot beyond the Gare Montparnasse. Lately the company decided to extend the conduit to the Place de la Bastille. The relation of this line to the rest of the system can be seen by reference to the map.

The conduit so prolonged will serve for three lines, viz., the St. Ouen-Champ de Mars, from the Porte d'Asniéres to the Ecole Militaire; the line from the Place de l'Etoile to the Gare Montparnasse, and the line from the last point to the Place de la Bastille. The two latter are at present important horse lines.

It will readily be seen that this is an important piece of work both from its extent, 10.5 km. (6.5 miles) of double track, and from the character of the territory through which it passes.

Some features of the conduit construction differ quite radically from anything yet done, and they may be of interest to the readers of the Street Railway Journal.

The conduits built by the French Thomson-Houston Company (and this is the only company which up to this time has constructed conduits for electric roads in France) have all been with the center slot. The type of construction in the main resembles that of the Metropolitan Railroad Company, of Washington, the important difference being that the cast iron insulator shields are bolted directly to the bottom flange of the slot rail, and the insulator pits are covered with a cast iron plate, this being low enough to allow its being paved over. This avoided the use of manholes in the street in any quantity, the municipal regulations being such in Paris that manhole covers must be entirely suppressed or reduced to a very strict minimum.




MAP OF PARIS, SHOWING LOCATION OF NEW ELECTRIC CONDUIT LINE

While the Thomson-Houston Company made every effort to continue the construction of this central slot conduit in Paris it has not succeeded and this is largely due to the question of pavement. Wooden pavement has been adopted here, as the standard. The wear is excessive, and in consequence it does not take long to leave the rail above the surface of the pavement. This is very hard on vehicular traffic, especially in a city with so many light vehicles as in Paris. Therefore the engineers in charge looked decidedly askance at the proposition of adding another line of rails in the center of the tracks. The wheel rails were regarded as necessary evils, but any other rails than these, which could be avoided, were not to be thought of. The plans of the company were therefore rejected, and it was invited to submit others which would avoid the central slot rails.

Of course there was nothing left but to do the best possible with the side slot conduit. The objections to this are:

1st. The question of slot closure becomes doubly important from the fact that the wheel flanges as well as the plow shank must pass into the slot.

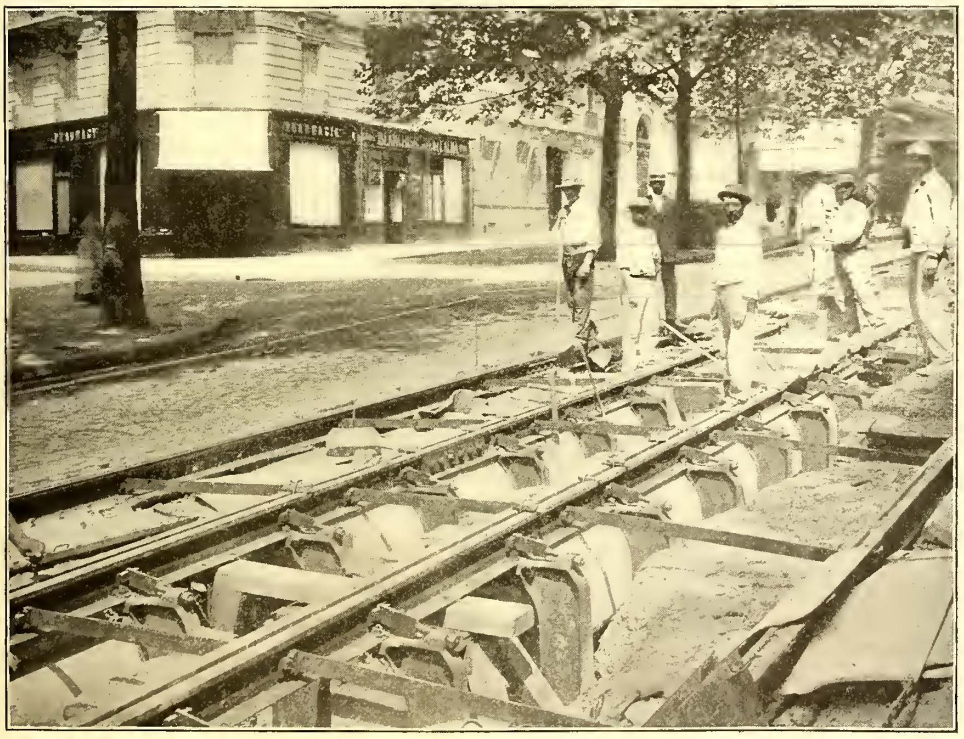
2d. The entire car traffic passing on the overhung yoke seats makes a stronger construction necessary.

3d. The plow insulation is rendered more difficult from the splash of mud and water directly on it from the wheels.

4th. It is fundamentally impossible to make a really satisfactory slot switch.

The last reason is much the most important. A wide slot is of course necessary for the wheel flanges, and the upper surface of the switch must be flush with the rail head because the wheels roll upon it. It must be very strong for this reason also, and have considerable width at the point where it must be supported. With these conditions a mechanically satisfactory switch will give a slot width of from $1\frac{3}{4}$ ins. to 2 ins. at the point. Such a width seems to be admissible in some European cities, but it needs no argument to prove that it is undesirable, and to be avoided if possible. In the Paris construction the difficulty has been avoided by the device to be hereinafter described.

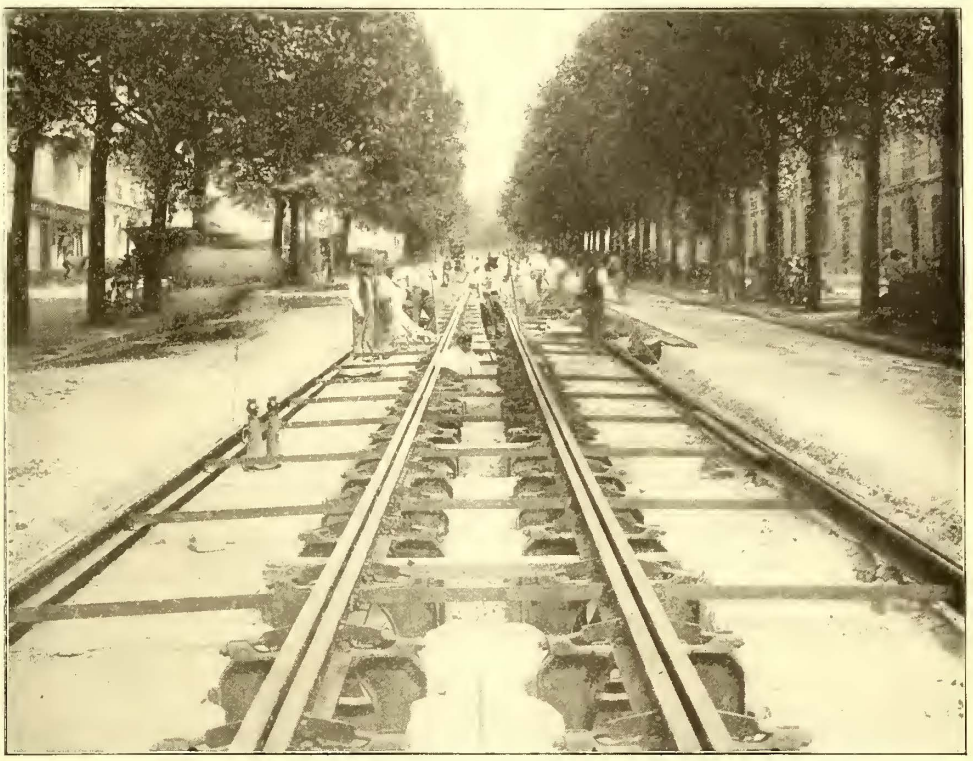
The general type of construction is shown in Fig. 1. The



VIEW SHOWING CONDUIT LINE IN COURSE OF CONSTRUCTION

two conduits are interiorly placed. The wheel rails are held to gage by tie-rods spaced every 2.10 meters (6 ft. 10 11-16 ins.) and the two interior slot rails are tied together in a similar manner. The insulator, conductor rail, the clips for fastening the latter in position to the insulators are, in general, very similar in construction to those of the Metropolitan Railroad Company, of Washington, D. C.

The regular track construction is clearly shown in the engravings herewith. The metal work is tied together by the tie-rods and gaged accurately. The forms are put into



VIEW SHOWING CONDUIT LINE IN COURSE OF CONSTRUCTION

position, and then the conduit walls are formed with concrete. The sheet iron forms are afterward withdrawn through the slot. They are in three separate parts, so that this is done with extreme facility. The use of sheet iron removable forms is to be recommended from every point of view.

The construction of the road bed is extremely simple. The delay in getting material has been a constant source of annoyance, and would not warrant an organization for rapid track laying, but nevertheless, with no effort, the advancement has been about 100 meters (328 ft.) of street per diem, or twice that length of track.

The paving in and between track is wood, and outside principally Belgium block and macadam. The conduit construction has shown every sign of being amply strong. The swelling of the wooden pavement blocks has not affected the slot width. While it has stood this severe pressure well, the same cannot be said of the wheel rails. Not being supported by the concrete base of the exterior wooden paving (the usual condition) these rails have tilted somewhat. The use of wooden pavements adds a most perplexing problem to the engineer. The most unheard of things happen to the track and the engineer never knows exactly what "bizarre" effect is going to result.

To avoid the inherent difficulties of the side slot switch, the device of deflecting the slot to the center at such points

was decided upon. The engravings on page 851 show clearly this construction at the terminus of the "Etoile Montparnasse" line at the head of the Avenue Marceau. The center slot switch is then always used and the difficult problem of the side slot switch effectually avoided by "dodging." The slot switch mechanism is one designed especially for the Omnibus et Tramway Cie., of Lyons, where it has given very good results. Figs. 2 and 3 show this in plan and section respectively. The slot and track

The line crosses the Seine on what is called the Pont Alma. The height over the masonry arches would not permit the regular conduit construction. A special conduit was designed for this; see Fig. 4. It is a continuous cast iron tube, reinforced by an exterior web every 1.05

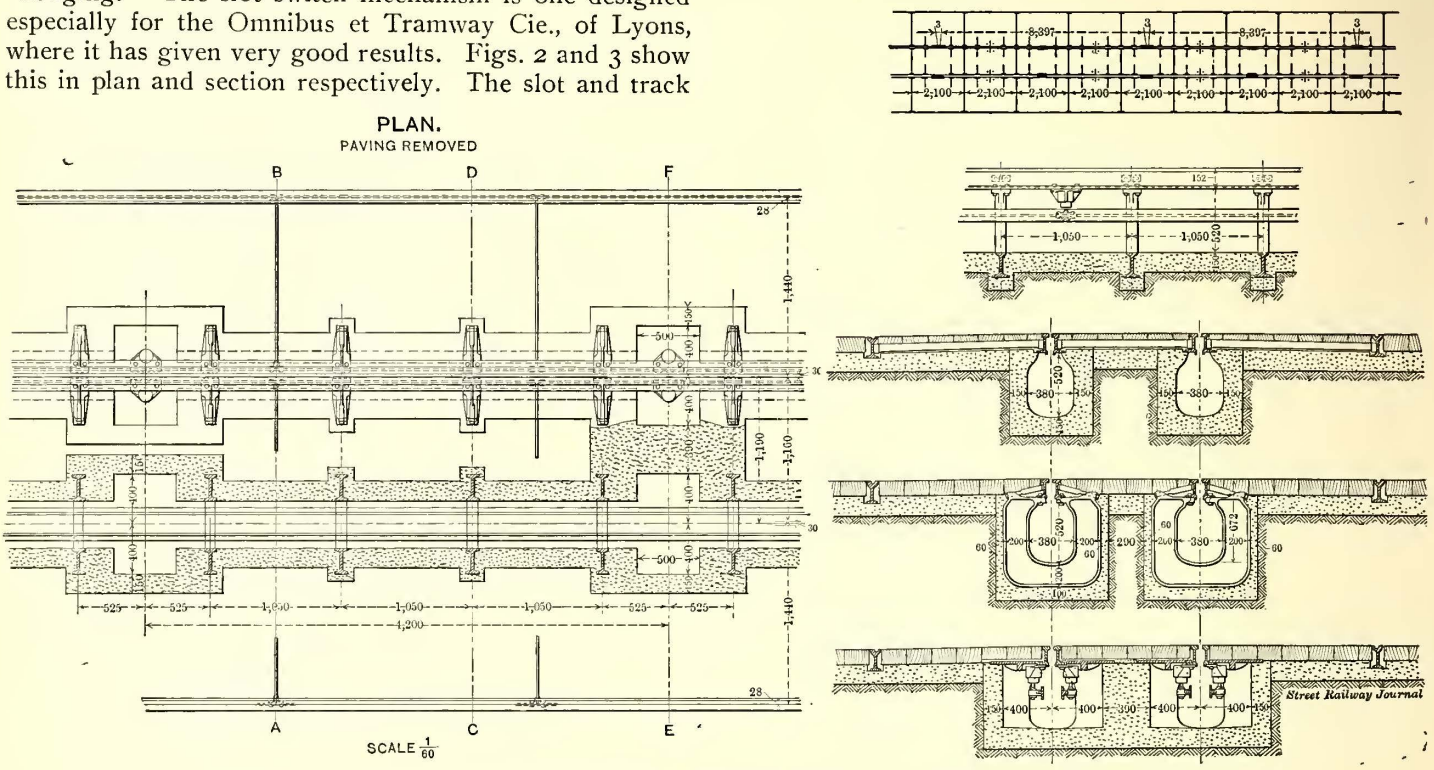



FIG. 1.—PLANS AND SECTIONS OF UNDERGROUND CONDUIT CONSTRUCTION—PARIS

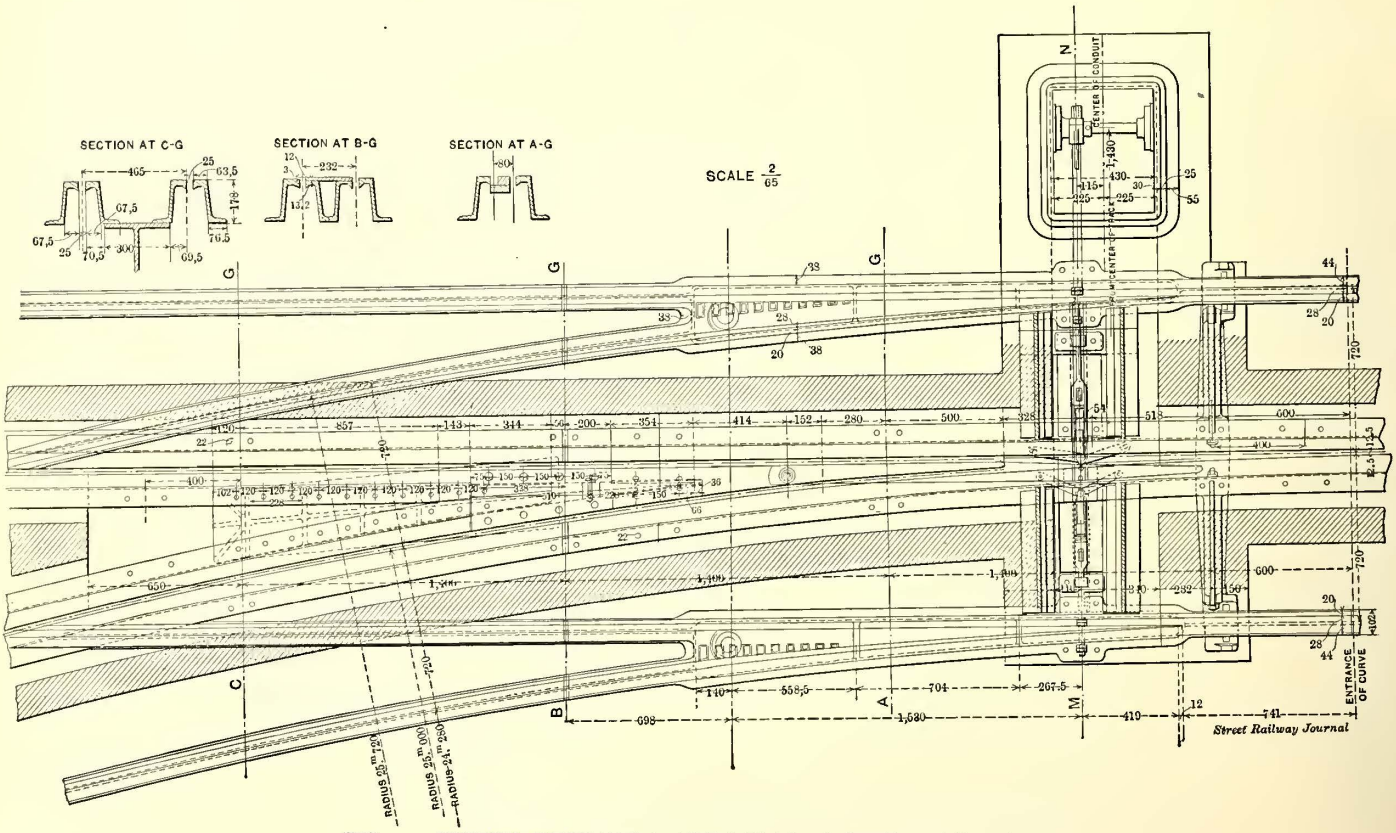


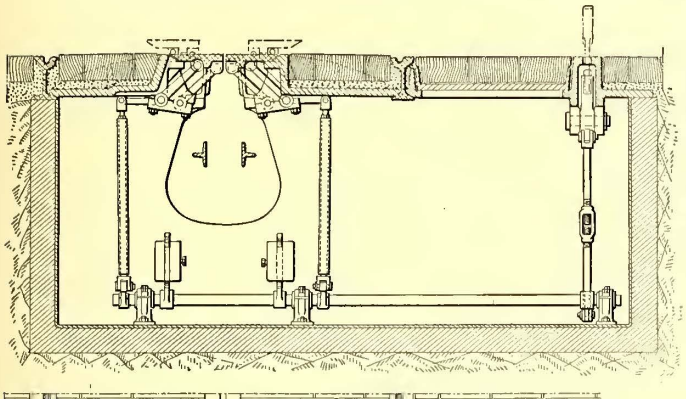

FIG. 2.—SWITCH MECHANISM, WITH SLOT IN CENTER OF TRACK

switches are thrown into position together by a pull on the detachable switch lever placed outside of the track. The arms which push the slot tongue are inclined to the slot. The plow in passing pushes them back under the slot rail. The force required to do this is so very slight that there is no danger of damage to the plow or the plow carrier.

meters (3 ft. 5 ins.). The tubes are covered with steel plates upon which a special Z bar is bolted, this forming the slot rail. Special steel castings act as tie-rods to hold the slot rails in position. This construction requires raising the conductor bars 12 cm. (4¾ ins.) above their level in the normal conduit. Special means to raise and lower

the plow for the passage over this bridge are therefore necessary.

The "St. Ouen-Champ de Mars" line being partly trolley and partly conduit special requirements are necessary at the points of contact of these systems to make it possible. The necessity of cars running at will on conduit and overhead systems is one common to all European conduit roads. This problem has been solved on two unimportant lines in the United States by the crude method of attaching and detaching the plow at these points. For an important line where this manoeuvre must be made many hundreds of times a day the question of making the change without an appreciable loss of time becomes important. The placing of men in vaults under the street is also to be avoided if possible.



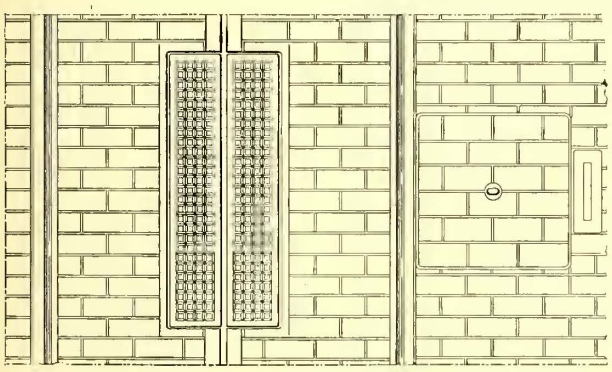



FIG. 5.—ARRANGEMENTS FOR WIDENING SLOT TO PERMIT REMOVAL OF PLOW

The problem has been very ingeniously solved on the Continental roads at Berlin and Brussels, and the latter roads at Buda-Pesth. It has been recognized that the simplest and most practical solution was to carry the plow on the car always, and to provide the proper means on the car of raising it from or lowering it into the conduit. The plows are designed to pass through the normal slot, therefore they can be raised or lowered at will anywhere on the conduit line. This involves a question of permissible slot width which

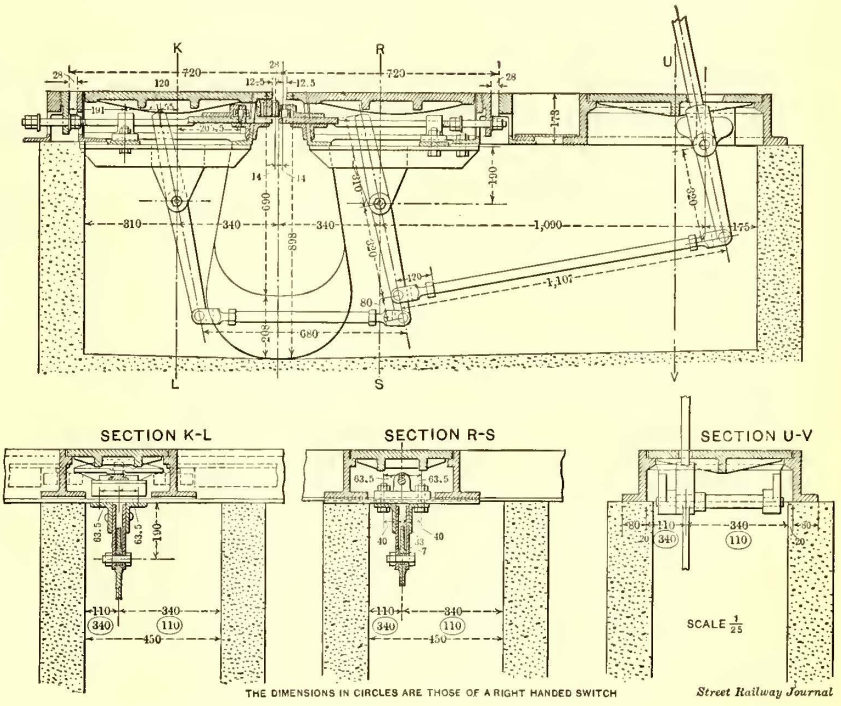



FIG. 3.—SECTIONS OF SLOT SWITCH MECHANISM

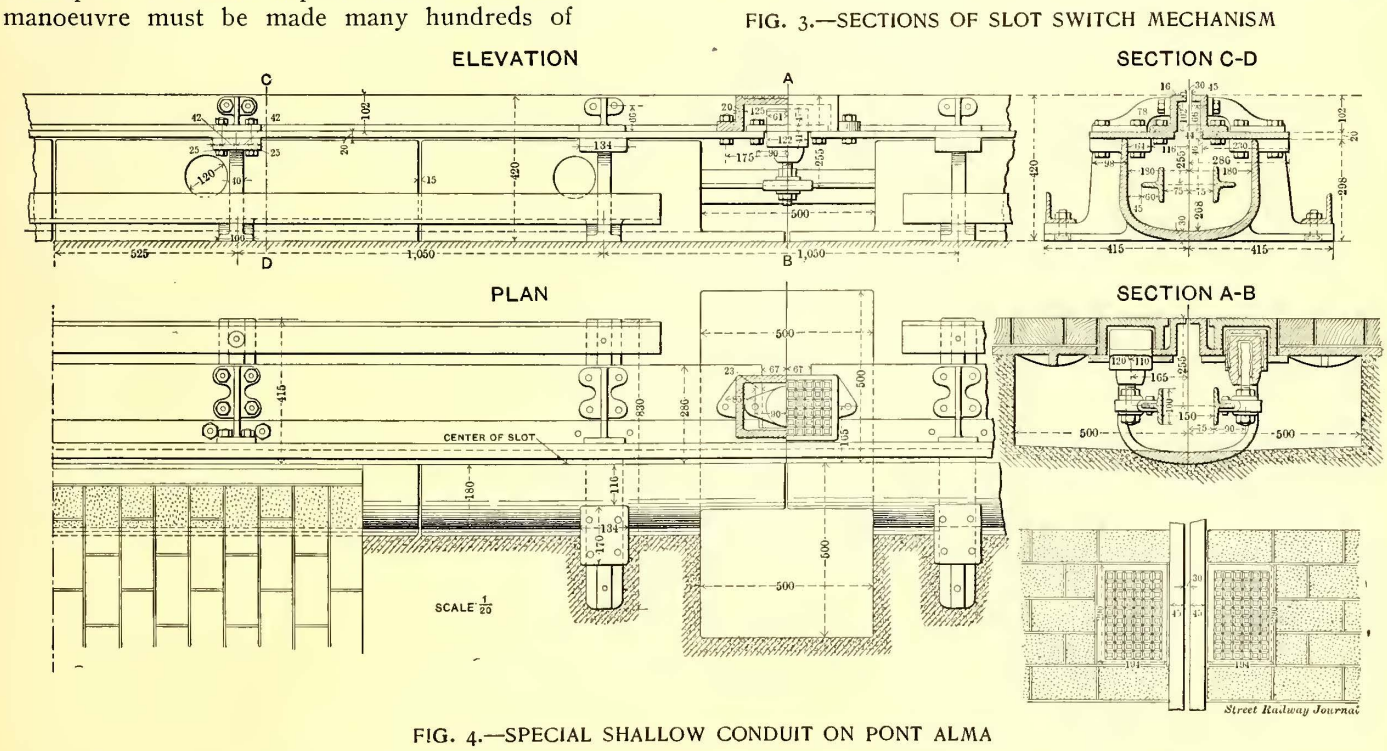



FIG. 4.—SPECIAL SHALLOW CONDUIT ON PONT ALMA

would make it impracticable for all American and many European cities. Besides it requires a form of plow construction of which many engineers would not approve. The writer, after giving the matter much thought, decided to adopt for the conduit lines of the French Thomson-Houston Company the main idea of the plow he had successfully used in Washington, viz., cast iron shoes pressed sideways by light semi-elliptic springs, the shoes being supported by horizontal links which limited their outward play. These links make the question of the mechanical strength of the springs unimportant, as they carry the shoes and resist all of the shocks; the role of the springs therefore is simply to lightly press the shoes against the conductor rail. At the same time he adopted some excellent ideas from the plows designed by the General Electric Company, for New York, which increased very materially the insulation resistance of the Washington plows while retaining the excellent mechanical features of the latter.

But starting from the point that for the best interests of operation such a form of plow was superior, it was necessary to give up the advantages of being able to raise or lower the plow from or into the conduit without a special construction. The advantage claimed by the adherents of the other method of being able to do this anywhere on the conduit line is of slight practical value. But the fact of

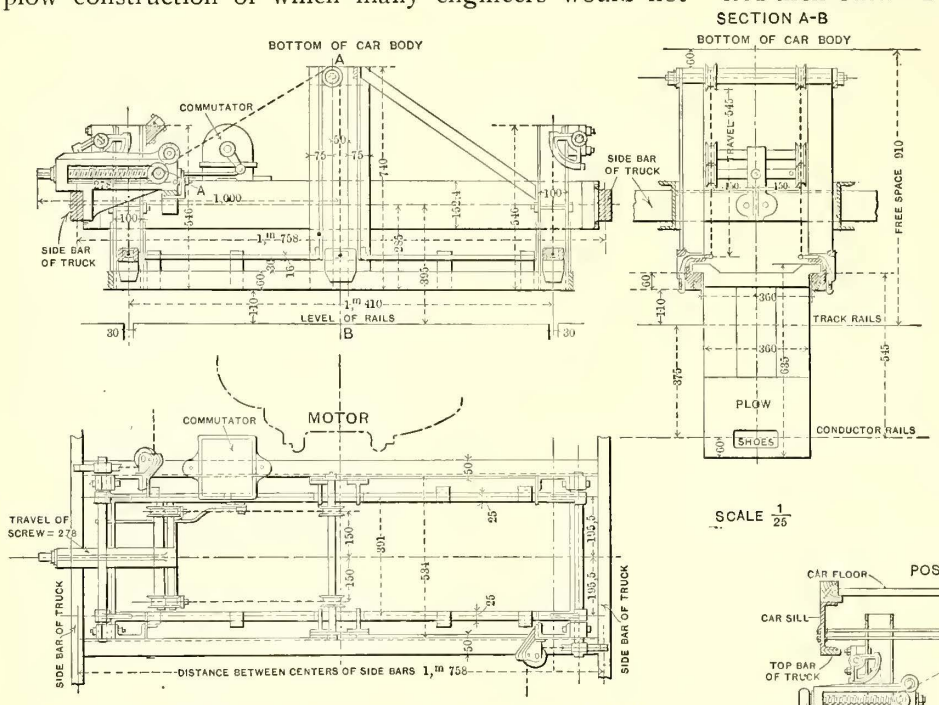



FIG. 7.—METHOD OF SUPPORTING AND RAISING PLOW

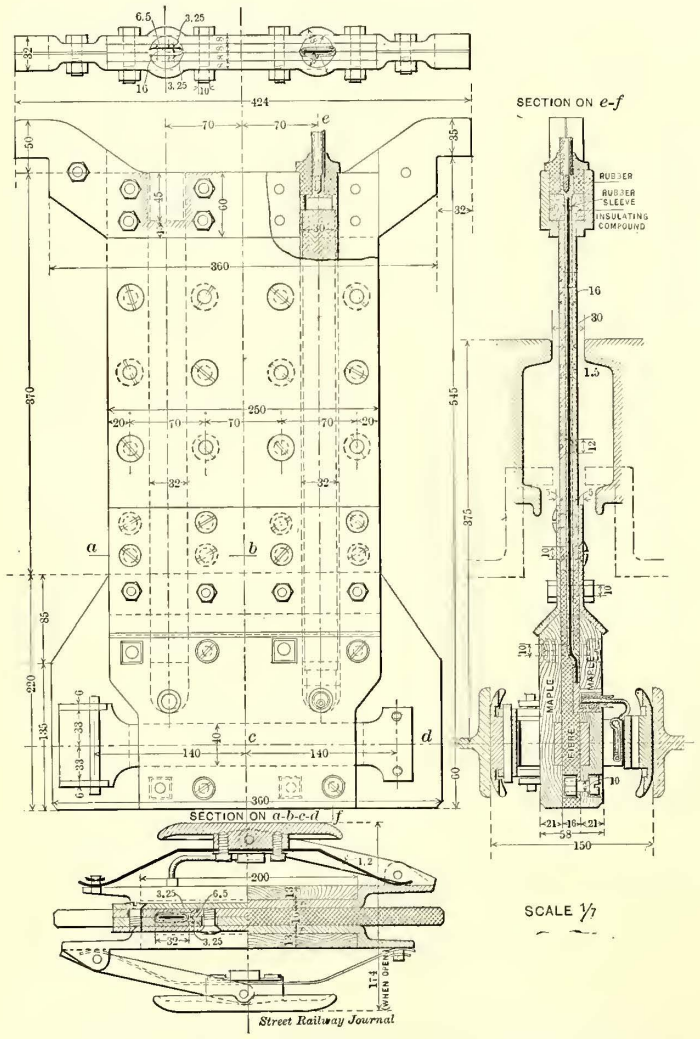



FIG. 8.—SECTIONS AND SIDE ELEVATION OF PLOW

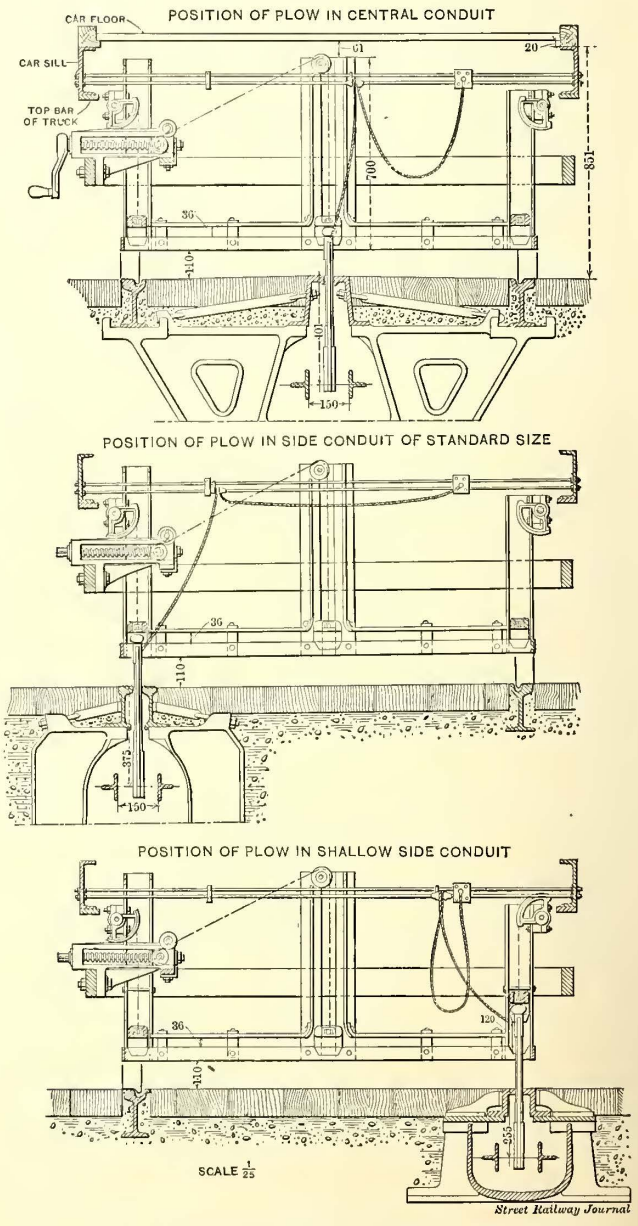



FIG. 6.—SECTIONS SHOWING POSITION OF PLOW IN DIFFERENT TYPES OF CONDUIT

being able to do it at the points of contact of trolley and conduit lines without any special construction is a decided advantage. The problem of making an opening in the slot wide enough to allow the plow to pass through and which could be opened and shut quickly by a sure and simple mechanism was a rather difficult problem to solve. The one finally chosen (Fig. 5) has proved most successful in Paris and Lyons, and has been adopted as the standard of the company. In the slot are placed two cast steel covers, supported on one side by a cast iron frame, and the ends by angle irons bolted to the slot rails.

These covers are raised to the dotted position shown in the drawing by a simple motion of a removable lever placed outside of the track. The use of counter weights makes this operation an exceedingly easy one. Sheet iron guides (not shown in the drawing) are fastened to the conductor rails, and direct the shoes when the plow is lowered. The covers are opened by the conductor, who, at the same time, raises or lowers the plow from the side of the car by the device to be explained. If the car traffic is very heavy it pays to have a man for this who takes care of two traps, one for each track, and placed side by side.

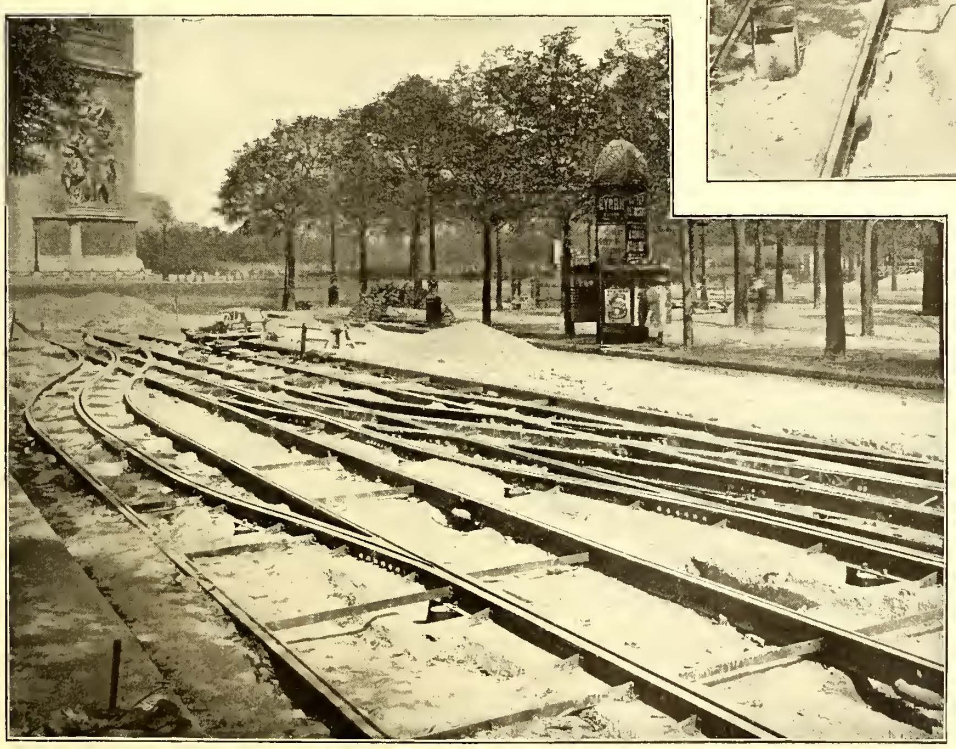
The most difficult problem has been in the design of the plow carrier. The conditions necessary to fulfil were:

First. That the plow should be able to slide laterally the full width of the track.

Second. That at its central position it could be raised clear from the conduit so as to be carried over the trolley section, and vice versa, to be lowered into the conduit.

Third. That it could be raised and lowered from each of its side positions the necessary distance between the height of the conductor rails, so as to pass the shallow conduit of the Pont Alma.

Fourth. That at the contact points of trolley and conduit, the circuits could be changed automatically with the same operation of raising and lowering the plow. This change is rendered necessary from the fact that the conduit circuit is a completely insulated one, while on the trolley the return is by the rails. The advantages of this change being automatic are self evident.



VIEWS AT HEAD OF AVE. MARCEAU, SHOWING METHOD OF DEFLECTING SLOT FROM SIDE TO CENTER OF TRACK AT SWITCHES

Fig. 6 shows the plow in the three different conduits, and gives a general idea in section of the operating mechanism. The plow is deflected to the center, and is raised or lowered by means of the trap already described (Fig. 5). The plow carrier is shown more in detail in Fig. 7.

The plow is raised from its central position by means of the screw bolted to the side bar of the truck. This

screw is turned with a controller handle. The switching of the circuits is accomplished at the same time by the bar attached to the "commutateur." The necessary motion is given to the crank handle attached to the cylinder, at the ends of the course of the block "A," insuring that the switching of the circuits takes place at the proper moment.

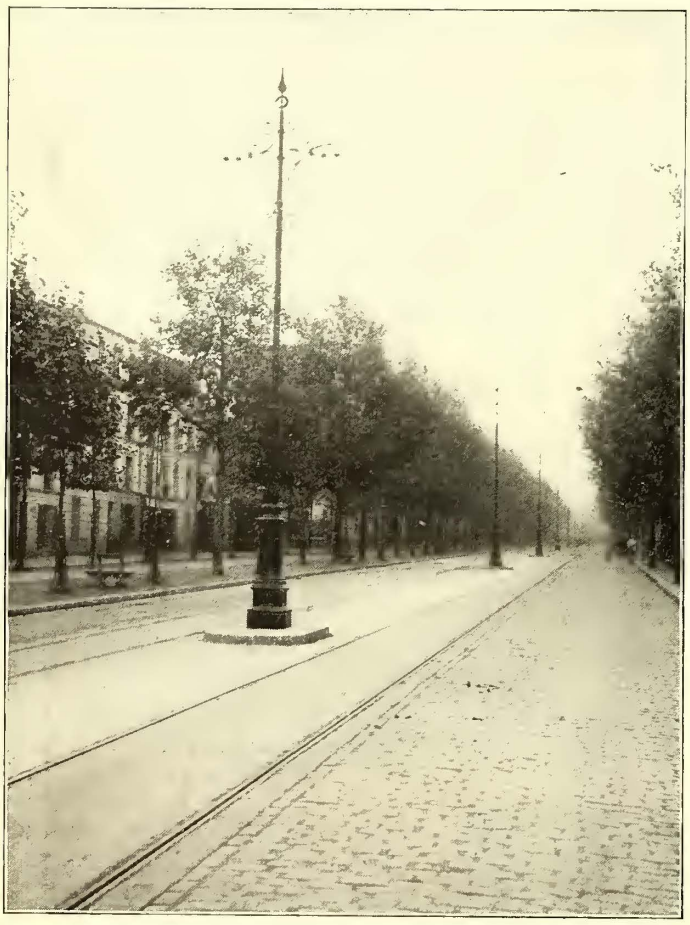
This "commutator" is in construction based on a car controller, with fingertips, cylinder, and a spring to make a quick break and so avoid destructive arcs. It is a very important mechanism. With some modifications dictated by the results of experience, it has proved itself entirely satisfactory.

This entire lifting device is the same as that employed on the Bastile-Charenton line, at Lyons, Nice, etc., with the exception that on these lines the lifting chains are attached directly to the plow. This becomes impracticable in this case, where the plow shifts its position the entire width of the track. The chains are therefore attached to a "cage" in which the plow slides. This "cage" must be

fixed mechanically in position, so that it will not be an obstruction to the plow in its side movement. At the same time the movement of the chains should release the "cage" without any additional manoeuvre.

Fig. 7 shows in section the hook for this purpose. The pull of the chain first releases the hook and the "cage" with the plow slides up the ways provided for this purpose. In the casting opposite the hook a hole is drilled (not shown in the drawing) in which is placed a small spiral spring, which acts to engage the hook when the "cage" descends to its seat.

The same apparatus is shown at each end of the slides to lift the plow for the passage over the shallow conduit. As shown on the drawing this is intended to be done by the



TROLLEY LINE, PLACE DAUMESNIL—PARIS

motorman from the car platform. This operation in reality will be done by another mechanism from the side of the car, it being considered safer to bring the car to a standstill, and release the motorman of any other responsibility than to stop his car at the proper point. The drawings are not sufficiently advanced to show this modified mechanism.

The plow design needed a special study. The type already in such successful use for the central slot not being at all applicable for the side slot or the shallow conduit, another form had to be adopted. That finally selected is shown in Fig. 8. It offers all of the advantages of the "Bastille-Charenton" type, while being much simpler in construction. This plow should give an excellent account of itself.

This line has numerous other points which have required special construction and perhaps additional information will be given in another article, but for the present enough probably has been said to show that the line is one having some special points of interest.

## High Speed Service on Private Right of Way in Buffalo

The International Traction Company has recently put in service a new route for its Buffalo and Lockport branch. On account of the length of this line, high speed and a private right of way are almost imperative. Between Tonawanda and Lockport the cars always have run on the Erie railroad tracks, but heretofore, between Tonawanda and Buffalo, they have used the tracks of the Niagara Falls line, which extend along the highway.

The new route between Tonawanda and Buffalo consists of about 6 miles of track from Tonawanda to Buffalo city line, where the cars turn into Main Street, near Cold Spring, and thence run down town. The new private right of way has allowed a considerable reduction in the schedule running time, which is now seventy minutes between the downtown section of Buffalo and Lockport. The time on the New York Central road is from fifty minutes to fifty-five minutes. Of this seventy minutes, thirty minutes are spent on the streets of Buffalo, the average speed on the private right of way being 45 miles per hour between stops, with maximum speeds running up to nearly 60 miles per hour. The new road is single track, and laid with 85-lb. American Society Standard rail. The whole line is operated by a regular train dispatching system exactly like that of steam roads. The passenger cars run every thirty minutes throughout nearly the whole day.

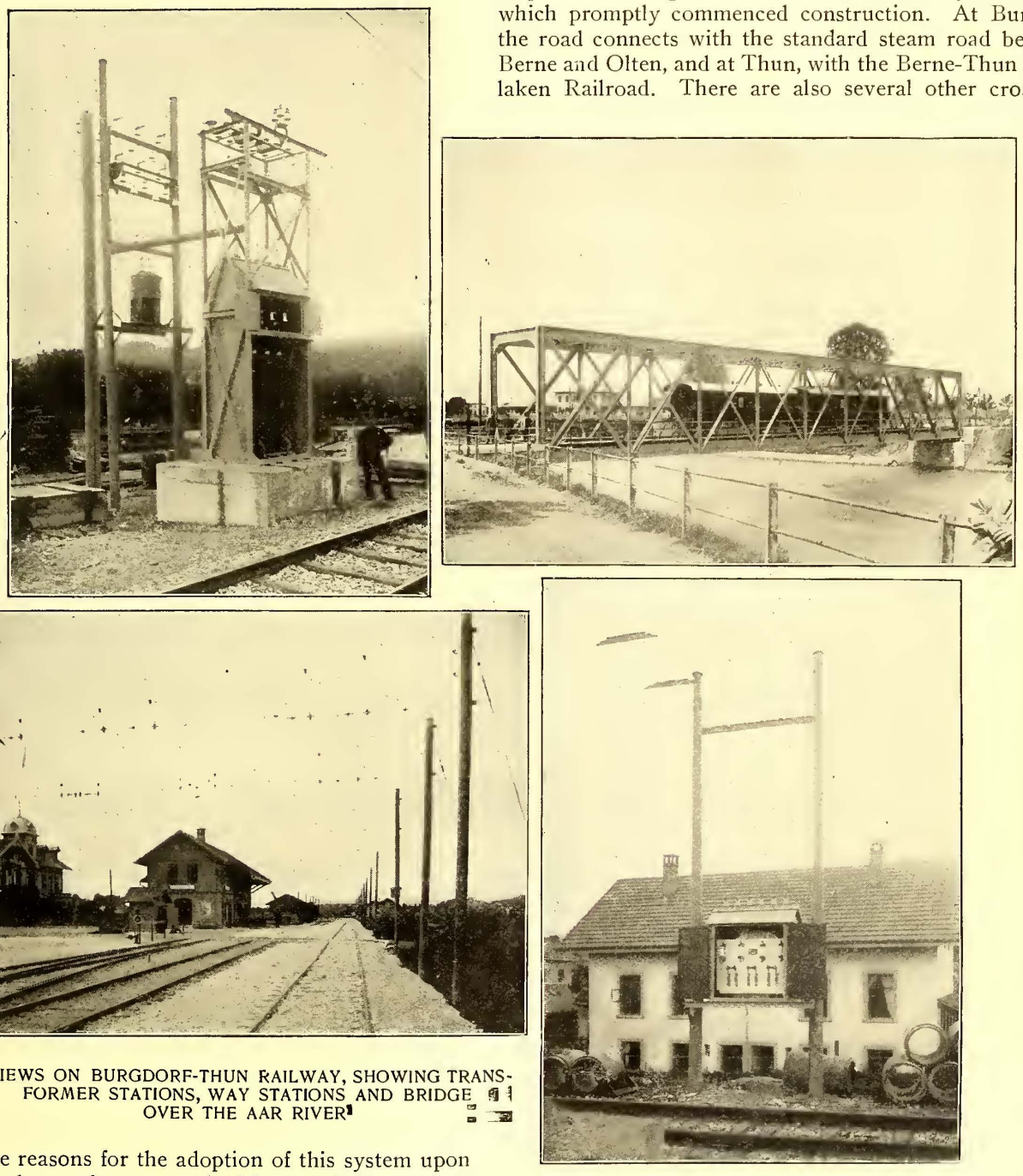
The overhead construction used involves some new features, which were introduced by the electrical engineer, C. K. Marshall. The overhead wire is carried on brackets, but instead of suspending the trolley wire immediately from the brackets, a 7-16-in. stranded steel cable is strung the whole length of the line, and the trolley wire is hung from this cable by means of ordinary straight-line hangers offset on the cable a considerable distance from the brackets. This gives flexible suspension, and in addition prevents any break of the trolley wire from twisting out of shape several brackets. The International Traction Company has also directed the General Electric Company to gear up one of its freight locomotives for experimental purposes to determine its applicability to passenger train service. The locomotive will be geared to give a maximum speed of 70 miles per hour, and if this speed can be attained with a load of 150 tons, electric locomotives will be used on the Erie tracks between Buffalo and Niagara Falls to haul regular Wabash and other passenger trains.

E. G. Tillston, Jacob Mandlebaum, H. R. Newcomb and others, of Cleveland, have acquired control of about four-fifths of the capital stock of the Dayton Traction Company, and have been elected to the directorate of the company. It is said to be the intention of the syndicate to consolidate the property with that of the Cincinnati & Miami Valley Traction Company, and the Cincinnati & Hamilton Electric Railway, which it now owns. Mr. Mandlebaum is quoted regarding the deal as follows: "Our plans are not yet in shape to be discussed. All that I can say is that we now have a line practically completed from Cincinnati to Dayton. When the reorganization is carried out, which will be very shortly, enough bonds will be left in the treasury of the (new) company to pay for the extension of the line through to the northward from Dayton, the whole length of the Miami Valley to Troy. This will, I believe, be the longest trolley line in existence. The valley of the Miami is the richest territory in the State, and I regard Dayton as the best traction town in the State. The road, when completed, will be about 72 miles long, and will traverse a territory having a population of 750,000. Practically the whole enterprise is a Cleveland affair.

## Important Three-Phase Electric Railway in Switzerland

BY CHARLES ROCHAT

On July 21, last, a railway was put in operation in Switzerland which will mark an interesting epoch in the history of electric railroading. The road referred to is that connecting Burgdorf and Thun, about 40 km. in length, and is noteworthy from the fact that it is the first extensive line to employ the three-phase current, and is as well the largest road of this type which has ever been installed. To understand the reasons for the adoption of this system upon this road a short reference to the history of the employment of the three-phase system is necessary.



VIEWS ON BURGDORF-THUN RAILWAY, SHOWING TRANSFORMER STATIONS, WAY STATIONS AND BRIDGE OVER THE AAR RIVER.

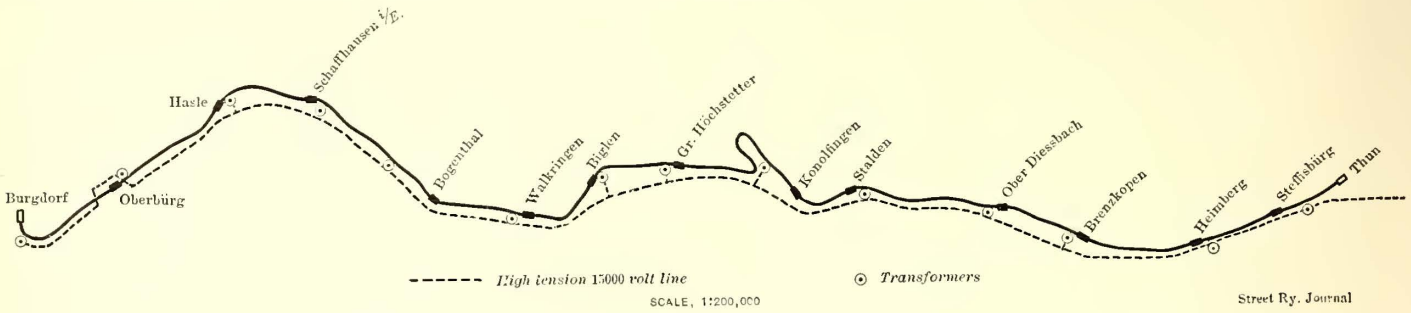
It was on June 1, 1896, and at Lugano, that the first electric railway to use three-phase current on its trolley lines was put into operation. The experiment, having given satisfactory results, was followed on Aug. 20, 1898, by the three-phase mountain electric railway at Gornergrat, near Zermatt. Sept. 20, 1898, saw the opening of the first section of the Jungfrau Railway, and Oct. 5, 1898, the electric railway from Stanstad to Engelberg. Finally, on July 21, 1899, as stated above, the electric railway connecting Burgdorf and Thun, the most important of all those mentioned, was put in service. The three-phase alternating current has thus assumed within three years an important position in Swiss tramway and railway enterprises, and will certainly be employed on a large number of future lines, where the conditions presented are similar to those where it has already been adopted.

Franchises for the construction of the electric railway from Burgdorf to Thun were acquired as early as the year 1873. After many negotiations the various concessions granted were finally united, and in 1896, came into ownership of the Burgdorf-Thun Electric Railway Company, which promptly commenced construction. At Burgdorf the road connects with the standard steam road between Berne and Olten, and at Thun, with the Berne-Thun Interlaken Railroad. There are also several other crossings with steam railroads. In order to make close connections with each of these lines a larger train service was necessary than would have been possible with steam power; and, again, the grades, though not very steep, would yet have been considerable for steam operated trains. With electricity, on the other hand, the grades could be easily surmounted, and single cars could be run frequently.

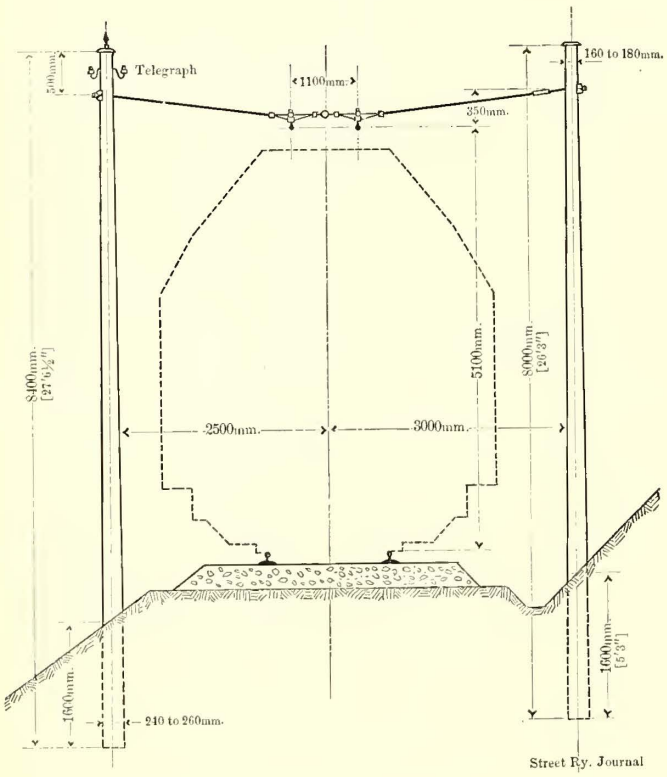
The road is single track and of 3-m. gage. The minimum curve radius is 250 m., and the maximum grade 2½

per cent. The sidings are 200 m. in length. The road passes through a number of tunnels, the minimum width of which is 4.4 m., and the height above the ties 5.4 m.

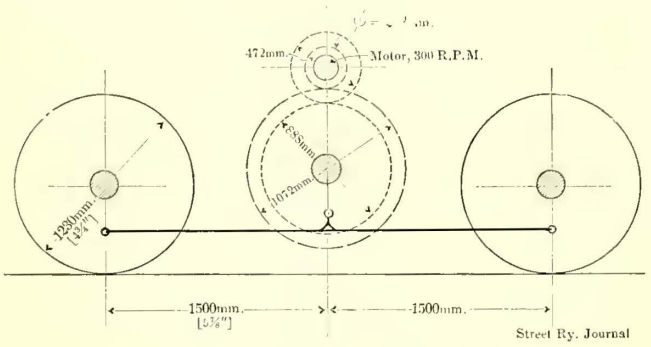
The track is laid with 36-kg. rails in 12-m. lengths. The ties are of metal, 2.4 m. long, weigh 45.5 kg. each, and are spaced fifteen to the rail length. The complete track weighs about 110 kg. per running meter. The rails are connected to the ties by lugs and bolts, and the track construction is very similar to that used in the ordinary trunk line railroads of Switzerland, where the running weight is 15 tons per axle. A special kind of bonding is used, the object being to avoid the possibility of the bonds breaking through the vibration of the rails. The under side of the head and the upper part of the base at the end of each rail have been grooved and filled with zinc, as have also the portions of the angle-plates bearing upon these parts. Moreover, about every 100 m. the two rails are cross-connected by an 8-mm. wire. It is premature yet to determine the results of this method of bonding, as a time test only will give correct information, but it is certain that the method has certain advantages.



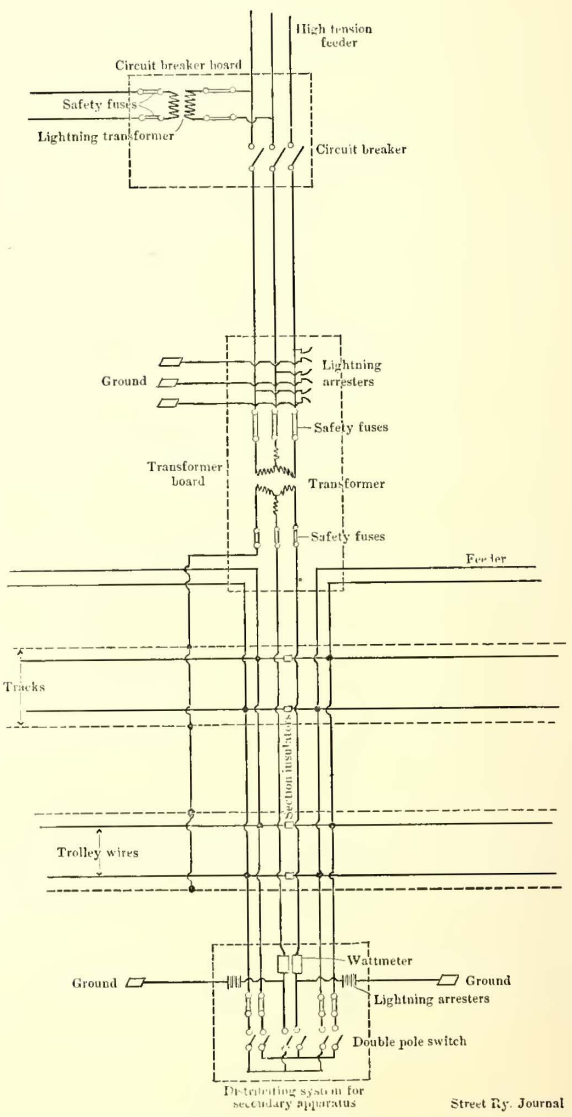

MAP OF ROUTE




STANDARD CROSS SECTION OF TRACK




LOCOMOTIVE GEARING




ARRANGEMENT OF CONNECTIONS AT TRANSFORMER STATIONS

Commencing at Hasle, going from Burgdorf, the line enters a very picturesque region, where the construction was considerably more expensive than that previously encountered. There are three tunnels, of 150 m., 95 m. and 100 m. length, and two viaducts 20 m. and 54 m. in length. The stations are most attractive, and as complete in all parts as those of standard steam railroads.

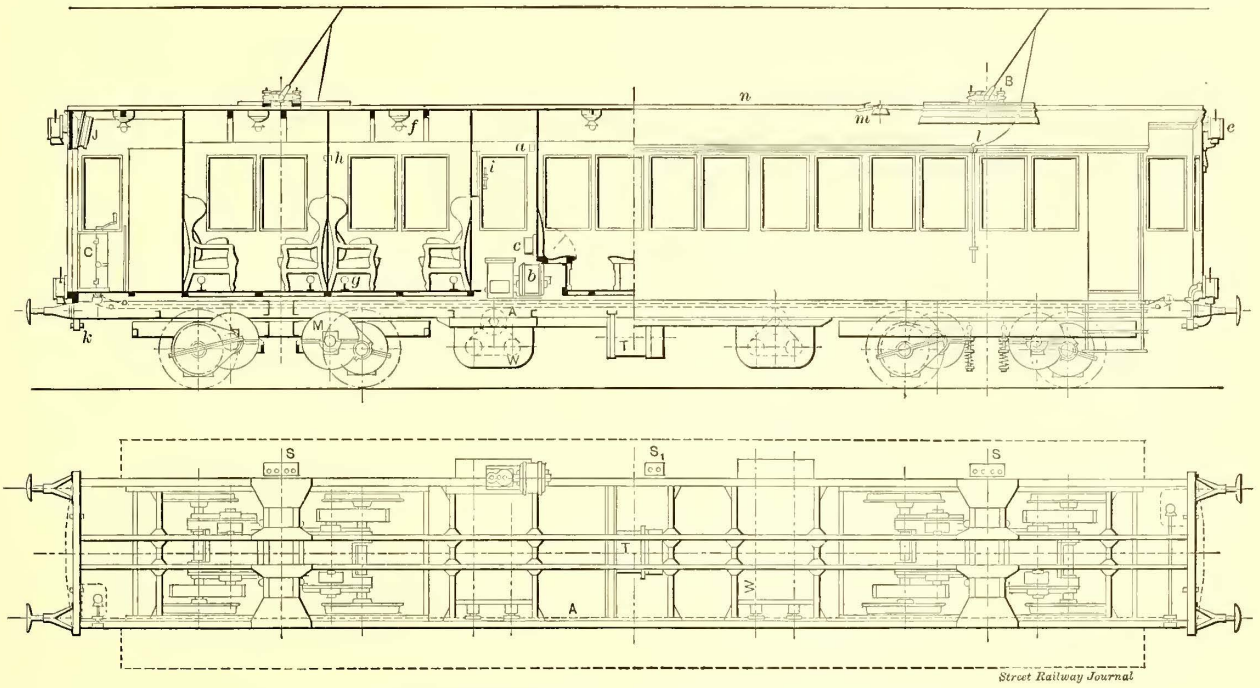
Owing to the use of the three-phase system, two trolley wires are carried over the track, and the transformer stations are fourteen in number.

There was considerable discussion as to whether the

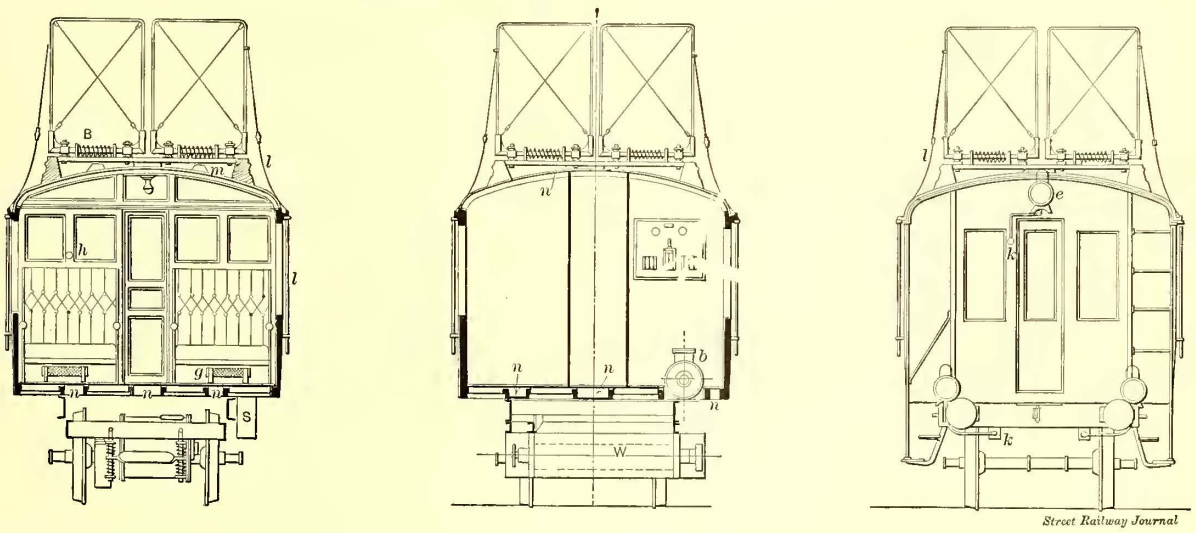
15,000-volt distribution circuit should be located along the track, where, of course, the facility for inspection was better, but where, on the other hand, it would have to follow all the curves of the line. It was finally decided to place the pole line independent of the track, wherever a saving in length could be effected. The primary circuit consists of

charges, water rheostats are introduced on the earth connection of the lightning arresters.

The transformers are placed at the side of the track, and are inclosed in metal housings, with wooden shutters, and supported on concrete bases. The housings are surmounted with the overhead construction necessary to re-

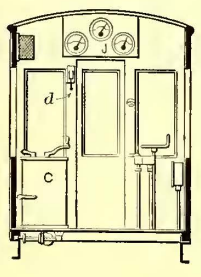



PLAN, HALF SIDE SECTION AND ELEVATION OF MOTOR CARS




REFERENCE.

M = 4 motors of 60 h.p. 750 volts.
W = 4 rheostats.
A = Rheostat rod.
C = 2 controllers.
B = 4 bow contacts.
T = 1 transformer 18 Kw. 750/100 volts.
S = 2 boxes each with 4 motor fuses.
$S_1$ = 1 " with 2 transformer fuses.
l = Volt and ampere meters.
a = 1 lightning arrester.
b = 1 motor compressor 4 h.p. 100 volts.
c = Automatic cut out for motor compressor.
d = 2 switches for motor compressor.
e = 6 signal lamps.
f = 10 illuminating lamps.
g = 14 electric heaters.
h = 6 heater switches.
i = switchboard with switches for lighting, heating and motor compressor circuits.
k = 6 plug contacts.
l = trolley rope.
m = catch for trolley.
n = conductor conduit.



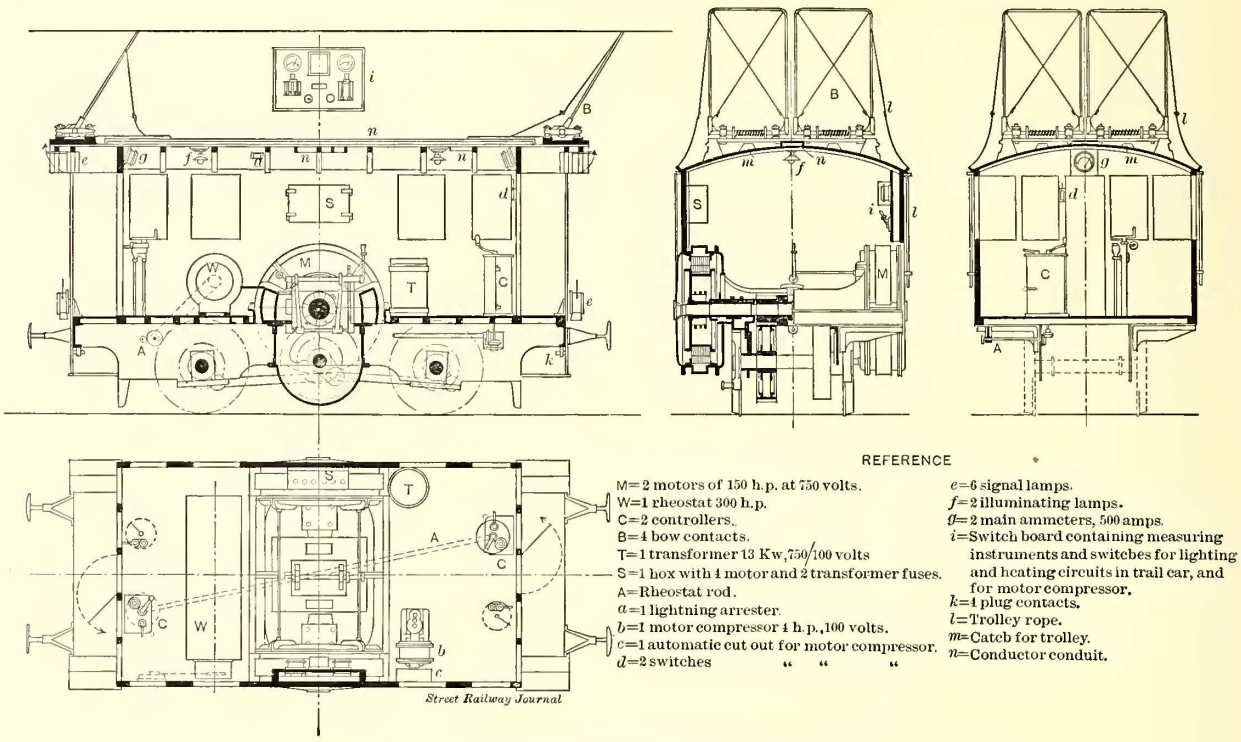
CROSS SECTIONS OF MOTOR CARS

three copper wires of 5-mm. diameter, carried on porcelain double-petticoated insulators mounted on wooden poles. The maximum span is 35 m. Between the power station at Spies and Thun (about 10 km.) wires are carried on latticed poles set in concrete. The high-tension line is protected at the entrance of the power station and at each transformer station by Siemens lightning arresters. To avoid short circuits to the earth after atmospheric disceive the high-tension wires, lightning arresters, etc. The operation of all the apparatus is very simple, and is in charge of the station master. The transformers are oil insulated and have a capacity of 450 kw. each.

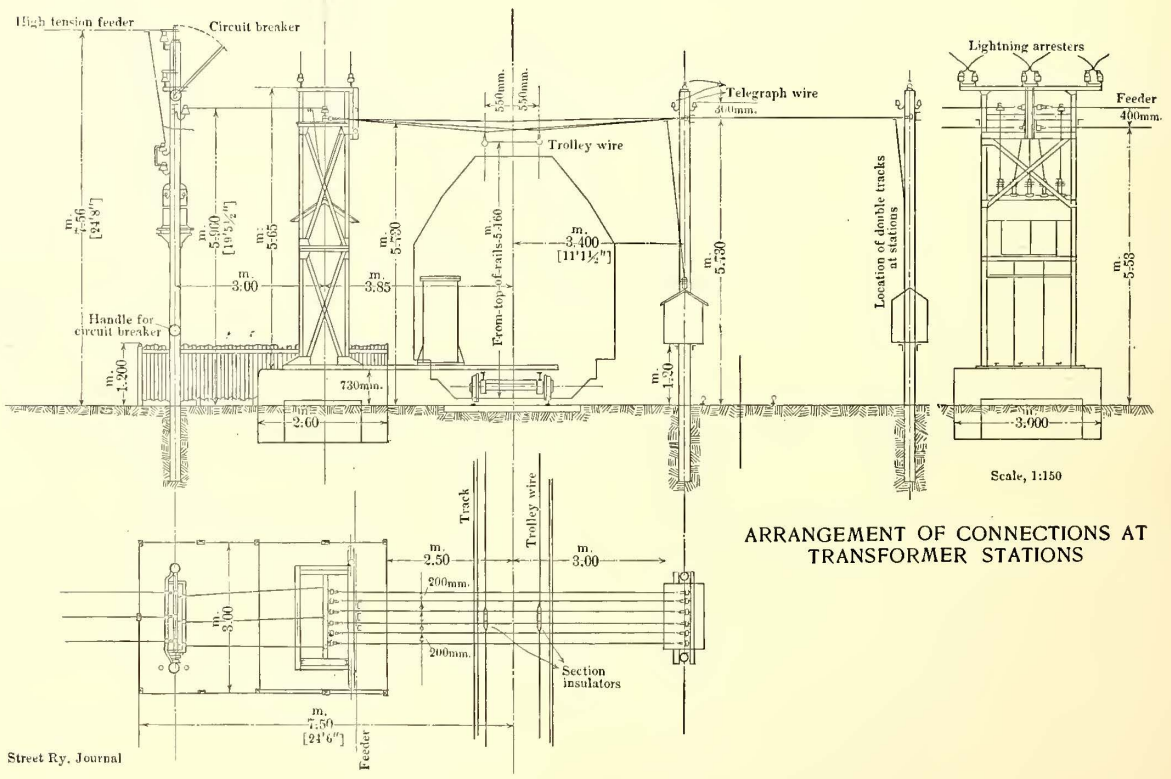
The contact wires, which are two in number, are of copper, 8 mm. in diameter, and are carried 5.1 m. above the track and 1.1 m. apart. Double insulation is employed between the trolley wires and the poles. The latter are

generally spaced 35 m. apart, but at a shorter distance at the curves. The principal difficulty so far experienced has been the overhead frogs. For this reason the firm of Brown, Boveri & Company, who made the installation, decided to install the bow sliding trolley, as this had been employed with success on the Gornergrat and Stanstad installations, as described in the Street Railway Journal

The power station is located at Spies, on the Kander River, and contains four groups of turbine generators. The turbines operate under a fall of 63 m., with an average volume of 10,000 litres of water per second, from which a maximum power of 6300 h.p. is obtainable. The current is produced by generators at 4000 volts, which is raised to 16,000 volts by means of transformers similar to those




PLAN AND SECTIONS OF LOCOMOTIVE




ARRANGEMENT OF CONNECTIONS AT TRANSFORMER STATIONS

for February, 1899. There are properly no overhead frogs except at the turnouts. At these points, where the wires cross, section insulators have been installed, and, as the motor cars always carry four trolley poles, two at each end, contact with at least one set of trolley wires is always secured. The normal position of the poles is vertical, although they take a slight inclination as the car moves. They are kept rigid by the use of cross-braces.

placed along the line. The lighting circuits are kept distinct from the power circuits, so that there are no fluctuations in the lighting voltage from variations in load on the power wires. Each generator has a capacity of 900 h.p., and the station when completed will have a capacity of 6000 h.p.

The company owns two electric locomotives, six motor cars, seven trail cars of different types, and three combina-

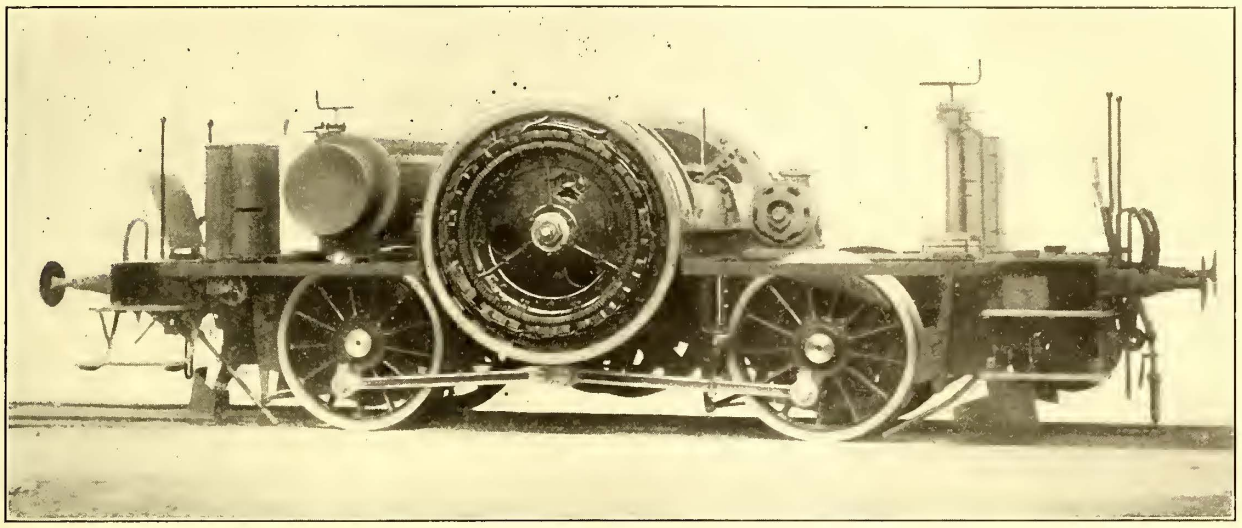
tion baggage, postal and passenger cars. The electric locomotives are principally employed for freight traffic, but are also used for passenger service. Each has a capacity of hauling 100 tons at a speed of 18 km. per hour on a grade of 2½ per cent, or 50 tons at a speed of 36 km. per hour on the same grade; the latter when hauling passenger cars. Each locomotive is equipped with two motors of 150 h.p., running 300 r.p.m. at 750 volts. They are placed in the middle of the locomotive and at either end of the same shaft. The rotors are keyed to the shaft, while the stators are mounted on the frame-work of the locomotive. The rotor shaft can be thrown into gear with either of two trains of gears connected with the axles. One of these is for use at the slower speed of 18 km. per hour, and the other for the higher speed of 36 km. For facilitating the mounting and dismounting of the rotors the sides of the locomotives are supplied with openings, through which the shaft can be removed. The collector brushes and rings can be inspected from within the locomotive.

The starting rheostat is composed of helical coils of ribbon, separated into three sections corresponding to the three phases, and connected to a commutator fitted with carbon brushes, by which the resistance can be cut in and out of circuit. At each end of the locomotive are two switches, of which one is for making and breaking the circuit, and the other for transposing the connections. The handle for operating the former also controls the starting resistance. This arrangement is to prevent the admission of current unless all resistances are in circuit.

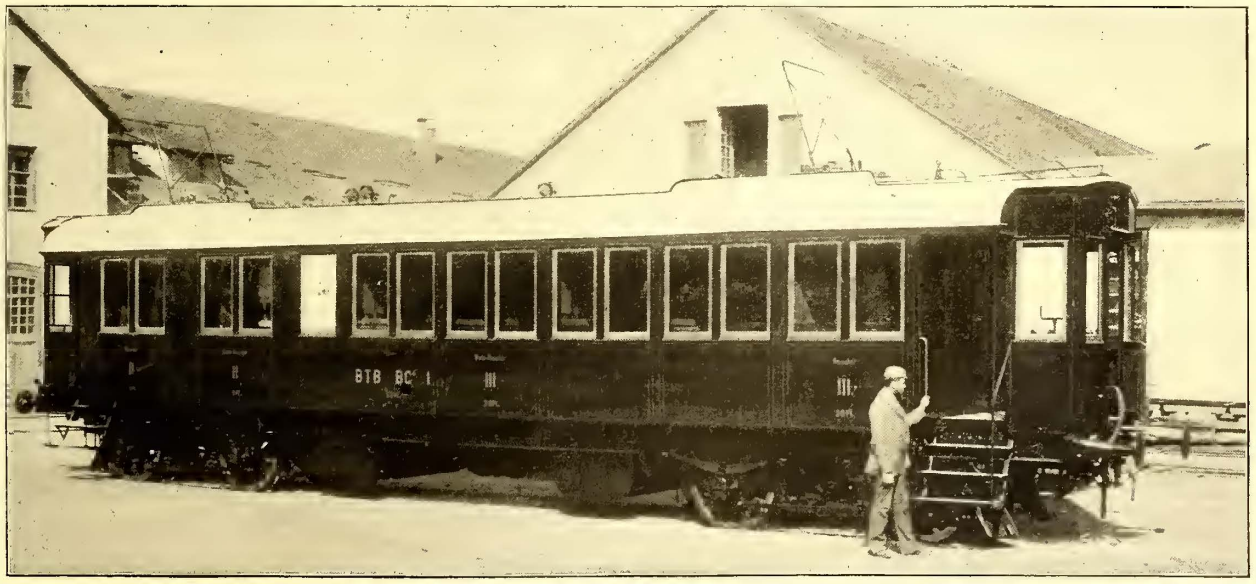
Each locomotive also carries a transformer for reducing the voltage from 750 volts to 100 volts. Part of this low tension current is used for operating a motor compressor for the use of the air brake, and part for lighting the car. The lower tension is preferred first, since it was hardly possible to build so small a motor for 750 volts, and, second, to avoid introducing into all parts of the cars and locomotive a voltage of 750. Current for light and heat is taken from two phases only, although the compressor motor is connected across all three phases. The motor compressor is of 3 h.p., and is cut in and out of circuit, as the needs of the pressure in the air reservoir require.

To measure the current used each car carries an ammeter for the motor circuit, one for the motor compressor circuit, and a voltmeter for the 750-volt circuit. This apparatus is carried on a panel on one side of the locomotive.

Lightning arresters are placed on both trolley circuits where they enter the cars, and are of the Wurts type. Electric headlights, made up of three lamps, are used, but the



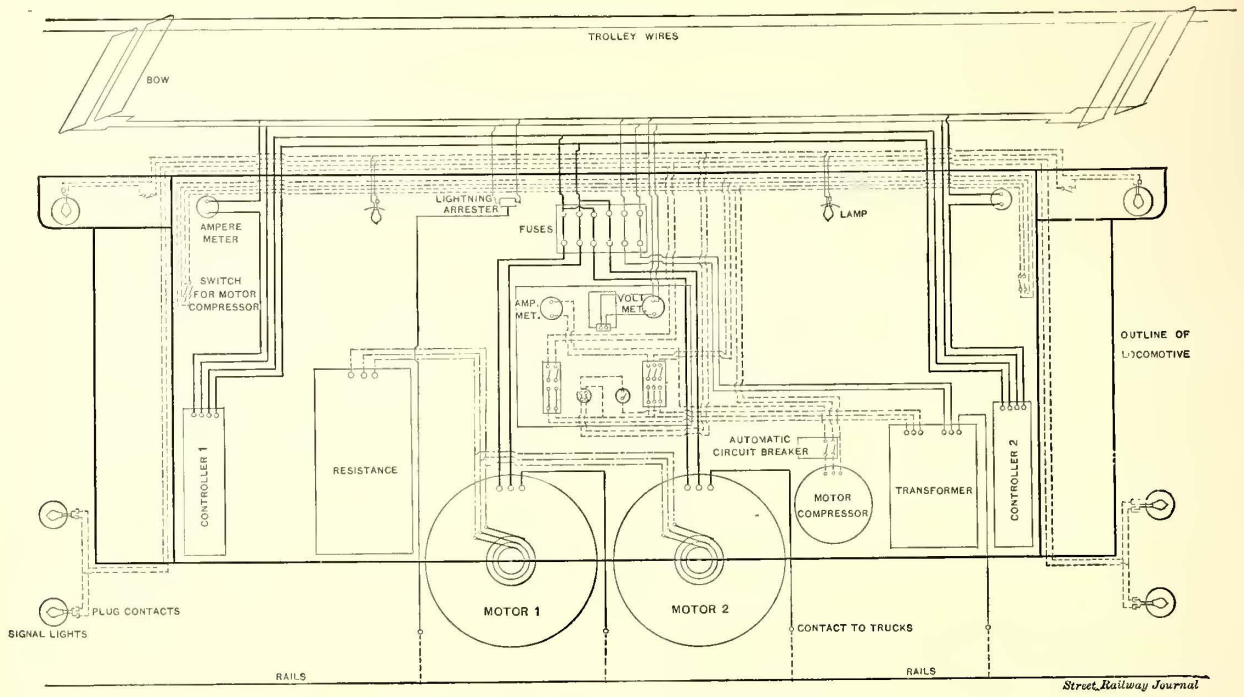
LOCOMOTIVE WITH CAB REMOVED



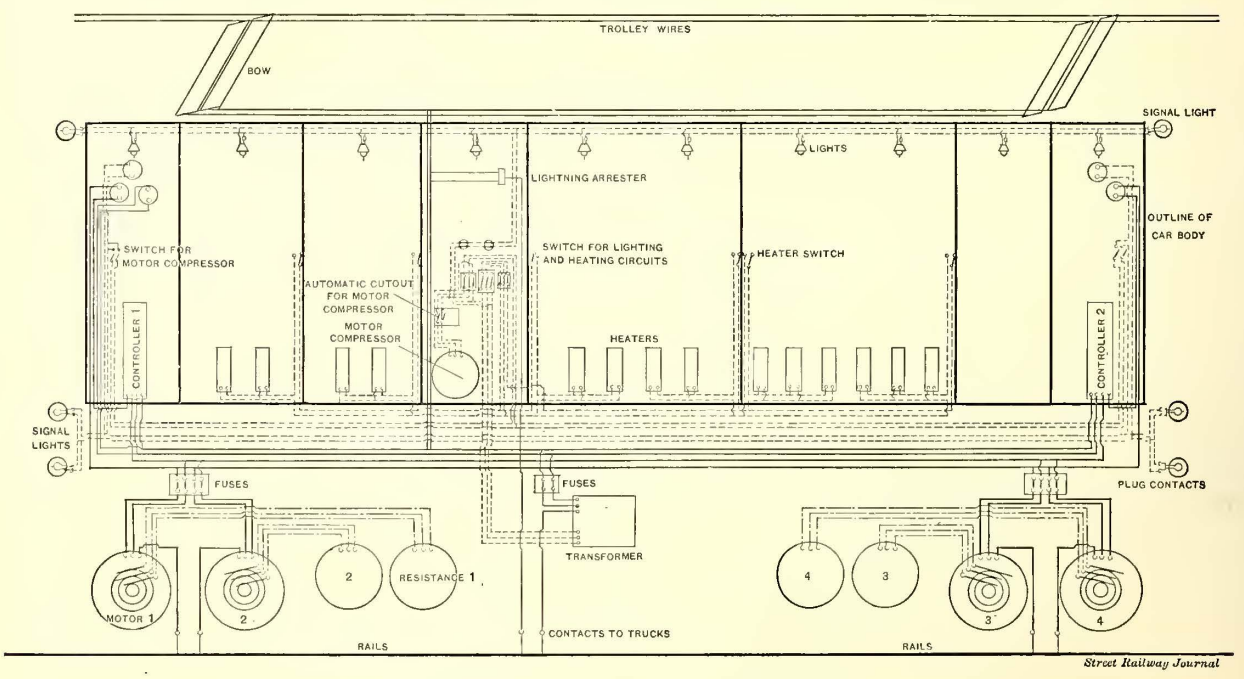
STANDARD DOUBLE-TRUCK MOTOR CAR

cars also carry oil headlights for emergencies. The principal dimensions of the locomotives are as follows: wheel base, 3 m.; length of body, 6 m.; length between buffers, 7.2 m., and diameter of wheels, 1.3 m. Weight of locomotive equipped, about 28 tons.

The motor cars are six in number, are of the double-truck type, and have the following principal dimensions: length of body, 12.2 m.; width of body, 3.05 m.; distance between centers of trucks, 9.5 m.; wheel base, 2.2 m.; diameter of wheels, 1.02 m., and length over all, 16.3 m. Four 55-h.p. motors are carried on each car, one for each axle. The motors run without load at about 600 r.p.m., and with load at 586 r.p.m. Each motor is equipped with a starting rheostat and controllers similar to those on the locomotives. On the platform are also a hand-brake handle, the triple valve operating the air brake, and above the motorman, about on a level with his head, is a small panel carrying the ampere meters and voltmeter, connected with the 750-volt circuit. Close at hand also are the switch for controlling the motor compressor and pump, and a handle for operating the whistle from the air reservoir. The electrical equipment of the motor cars is similar to that of the locomotives, and includes a 750 100-volt transformer for operating the motor compressor, the lights and the heaters. The motor compressor, its automatic cut-off and the motor fuses are carried in boxes under the cars, and adjoining the body sills.




ELECTRICAL DIAGRAM OF LOCOMOTIVE



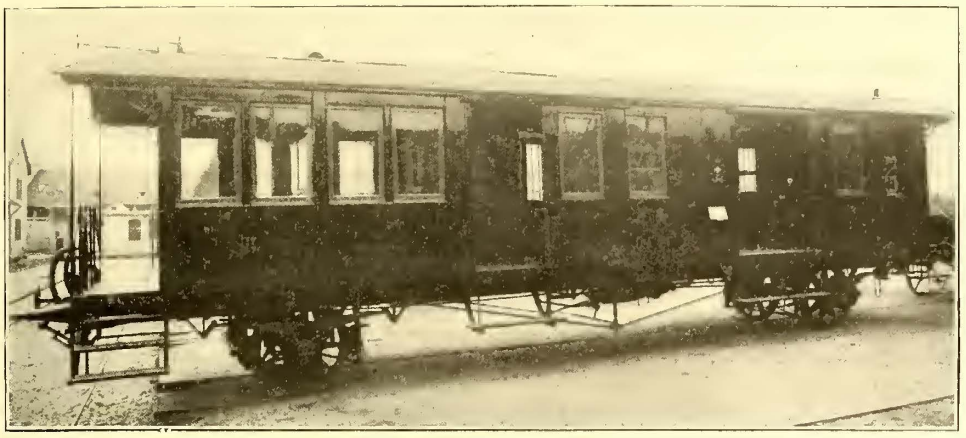

ELECTRICAL DIAGRAM OF MOTOR CAR

To lower the sliding contact bows a short cord is fixed to the upper end of the bow, and connected at its lower end to a short wooden pole, which is normally carried against the side of the car in spring clips. In the middle of the cord is a strain insulator, making it perfectly safe to draw the bow down, even in wet weather. When in a horizontal position the end of the bow catches in a small pawl on the roof, which holds it in position.

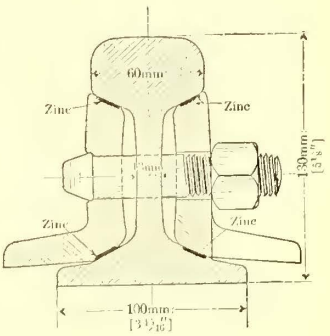
The cars have a central aisle, and are divided into four

compartments, of which two are second-class and two third-class, and carry a total of sixty-eight passengers. The weight of the cars fully equipped is 32 tons.

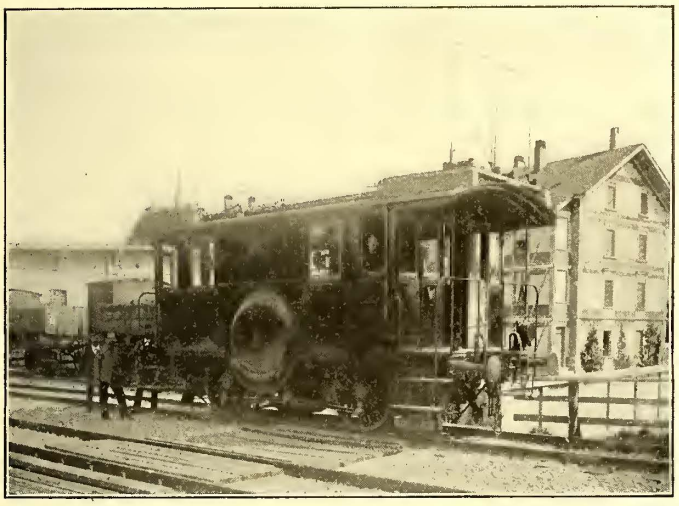
cars, carrying forty passengers, and one two-axle combination passenger, postal and baggage car, carrying twenty passengers. The several engravings herewith show the



COMBINATION BAGGAGE, MAIL AND PASSENGER CAR

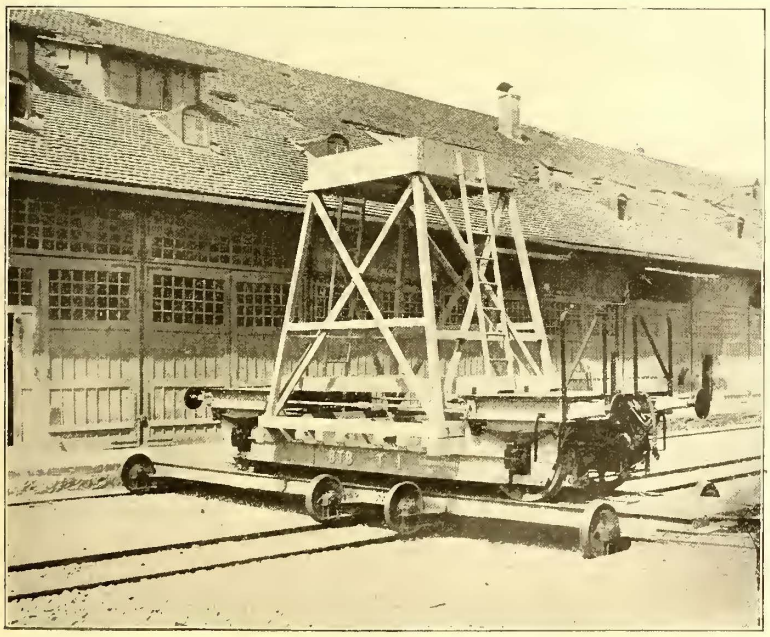



SECTION OF RAIL, SHOWING METHOD OF BONDING

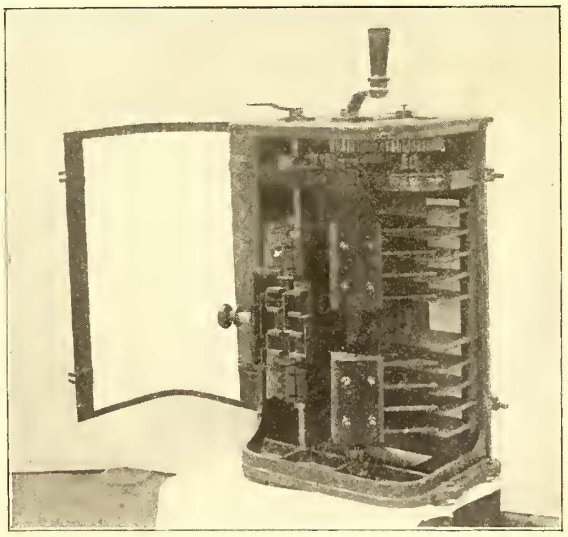


LOCOMOTIVE

MOTOR CAR



CONSTRUCTION CAR

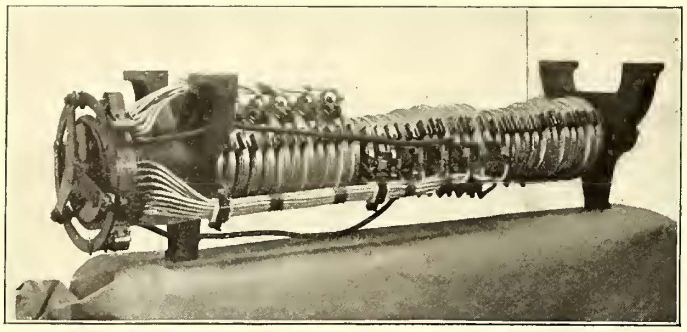


CONTROLLER FOR MOTOR CAR AND LOCOMOTIVE

The trail cars are of five different types, as follows: two two-axle cars for second and third-class traffic, carrying fifty-five passengers; two two-axle cars, third-class

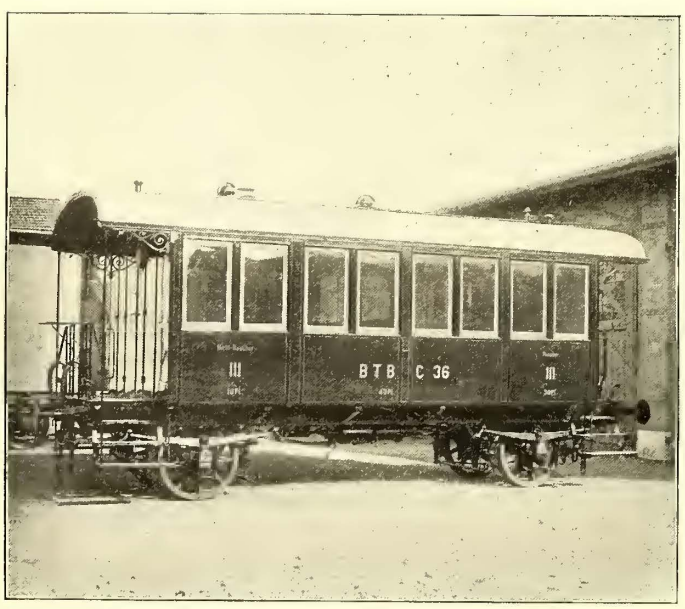
different types adopted. A special car for construction work, as well as for the transportation of transformers, is also illustrated.

As the cars are operated on a three-phase system, a constant speed of 36 km. per hour is maintained. The cars



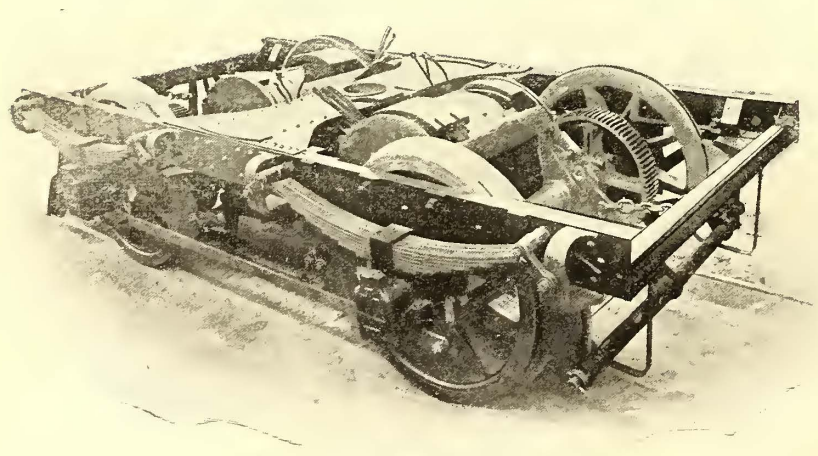
RESISTANCE FOR 60-H.P. MOTOR FOR MOTOR CAR

can be braked quickly, and stop in from three-quarters of a minute to one minute. The train service is conducted by




TRAIL CAR

ordinary steam railroad methods and on the block system. The stations are connected by telegraph, the wires of



STANDARD DOUBLE TRUCK WITH MOTORS

which are carried on the same poles with the trolley wires. Each train consists usually of one motor car and one trail car. If the traffic is too great to be accommodated on these two cars a second motor car is added, because one motor car will not draw more than one trailer. The freight trains operate at 18 km. per hour. In descending grades, the motorman is permitted to let the train speed up to 40 km. for passenger trains and 20 km. for freight trains per hour, when behind time.

Before the opening of the line the system was thoroughly inspected by the federal inspectors, who made tests of the braking system. These seem sufficiently interesting to be reproduced, and are given below.

| Train Made Up of | Brakes Applied | Grade in per Cent. | Speed in km. per Hour | Distance Run Before Stop, in Meters |
|---|---|---|---|---|
| 2 motor cars and 1 trail car. | 2 hand brakes. | 2½ | 36 | 100 |
| " " " " .. | " " | 2½ | 40 | 122 |
| " " " " .. | Air brake..... | 2½ | 35 | 53 |
| " " " " .. | " " .... | 2½ | 38 | 61 |
| " " " " .. | " " .... | ... | 30 | 38 |
| 2 motor cars and 2 trail cars. | 2 hand brakes. | 2½ | 40 | 125 |
| " " " " . | 4 " " .. | 2½ | 30 | 76 |
| " " " " .. | Air brake..... | 2½ | 36 | 64 |
| " " " " .. | " " .... | 2½ | 38 | 77 |
| " " " " .. | " " .... | 2½ | 38 | 76 |
| 1 locomotive and 100-ton train | 4 hand brakes. | 2½ | 18 | 80 |
| " " " " | " " | 2½ | 18 | 85 |
| 1 locomotive and 50-ton train | " " | 2½ | 36 | 128 |
| " " " " | Air brake..... | 2½ | 36 | 90 |
| " " " " | " " .... | 2.1 | 36 | 108 |
| " " " " | " " .... | 2.1 | 36 | 76 |

The power consumption for starting gave the following results: with one motor car and one trail car, on a 2½ per cent grade and a straight track, the current reached 260 amps. with 760 volts, although on a curve of 250-m. radius and a 2½ per cent grade the same trial took 330 amps. at 850 volts. The maximum consumption of the electric locomotive during the time of trial, with a complete train of 50 tons, at 36 km. per hour, never exceeded 300 amps. at 700 volts. It has been found not advisable to run two trains of cars at the same time in a section fed by one transformer. With two trains, the trains should be six minutes apart, and with three trains of the same size the headway must be about ten minutes.

In conclusion, I will mention the principal contractors. All the electrical apparatus for the railway was furnished by Brown, Boveri & Company, of Baden. The locomotives, so far as the mechanical construction is concerned, were supplied by the Fabrique Suisse pour le Construction de Locomotives, of Winterthur. Finally, the rolling stock was supplied by the Société Industrielle Suisse, of Neuhausen. The turbines at the power station were furnished by Escher, Wyss & Company, of Zurich. The credit of having carried this work through to a successful completion belongs principally to Mr. Dinkelmann, of Burgdorf, a member of the Federal Council and manager of the Ementhalbahn, who gave great personal attention to the construction of this line, of which he is now the manager.

The terminal station of the Staten Island Electric Railroad Company, adjoining the ferry house and station of the Staten Island Ferry and Staten Island Rapid Transit Railroad Company, at St. George, was destroyed by fire Nov. 11. Five cars, which were in the building at the time of the fire, were gotten out without damage.

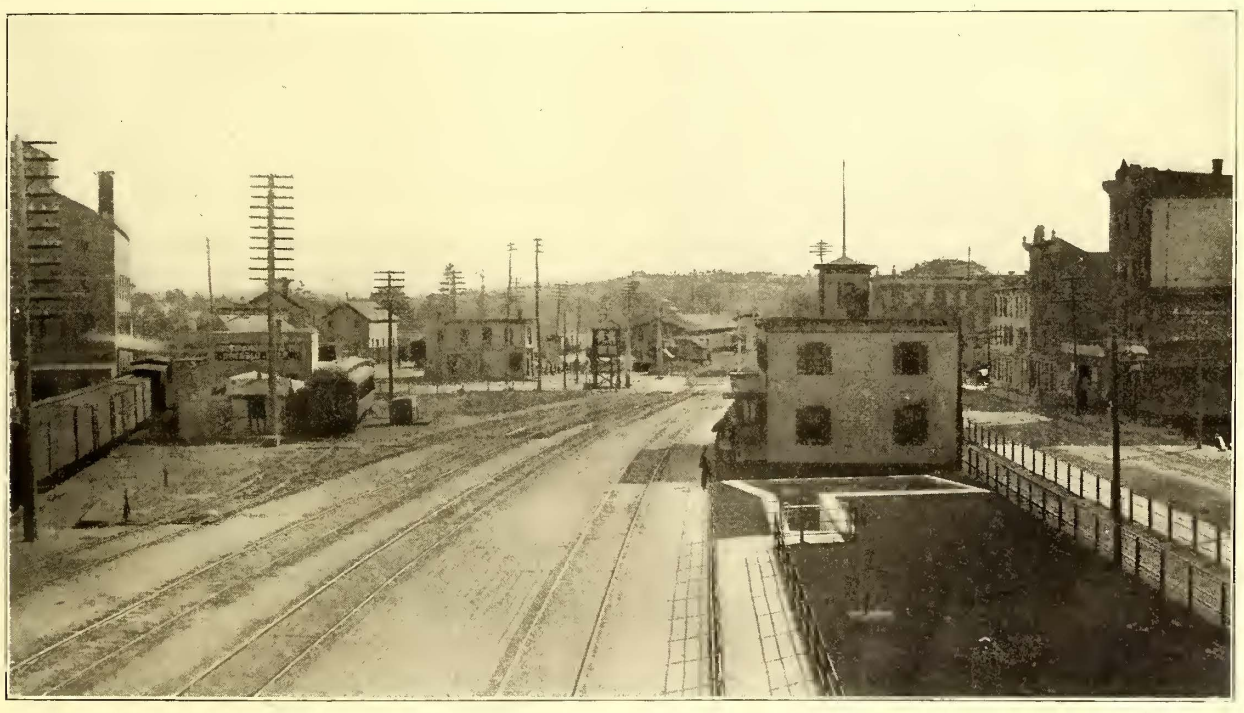
## Subway at Kingston

A very interesting piece of construction work, by which a five-track grade crossing with a steam railroad was avoided, has recently been completed by the Colonial City Traction Company, of Kingston, N. Y. The work is unique so far as is known in the history of small electric railways in the country, for the Colonial City Traction Company owns only fourteen cars, and may be an important suggestion to other companies placed under somewhat similar conditions.

The circumstances which led up to the construction of this subway were as follows: The city of Kingston is intersected by the West Shore Railroad, and possessed up to a few years ago but one railway company, whose line crossed the railroad tracks on grade at right angles. The Colonial City Traction Company was organized as a competing line. Franchises were secured and about two miles of track were built on each side of the city down to the crossing. An effort was then made to secure the right of crossing the West Shore tracks on the tracks of the existing company for a distance of 800 ft., but this was refused by the latter company. The Colonial City Traction Company then (in 1896) went to the Supreme Court for privilege to condemn the right of way over these tracks, and won the suit. The case was appealed, however, by the existing railway company, and carried to the Appellate Division of the Supreme Court, which decided that the consent of the municipal authorities and of the abutting property owners were prerequisites to the action, in this way reversing the decision of the lower court. The question was then carried up by the new company to the Court of Appeals, which sustained the last decision. The Colonial City Traction Company then secured the permission of the authorities, but were unable to obtain that of the property owners. Under these circumstances a request was made to the Appellate Division to appoint commissioners to decide whether the property owners for these 800 ft. were unreasonable in withholding their consents; the commissioners found in favor of the new road. These suits created much interest at the time, as deciding important legal questions, and were commented upon in an extended way in the STREET RAILWAY JOURNAL. During the final litigation, however, a compromise was reached between the two railway companies, by which the Colonial City Traction Company, instead of crossing the West Shore tracks on the tracks of the existing company, agreed to divert its route a short distance to the north, and build a subway under the West Shore tracks, thus connecting its two existing sections.

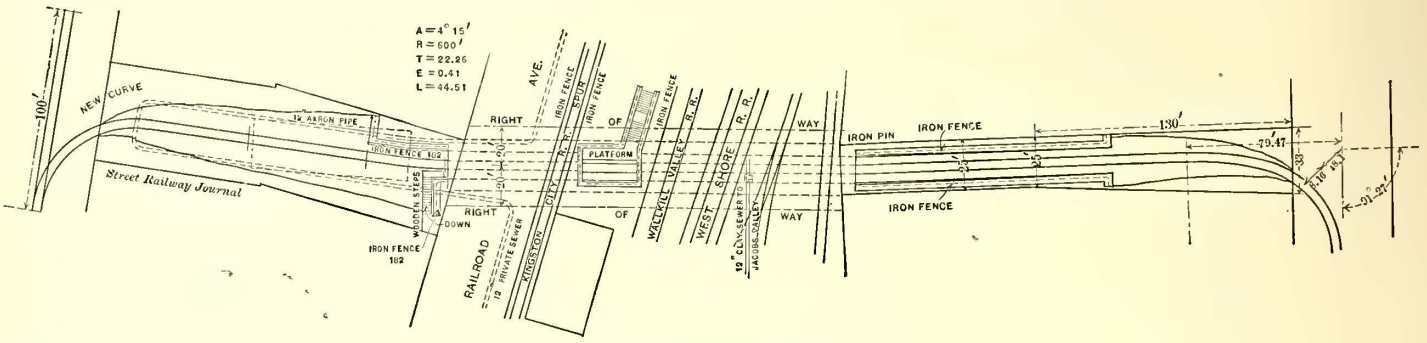
The covered part of the subway is 220 ft. in length, with approaches of 130 ft. on the east side and 160 ft. on the west side. The sides of the subway under the West Shore Railroad tracks are of first-class bridge masonry, and elsewhere are first-class rubble masonry. The subway station is faced with white enameled brick; the roofing is of open-hearth steel troughs, with a tensile strength of 60,000 lbs. per square inch. The plates and angles composing the troughs of the solid floor system were covered with asphalt, mixed ten parts asphalt and thirty parts coal tar pitch. The bottoms were then filled with a binder composed of ¼-in. clean, sharp gravel and No. 4 asphalt paving composition,

STEPS TO ELECTRIC RAILWAY PLATFORM



ENTRANCE TO SUBWAY FROM WEST SHORE STATION, KINGSTON

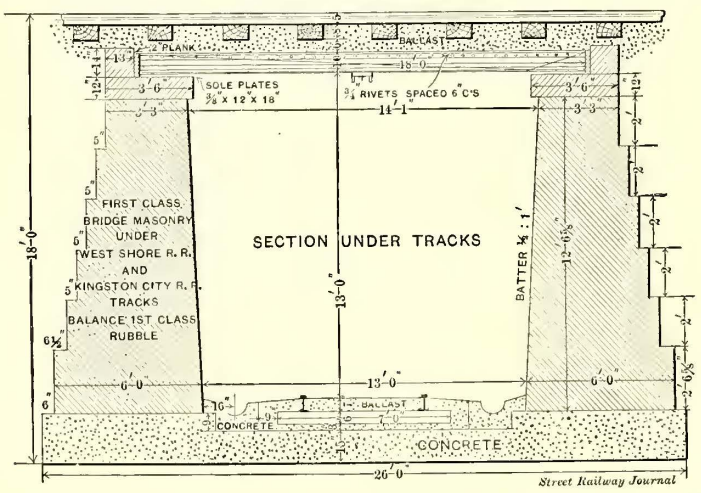
in the proportions of 1 cu. ft. of gravel to 1 gal. of paving composition. There is an entrance to the subway from the platform of the West Shore Railroad Company. This has proved a great convenience to passengers and a means through which the company has added greatly to its traffic, as will be described later. The entrance to the West Shore station is fitted with handsome hand-rails of heavy brass pipe of 2 ins. in diameter, and all stone work is of North River blue stone.

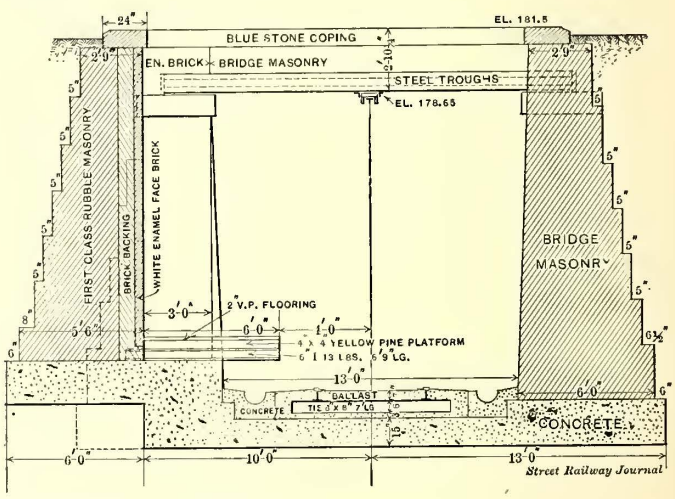



GENERAL PLAN OF SUBWAY

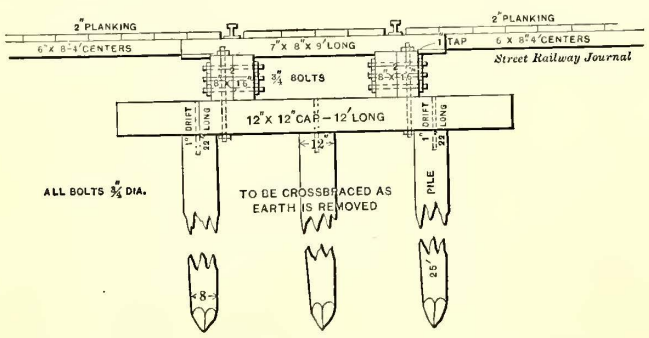
Work on the subway was commenced Aug. 22, 1898, and the first car ran through it on March 19, 1899. The work was carried on without any delay to the traffic on the West Shore Railroad. The method of supporting the tracks on the latter is illustrated on this page. Before any excavation was made within the West Shore right of way a temporary trestle was constructed by driving 25-ft. piles between the tracks. These piles were white oak and not less than 8 ins. on the top and 12 ins. diameter at the butt. After being driven they were capped by 12-in. x 12-in. yellow pine caps, secured to the piles by wrought iron drift pins 1 in. square and 22 ins. long. On these caps were laid the track stringers, which were of yellow pine 8 ins. x 16 ins., and long enough to cover two bents in the trestle. Two stringers were placed under each rail and decked with cross-ties. The entire deck was then covered with 2-in. yellow pine plank, as shown in the sectional view. This supported the tracks while the excavation for the subway was being made.

The method of conducting current to the cars in the subway was another problem, and that first employed is illustrated in section on page 863. It consisted of T iron, 2¼ ins. x 2¼ ins. x 5/16 in. thick, lag-screwed to an 8-in. x 1¾ in. white pine plank, which was held to the roof girders by angles. The plank was protected on the edges by 1-in. x 3-in. timbers, held to the upper plank by wood screws, making a trough to catch the trolley in case it should jump from the conductor. A rubber cushion 3 ins. x 3 ins. x 3/16 in. was used between the conductor and the trough. This construction proved, however, to be too rigid and noisy, in spite of the precautions taken to prevent trouble of this kind, and has since been changed to ordinary trolley wire carried on hangers.

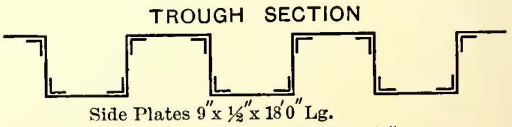



SECTIONS OF SUBWAY UNDER TRACKS AND AT ENTRANCE




SECTION OF TEMPORARY STRUCTURE FOR SUPPORTING STEAM RAILROAD TRACKS

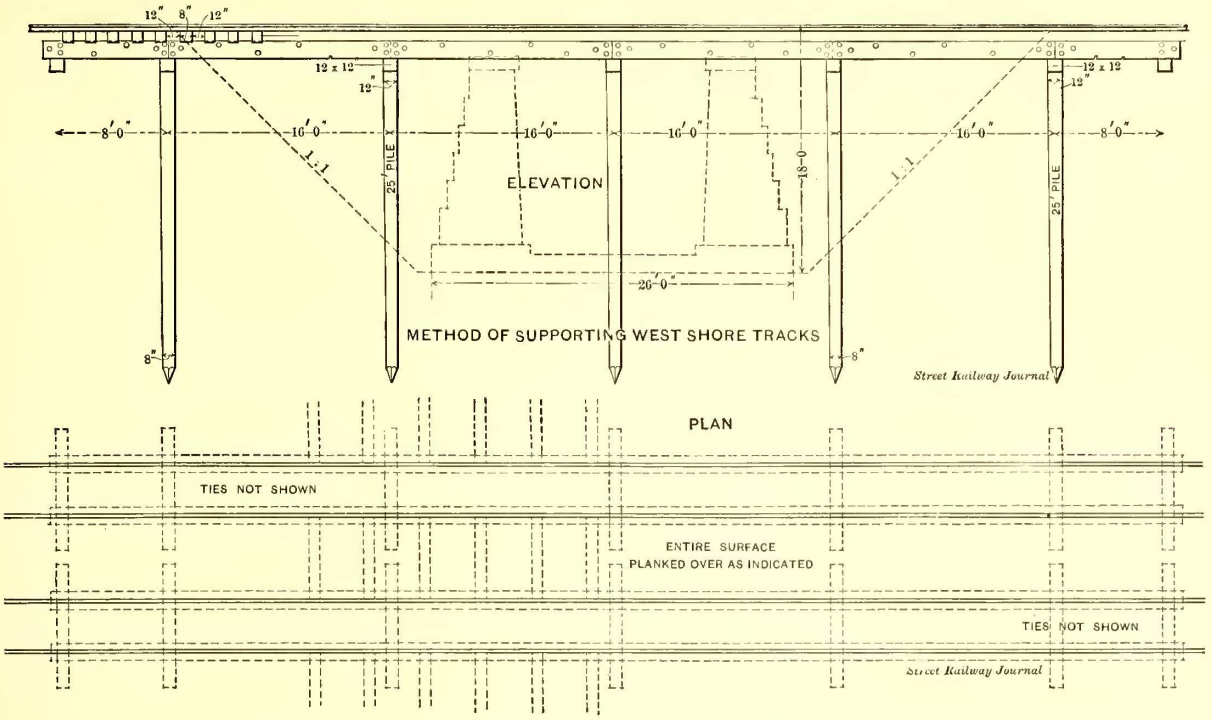



Side Plates 9" x ½" x 18' 0" Lg.
Top and Bot. Plates 14" x 9/16" x 18' 0" Lg.
Angles 3" x 3" x ½" x 18' 0" Lg.
Rivets ¾" D. and 6" Centers.
Troughs Filled with Asphalt Comp.

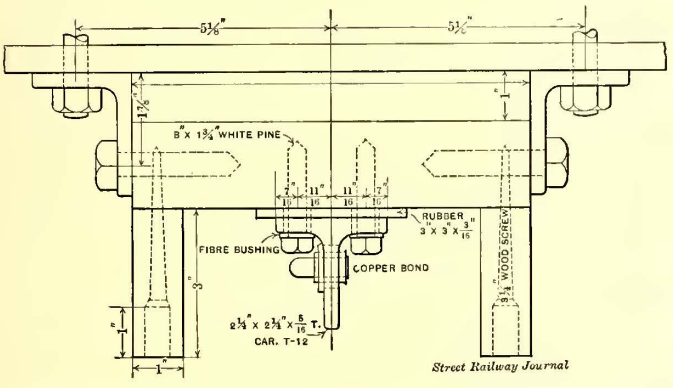
SECTION OF ROOFING

Before the subway was completed and during its construction passengers were transferred from one section of the road to the other, across the West Shore tracks, by bus. The completion of the subway was naturally fol-

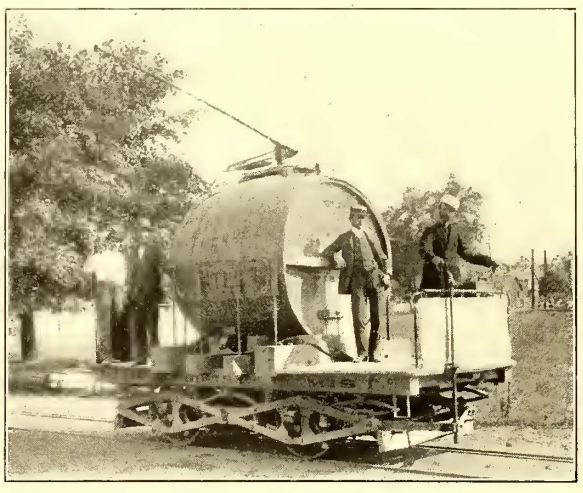
lowed by large increase of traffic, partly because the line was now a continuous system and also partly because of its corresponding period a year ago. The entire cost of the subway was about $28,000.




SIDE ELEVATION AND PLAN SHOWING METHOD OF SUPPORTING STEAM RAILROAD TRACKS




ORIGINAL METHOD OF ATTACHING CONDUCTOR TO ROOF



HOME MADE SPRINKLING CAR

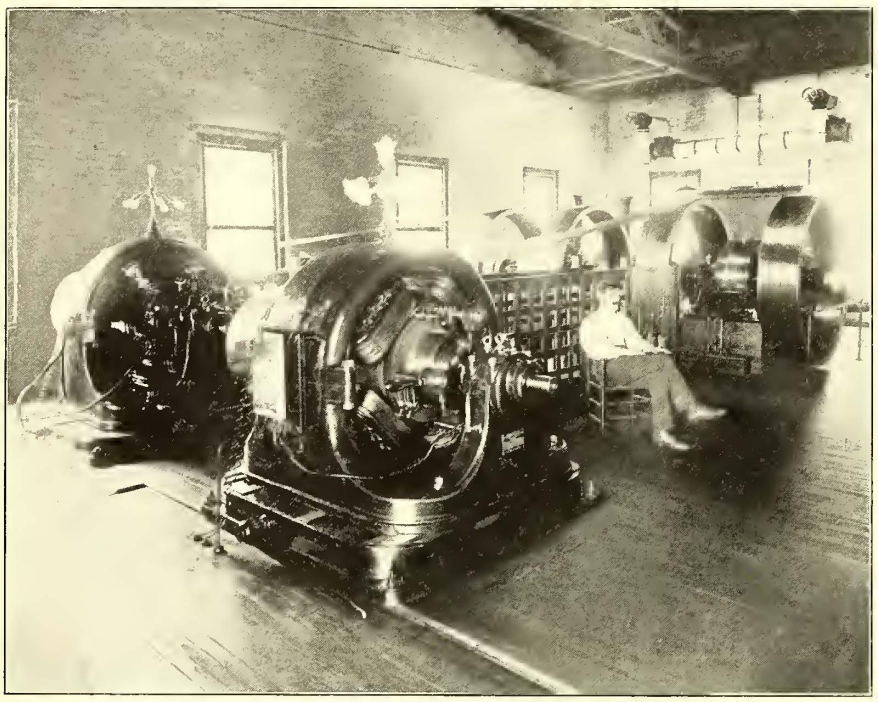

STANDARD 18-FT. CROSS-SEAT CAR

ENTRANCE TO SUBWAY

proximity to the only railway station in the city. As a result, the gross receipts of the company have increased 75 per cent during the past six months, as compared with the

The system of the Colonial City Traction Company has interesting features besides the subway. As Kingston has a population of only about 30,000, and there are two lines

in the city, the keenness of competition makes each company put forth every effort to secure as much traffic as possible. Considerable popularity has been secured by the Colonial City Traction Company through the opening of its subway. Another step to secure traffic was the introduction of cross-seat cars, which have proved very popular. The amount of traffic did not require long cars, so the experiment was tried of using cross seats in an 18-ft. closed car. There are six seats on a side, and a view of one of these cars, which were built by the Pullman Company, is illustrated herewith. The company has in all seven closed and six open cars, mounted on Peckham and Diamond trucks. G. E.-800 motors are used under the former and Westinghouse 49 motors under the latter. The open cars



INTERIOR OF ENGINE ROOM

are of the ten-bench type, and were built by Jackson & Sharp.

Another novelty in car construction is the sprinkler car illustrated. This was gotten up by the superintendent of the company, C. Gordon Reel, at a cost of $65, and consists of a large beer barrel holding 1600 gals., purchased of a local brewer for $10, and mounted on a platform car. The cost of the sprinkler, fittings, etc., which were all home-made, brought the cost up to that stated. In winter this car is fitted with nose plows and used for a snow plow.

The power station is located at the eastern end of the line on the Hudson River, and contains two 150-h.p. Ball & Wood tandem compound condensing engines belted one to a 125-kw. and one to a 150-kw. Westinghouse generators; the two generators are run in parallel. The condensers and pumps are of the Worthington type, and there are two Sterns tubular boilers of 300 h.p. each. Eighty-lb. girder rails are used. The improvements described had an excellent effect on the increase of traffic of the railway.

The road is now in the hands of and operated by a reorganization committee consisting of John I. Waterbury, Chas. M. Preston and August Belmont, with C. Gordon Reel as superintendent. Mr. Reel was formerly connected with the Lindell Railway, of St. Louis, but assumed control of the Kingston road in November, 1896. The receipts have increased 75 per cent during the last year, with an increase in car mileage of 15 per cent and a decrease in operating expenses over 1898 of $6,000 (from $35,000 to $29,000). The cars are now earning about $20 a day on an average of fifteen hours each. The electrician of the company is C. J. McNelis, and Francis Gaffney is the chief engineer of the power station.

## Result of Low Fare Experiment on the Chicago General Railway System

The Chicago General Railway Company has been for some time past trying some very interesting graded fare experiments on certain portions of its system. By reference to the colored map of Chicago in the Street Railway Journal for October it will be seen that this company's lines consist of one main stem, running from Wabash Avenue and Twenty-second Street, a distance of about 2 miles from the general postoffice in Chicago, through Twenty-second Street west to Fortieth Avenue, together with a number of comparatively short branch feeders running south from this main stem on Lawndale Avenue, Kedzie Street, Throop and Laurel Streets (to the Union Stock Yards), etc.

A single fare of five cents, with full transfer privileges, is charged on the entire system, or tickets, six for a quarter, are sold with the same privilege. On the branch lines a 2-cent fare without transfer privilege is charged, and twelve tickets are sold for 20 cents. These branch lines are little less than 3 miles in length. Transfer tickets are issued at the time that the fare is paid.

For the first eight months of the present year the Chicago General Railway system was operated on a straight 5-cent fare. The graded fare system has since been in use, and in September and October the gross business showed an increase over the average for the eight previous months of 28 per cent, without materially increased expenses. It is further stated as an interesting fact that on the four lines the company now receives a larger number of 5-cent fares than were taken in before the tickets were sold.

The Berlin Elektricitäts Werke, which supplies current for all the electric railways of Berlin, is the largest electric power company in Europe, and one of the largest in the world. It owns five separate power stations with a total of 43,000 h.p., which will be raised to 61,000 h.p. as soon as the extension, which is now in course of erection, is completed The central stations in the Spandauerstrasse, Mauerstrasse and Schiffbauerdamm form only a part of the electrical supply system. An idea of the total capacity of the system can be obtained from the following table, which gives the maximum capacity of the several stations, all of which are connected together by a net of feeders:

| | H.P. | KW. |
|---|---|---|
| Central station at Schiffbauerdamm | 14,500 | 9,500 |
| Central station at Spandauerstrasse | 11,200 | 7,400 |
| Central station at Mauerstrasse | 9,300 | 6,100 |
| Central station at Markgrafenstrasse | 2,100 | 1,400 |
| Central station at Oberspree | 6,000 | 4,000 |
| | 43,100 | 28,400 |

According to these figures the capacity of the Schiffbauerdamm station alone is nearly as great as that of the largest German central station at the present time, and as soon as the 30,000 h.p. additional equipment is installed, the capacity will exceed even that of the power station at Rheinfelden, also installed by the Allgemeine Elektricitäts Gesellschaft.

## Overhead Line Construction IV

BY ALBERT B. HERRICK

*Erecting and Testing Feeders and Setting Poles*

It is usual to run two feeders from one circuit breaker in the station to each continuous section, but considerable money can often be saved by combining two feeders into one, giving one equivalent cross section of the two. For instance, 2 miles of triple braided No. 0000 wire weigh 8184 lbs., of which about 1600 lbs. is insulation. If now, a single 450,000 c.m. cable were used instead, it would weigh 8992 lbs., of which only 1000 lbs. is insulation, and the drop of this mile transmission would be lower by 8 per cent than with the two No. 0000 feeders. The tendency in modern line construction is to use larger and fewer feeders, both on the score of line cost, location of weight on pole, and copper economy.

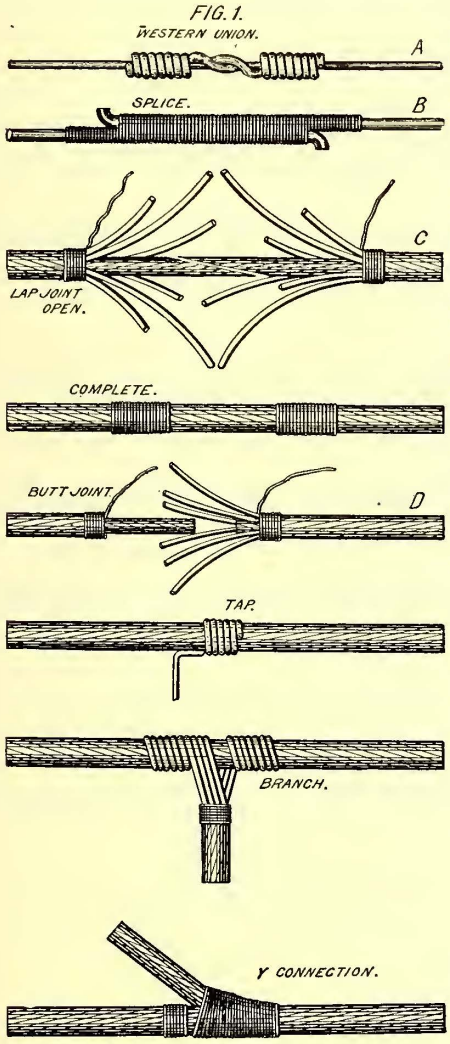


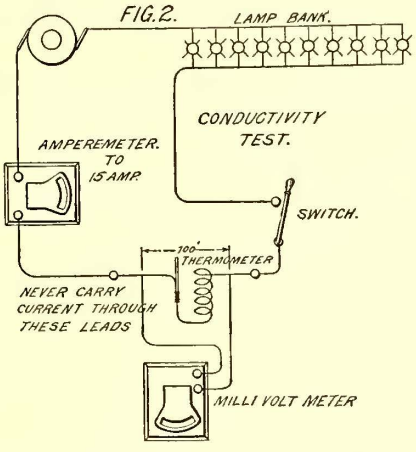

FIG. 1.—METHODS OF MAKING FEEDER JOINTS

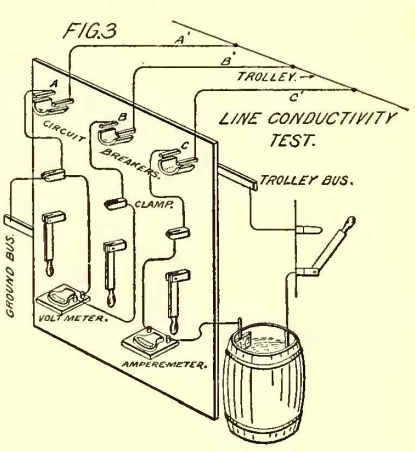
The insulation generally used on wires is known as weatherproof, and it consists of two or three braidings of jute, which should be thoroughly impregnated with a water-proofing compound. The covering and compound should be tough enough to resist considerable abrasion, and there should be no decrease in insulation resistance with 110 volts, after several hours immersion in water.

It has been the practice in the past to tin the wires of stranded cables. Tinning increases the resistance of the wire, for the tinning combines with the surface copper, and the effect is to slightly reduce the conductivity of the wire. There is no reason for tinning copper where weather-proof covering is used, except where the feeder is exposed to salt sea air, and in mining districts where the air is laden with corrosive gases. Where cables are spliced it is very easy to tin the strands before making the splices.

The ordinary Western Union joint, shown at A in Fig. 1, is satisfactory where the wires are No. 0 or smaller. Good results, however, are not obtained with this joint when the wire is larger than No. 0. The best joint in such cases is made by turning the ends sharply at right angles, paralleling two wires, wrapping with No. 12 copper wire, and then soldering the joint, as shown at B. Solder is usually poured over a joint of this kind, but care should be taken that the wire is hot when the soldering is done. The best way to heat the joint is to use blow lamps, placing the joint on a board. With a little experience the best results may be obtained with resin as a flux, but soldering acids and compounds are generally used. The lap of the two wires on this splice joint should be at least twelve times the diameter of the wire. If properly soldered, this joint will then be as strong as any other part of the cable. Exposed joints should be served with at least four layers of adhesive tape, so that the joint will be as well protected as the insulated wire. A splice in stranded cables is usually made by interweaving the strands of the two cables Several methods often employed are shown at C and D (Fig. 1), but to make the joint electrically satisfactory each wire should be separately tinned before the two cable ends are interlaced. The connection is then served with No. 20 copper wire, as shown.

The conductivity of the copper is of vital importance, of course, and, if desired, it may easily be tested to a fraction of 1 per cent. The necessary instruments are a reliable amperemeter, reading by 50 amps., a millivolt meter, and a thermometer, see Fig. 2. If we produce a flow of 10 amps. through a conductor 100ft. long, the millivolt meter should read 481 millivolts in measuring a No. 0000 wire, or under these conditions each .0001 of an ohm will produce one millivolt deflection, provided the temperature of the wire is 60 degs. F., and the conductor has 100 per cent conductivity of pure copper. In case the temperature of the air is below 60 degs. the thermometer should be placed in contact with the wire, then pass the current through it for a few minutes until the thermometer records slightly above 60 degs., then cut the current off. The thermometer should then be watched until it falls to 60 degs., after which the millivolts drop with current flowing again may be read. To make this method a success, it must be borne in mind that the current should never be carried into the conductor through the contacts taking the drop for the millivolt meter.




FIGS. 2 AND 3.—CONNECTIONS FOR TESTING CONDUCTIVITY OF LINE

As the conductivity of copper changes .00226 for each degree F. the readings for any other temperature of the conductor than 60 degs. F. can be reduced to the standard temperature resistance. We may then divide the standard resistance of the copper by the measured resistance obtained, and thus get the percentage conductivity required. For methods of setting up these tests, see Fig. 2, and for standard resistances see eleventh column of copper table, August issue STREET RAILWAY JOURNAL.

The conductivity test is, of course, useful for the pur-

chase of conductors and to see whether the specifications have been complied with, but the actual line resistance is often of value. The apparatus required for this test is a water barrel rheostat, an ammeter reading about 100 amps., a voltmeter reading about 250 volts, and two connectors that will fit the jaws of a feeder switch and be capable of carrying a load of about 50 amps. The connections are shown in Fig. 3. It will be noticed that the current

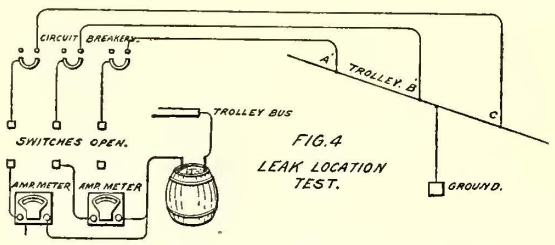



FIG. 4.—CONNECTIONS FOR LEAK TEST

passes from the water rheostat through the ammeter, out through feeder C to C', along the trolley line to A', and back to the station to the ground bus through the jaw of switch A. Now, if the voltmeter pressure between A and B and the current flow are known, then the volts divided by the current will give the resistance of the feeder C and

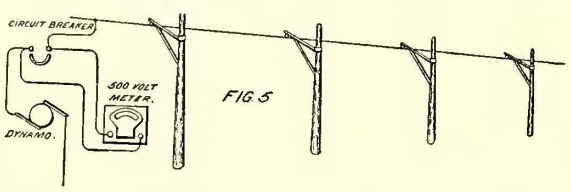
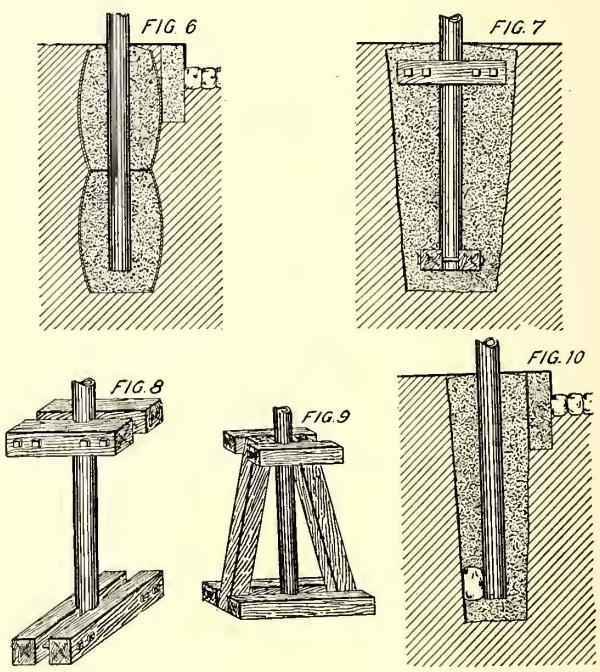



FIG. 5.—CONNECTIONS FOR LINE INSULATION TEST

that of the trolley line from C to B. Similarly the pressure between B and C, when divided by the current flow, will give the resistance of the trolley wire from B' to A', and the resistance of feeder A. By shifting the ground bus to the jaw of switch for feeder B, and again putting the load on the system, the volts dropped between A and B, divided by the current flowing, will give the resistance of feeder B. This principle can even be applied to complicated overhead feeder systems which can be temporarily tied together by putting jumpers around the line circuit breakers, and all the electrical data from the overhead line to the power station, can be determined. It is then easy to locate also from the power station grounds or leaks on the line. This requires the use of the water barrel rheostat, the two ammeters and the connections to fit the switch jaws, as in the previous test. The connections used are those shown in Fig. 4. If the leak is considerable, the feeder ammeters will show its approximate location by the irrelative readings, but if the current is slight, low reading ammeters will have to be used.

As an example, supposing it be found that the resistance of feeder A was .15 ohms, that of feeder B .3 ohms, and the trolley wire between A and B .25 ohms; the total resistance of this circuit would then be .7 ohms. It will be noticed that the current can take two paths to the leak, but the resistance of the leak is common to both circuits, consequently the current will pass to this leak through the circuits in the proportion that the resistance of these two circuits bear to each other. Suppose the readings on the two ammeters show that for the circuit A 20 amps. pass, and that for the circuit B 12 amps. pass, the total current flow being 32 amps. Then for A we have the proportion, 32 amps. is to 20 amps., as .7 ohms (the total resistance of the circuit) is to X, (the resistance to the point of leak). For the B circuit we have, 32 is to 12 as .7 is to X. Solving these gives for the circuit through A, .437 ohms, and through B, .2625 ohms. Subtracting the known resistance of B feeder from the resistance of B circuit gives .0125 ohms, from the end of B to the ground, and subtracting from the A circuit the resistance of A feeder (.437—.15) leaves .287 ohms, beyond the end of A feeder to the ground. If we know that the length of the trolley from A to B is (say) 2400 ft. and of uniform cross section, we may divide the resistance of this length by its length, or .3 ohms by 2400 ft., which is equivalent to .000125 per ft. If this resistance per foot is divided into the found resistance from B to ground, or .0125 ohms, we have 102 ft. from B. The same calculation on the A circuit would give 2296 ft., which is the distance from A. Any other leak on the system can be located by removing the ground connection from the ground bus, and applying it to any other feeder terminal with all the feeder switches open. A connection to each independent section will then show if there is a leak.

The practical test for line insulation resistance is to make the test after the line is erected, by the method shown in Fig. 5. Open the station circuit breaker and across the terminals of the open breaker place the leads to a 500 volt




FIGS. 6-10.—METHODS OF SETTING POLES

meter. Of course all circuit breakers feeding in this section must be opened, and all lamp circuits on this section disconnected, otherwise the voltmeter continues to read bus voltage. The voltmeter will show when all circuits are open (this also makes a good method of determining in an unknown system of wiring, which feeders are connected together). When a steady deflection of the voltmeter is obtained on connecting across the open breaker the resistance of the line can be found by multiplying the voltmeter resistance by the bus-bar voltage at the time of making the observation, dividing this product by the volts shown by the voltmeter when connected across the open circuit breaker, and subtracting from this result the voltmeter resistance. It must be remembered that the leakage is that of the total connected system, and not that of the feeder connected.

These tests can be made to determine the differences in resistance due to dry, rainy or foggy weather. Tree grounds can also be detected on rainy and windy nights, by the violent variation of the line insulation resistances.

In previous articles we have considered poles, feeder insulators, and feeders, their proper size and character. In

natural order the next question is that of setting the pole. With wooden poles the depth of setting is determined by the line strains, but roughly the pole is set 18 per cent of its length in the ground. For wooden poles the hole should be dug of as small diameter as possible with convenience in digging. In clay ground it should not be larger than 15 ins. at the bottom and 20 ins. at the top. A foot-stone is generally placed at the bottom of the pole on the side opposite from where the strain will fall on the pole. The earth should be well tamped around the pole, and only a few inches of earth should be thrown in at a time. The life of a pole can be considerably prolonged by treating it with creosote. Painting the butt of the pole with pigment, which does not enter the pores of the wood decreases, rather than increases, the life of the pole. Where sandy ground is encountered, such as will not well support a pole, barrels may be buried one upon another, and the pole set in these barrels, as shown in Fig. 6; where iron poles are to be set in concrete in very sandy soils, the same method can also be used.

Poles buried in marshy grounds have to be provided with a structure which will increase their bearing areas; Figs. 7, 8 and 9 show common methods of these constructions. The support of the pole in soft ground has also to be assisted by head guides or brace studs.

In case of iron poles the surface presented does not give a sufficient bearing area against the soil to carry the strain which the pole is designed to resist, so concrete is used around the base to enlarge the foundation area between the earth and the pole. Fig. 10 shows the standard setting.

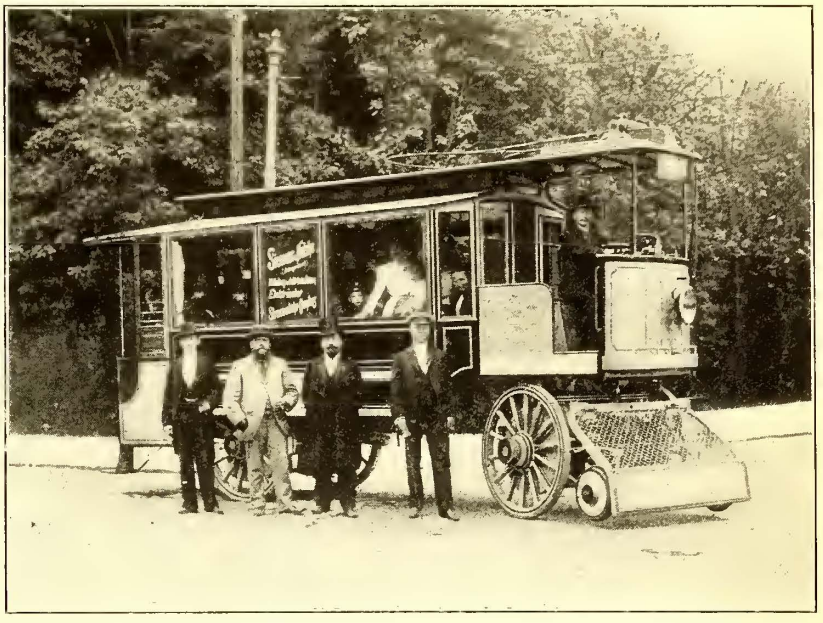
The concrete should be composed of one part Portland cement, two parts sharp sand, and four parts broken rock of the size to pass through a 2-in. ring in any direction. The sand and cement should first be thoroughly mixed together while dry, then enough water added to dampen the material and then turned until entirely mixed. The stone is then added and the whole concrete mixed together. Care should be taken that the hole in which the pole is set has fairly smooth sides, so that in tamping the concrete in place, dirt will not be knocked down and mixed with the concrete, and so destroy its usefulness. The setting of iron poles in marshy or loose ground requires about the same special structure as shown in Fig. 6.

Where hard stone is met in a few holes only, and in not sufficient quantity to warrant the use of a steam drill or dynamite, a piece of iron pipe slightly larger than the butt of the pole can be filed with teeth at one end, and by rotating this and feeding with emery and water, the hardest rock can be cut to the depth of 4 ft. in a few hours; the core can then be broken out with a chisel. Where concrete is mixed at one place and carted to the pole line it should be made very wet, and the slow setting variety of cements only should be used. Concrete should always be tamped until a smooth surface shows on the top.

The general standard of street railway employees for faithful service and fidelity to their trust has more than kept pace with the wonderful changes and improvements that rapid transit has brought about, and they will be found vying with their brethren in other pursuits in their devotion to the best interests of their employers.—From address at the Montreal Convention, 1895.

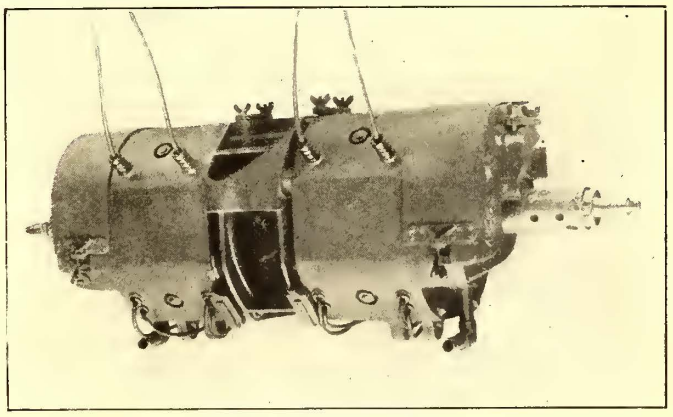
## Combined Trolley Car and Omnibus

An exceedingly novel type of vehicle has recently been put in operation in Berlin, Germany, by the Siemens & Halske Aktien-Gesellschaft. The vehicle, as illustrated in the accompanying engraving, possesses the characteristics of both a trolley car and an omnibus. It is in reality an automobile omnibus, fitted with a trolley pole for taking current while running on the railway track and storage batteries, so that it can turn off the track or run in parts of the city where there are no tracks, if desired. It is therefore particularly useful in those cities where the importance of certain streets is such that tracks are not permitted upon them, or where by reason of their narrowness or the enormous traffic in them, the construction upon them of railway tracks is not feasible. The advantage of using the trolley circuit in places is, of course, that the storage battery can be made much lighter than if the omnibus was entirely an electric automobile, that when running on the tracks the traction resistance is less, and also that the batteries can be stored from the trolley circuit during this time, making it unnecessary to change batteries.



COMBINED TROLLEY CAR AND AUTOMOBILE OMNIBUS

To keep the vehicle on the tracks when operating as a trolley car, it is fitted with two guide wheels which run in front of the front driving wheels, and being flanged, keep the regular wheels on the rails. When the vehicle is turned



MOTOR FOR OMNIBUS

off the track these guide wheels are raised and the trolley pole is tied down, as shown in the engraving. The car can then be run in any direction desired. In outward appear-

ance, the vehicle differs from a horse omnibus only in that the rail wheels are close together, conforming to the gage of the front wheels, and the latter, to secure greater mobility, are directly under the platform with the motorman.

The usual steering gear is used, but runs in ball bearings, allowing the front truck to be turned at an angle of 90 degs. to the direction of motion. This makes it possible to turn the vehicle in very narrow streets. Ordinary shoe brakes acting on the rear wheels are employed with an electric locking brake on all four wheels for emergency use. Four motors are employcd, one for each driving wheel. The motors are 4 h.p. each and are illustrated in the accompanying engraving. The wagon empty weighs 6500 kg. (14,300 lbs.), which is evenly distributed on all four wheels. Of this weight 1500 kg. (3300 lbs.) is that of the storage batteries which consist of 200 cells.

## Large Installation of Special Work in Boston

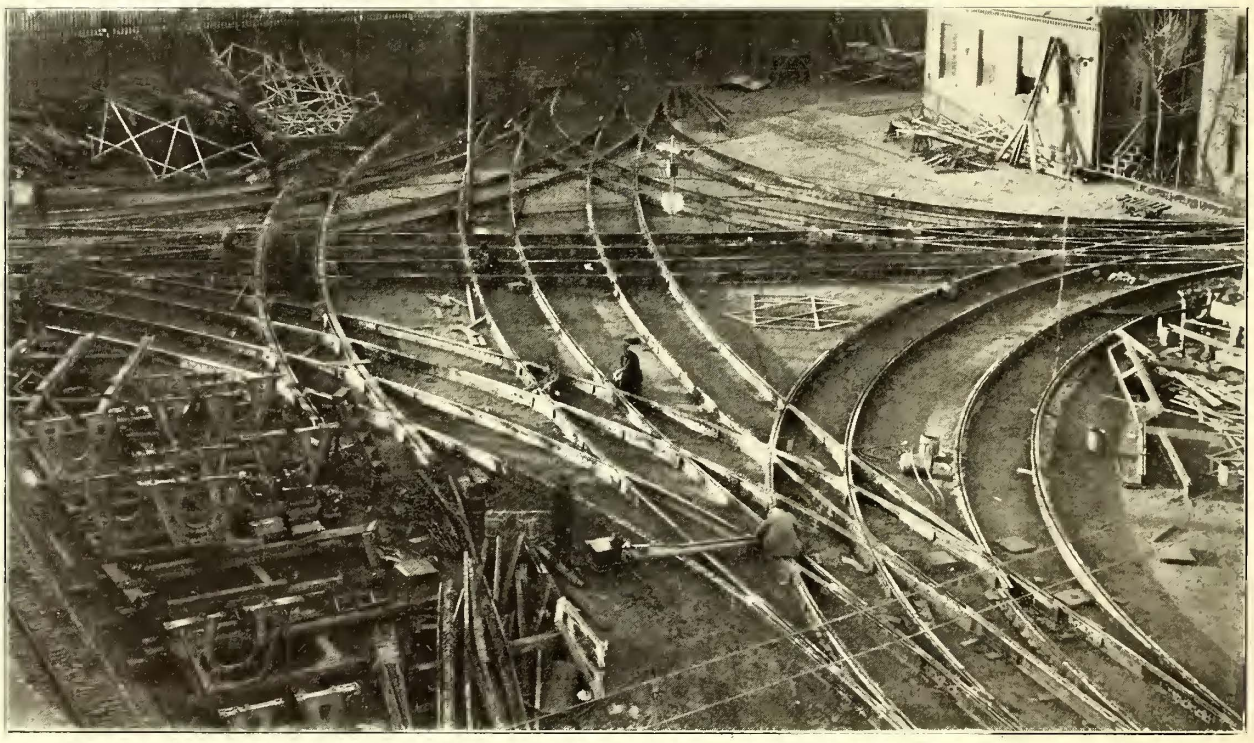
William Wharton, Jr. & Company, of Philadelphia, have recently completed for the Boston Elevated Railway Company the most important piece of track construction ever laid in that city, which is noted for its many and complicated track lay-outs. The installation referred to is that at Dewey Square, and is right in front of the South Boston Terminal steam railroad station. It consists of a double street railroad crossing with two of the tracks on a curve, and both connected with double curves, together with a third track, that shown at the left hand side, which is a freight track used by the Union Freight Railroad Company, and crosses six of the trolley tracks.

All of the curves are provided with spirals on the end, making the engineering work in connection with the lay-out exceedingly difficult and tedious. There are 183 intersecting points of the track lines and the lay-out itself comprises 190 crossings and switch pieces and rails. The design, the steam railroad track being formed of a special crossings for the Union freight track are made of a new very heavy guard rail of the same depth as the girder rail for the street railway track. The intersecting points of the street railway crossing are provided with manganese steel centers, as are, in fact, all of the intersecting parts of the crossing. The weight of material used is about 170 tons.

An especially interesting feature of the work was the promptness with which the order was filled. The entire crossing was manufactured and delivered within ten weeks after the receipt of the order. This time, considering the enormous size of the lay-out and the state of the iron market, is certainly remarkable. The material for the lay-out had to be transported on seven railroad cars of large capacity, and by special arrangement this train of cars was rushed through Boston, reaching there in two days, in spite of the immense accumulation of cars and freight blockade now existing in Jersey City. It was taken in hand at once by the engineers of the Boston Elevated Railroad. Work was commenced on Saturday, Nov. 18, and by the following Tuesday the entire lay-out was practically down and finished and cars running over it.

Another interesting feature of the installation is that in spite of its size it was all laid down complete in the works of the Wharton Company before shipment, evcry piece being in its place.

The contract price is said to have been in round numbers $15,000. This low price was secured by contract last February before the recent rise in the steel market, otherwise the cost would have been considerably higher.



LARGE PIECE OF SPECIAL WORK AT DEWEY SQUARE, BOSTON

## Street Railways in Para

In a recent letter from a friend in Para, Brazil, he says: "This is a city of from 125,000 to 150,000 people, and is growing very rapidly. It has a street car system which threads the city in every direction, and it is patronized to perfection, almost every one being willing to wait fifteen or twenty minutes for a tram car in preference to walking. The equipment is, however, unmentionable. The little mules can fairly fly down hill, but up grade they are always in trouble with the heavy loads they have to haul. There is a great opportunity for the spare capital and spare engineers of the United States to come down here and put in an electric system. Please send them down, and the sooner the better."

## Interview With John A. Brill on Foreign Practice in Rolling Stock

John A. Brill, vice-president of the J. G. Brill Company, of Philadelphia, returned to this country last month from a trip to Europe. A representative of the STREET RAILWAY JOURNAL called upon him, shortly after his arrival, and in response to questions obtained some very interesting information in regard to European practice in rolling stock, and the reasons which have led up to the large export movement from America in tramway rolling stock.

Mr. Brill was first asked whether as much electric railway construction projected abroad as in the United States, that is, whether the business is opening up largely at the present time.

In reply, he said: "The countries of Europe are in about the same condition that this country was six or eight years ago, that is as far as the urban railways are concerned. As yet there has been little done in interurban lines. The development is likely to be more rapid in European countries than in the United States, owing to the greater density of the population and the greater amount of wealth which can be used for the building of roads, and no doubt urban, suburban and interurban electric railroading will become as important an industry in Europe as in America."

"What countries are taking up this matter most vigorously?"

"Up to the present time Germany has completed the most electric railways, with France second and Great Britain third. There is considerable now being done in Italy, which is probably a good fourth. The other European countries straggle far in the rear, with the exception of little Belgium, which has done considerable for its size."

"In what countries do you think there is the best field; that is, what countries possess the best local conditions?"

"This has been probably answered by the foregoing, as the qualifications of the respective countries have placed them in the above mentioned order. The local conditions of none of the European countries are quite as good as they are here, so far as the local aspect is concerned, for the reason that in all European countries there are greater or less restrictions and difficulties, first as regards charter rights, second as regards the quality of work done, and lastly, which is probably the greatest obstacle, the restricted width of cars, together with the limitations as to loads and other details of operation. In many of the larger cities the speed limit hampers the profitable operation of a road and has brought the mileage down, in some cases, as low as ordinary horse travel. There is a scheme proposed now in England that the Board of Trade, which controls all of the tramways, shall compel them to equip their cars with a speed meter which will show the rate of speed, and will be inspected from time to time while the cars are in operation by men appointed for the purpose. I understand that the authorities of the city of Dover, Eng., have placed a speed restriction of 4½ miles per hour in the center of the city. These restrictions are so foreign to what exist in the United States that to an American railroad man they seem greatly to handicap the operation."

"Is the electric railway work abroad being done under municipal or private ownership?"

"In Great Britain the majority of the roads are under municipal ownership, as in Liverpool, Leeds, Hull, Southampton and Glasgow. On the Continent they are very largely under private ownership."

"In what respects does European and English practice in rolling stock differ from that of this country, especially in such features as length, width, height, seating capacity, length of platforms, single and double-deck cars, California types, etc.?"

"The practice differs in many respects. In England, at the present time, the double-deck car has largely the 'call,' and although a few single-deck cars are being ordered, they are very few as yet, and are greatly in the minority. The universal practice in Europe is to restrict the load of the car to the number of passengers that can be seated, except that a certain number of persons are allowed to stand on the platforms, which number is always specified by a sign on the car. In consequence, the disposition is to get very large platforms; in some cases they are as long as 6 ft., which allows standing room for nine persons. This length is 50 per cent greater than the practice in America. As regards the length of cars on the other side, they do not as yet appreciate the advantage of large units as we do in this country. The great majority of the cars are of the four-wheel type and in very few instances longer than 18 ft. in body, which gives a seating capacity for twenty-four people."

"What are the conditions which lead to the differences in types?"

"In France the double-deck car is largely in demand for the reason that the outside seats are for second class passengers and the inside for first class passengers. In Paris the rate of fare for outside passengers is one-half of that for the inside. In England the reason for the large demand and use of double-deck cars is because many people prefer the outside seats where they can smoke and get the fresh air. Open cars are very little used on account of the width restrictions and the briefness of their hot season. I think that these conditions are likely to continue."

"Is it probable that ultimately different standard types will be developed for French, English and German Railways?"

"Everything indicates, to my mind, that they will ultimately fall into the American types, which are certainly in the lead, and of the double-truck class."

"In the matter of brakes and wheels, what are the peculiarities of European practice and what are the prospects for the future of cast-iron wheels as they are used in this country?"

"As regards wheels, when we first began to ship trucks abroad our customers almost invariably demanded a steel-tired wheel with wrought-iron centers; later on we were allowed to put in cast-iron centers, and now about 75 per cent of our orders call for chilled-iron wheels. This, I think, is largely due to the fact that they have found that the chilled-iron wheels, when made with proper flanges, have given very good satisfaction. In conversation a short time ago with one of the employees of the Liverpool Corporation Tramways, I was informed that the wheels that we had furnished on a lot of cars had already made 24,000 miles, were in very good condition and looked as if they would make at least 16,000 miles more. Considering the additional wear engendered by the narrow-grooved rails, this is very good service. It might be well for me to say here that to P. H. Griffin, of the New York Car Wheel Company, is due very largely the fact that American chilled-iron wheels are now looked upon with favor. He has personally studied the subject on the ground and his agents have carefully looked into any complaints which have been made and rectified such troubles as have been called to their notice, and as a consequence we have many calls for wheels of this make. As regards brakes, the conditions are nearly the same there as they are in this country, although it is quite an interesting item historically that on a lot of trucks which we built for Rome, Italy, the authorities required that cars riding on the Seven Hills

should be fitted with the extra precaution of track brakes, in addition to the wheel brakes. I found that air brakes were used more extensively in Germany than anywhere else in Europe, and that they were of the Standard Air Brake Company's type with the axle-driven compressor, which is rather remarkable considering the fact that the axle-driven compressor is not at all in favor in this country."

"Will the high rate of speed and the long distances between their stops enable European roads to use steel-tired wheels with economy?"

"In answer to this question I would say positively, no, because I am a firm believer in the American chilled-iron wheel, as regards the economy of their use over steel-tired wheels. Steel-tired wheels, if used on T rails and well up out of the dirt and dust of the highway, will probably prove more economical than on an ordinary street railway track, but if used on the ordinary street railway track, in competition with the cast-iron wheel, there is more abrasion from the dust and grit, from the fact that their composition is much softer and more easily worn away than the chilled-iron rims."

When asked about the use of heaters abroad, Mr. Brill said: "We have not had electric heaters in the specifications of any of the cars that we have built for Europe, and I do not recollect seeing them in any of the cars in the European countries. Naturally, they must come into use in countries where the climate is sufficiently cold to call for a heater."

"Is there a favorable prospect for the introduction of American registers on European roads?"

"No, I do not see that there can be much of a field for American registers on European roads for the reason of the multiplicity of fares. At the present time the system mostly in vogue is the ticket system, which compels the conductor to give each passenger a ticket recording the amount of fare he has paid and the destination, and at regular stations along the road are inspectors who are supposed to look at them. In other places they have the bell punch system."

"How do foreign built cars compare with those built in this country in weight, cost, durability, style, etc.?"

"With the exception of the products of one or two manufacturers, the foreign built cars do not compare favorably with the American cars in the cost of construction, which is somewhat less than the transportation together with the duties taken into consideration. They keep their prices just low enough to meet these two items, so that the price is rather a high wall or bar to the selling of many cars in European countries. As regards the weight of European cars compared with that of American cars, I think that there is very little difference, as the American builders have been gradually increasing the weight of their cars to a considerable extent within the past few years owing to the increased speed, and I really think that we have arrived at a point now where our cars are heavier than European cars, because of the demand occasioned by the increased speed and loads. As regards the durability and style, I do not think the foreign builders approach us. There are a number of things that the best American builders do, that are recognized as good practice, to increase the strength of their cars without adding additional material, which as yet the European builders have not followed. As to the style and finish, there is absolutely no comparison between the average European car and the average American car. It is all in favor of the American car, notwithstanding the fact that European builders are living in the atmosphere of the old masters and high art and we are surrounded by the crudities of a new country."

"Are the German builders likely to be successful in building cars in which iron largely takes the place of wood?"

"I do not know that the Germans use iron largely in place of wood, with the exception of the panels. These are made of sheet-steel instead of thin poplar. As regards the under construction of a car, that is, the bottom framing, I think that we use about as much iron as they do."

"Is there any information available in regard to the kinds of woods used in England and on the Continent for car building?"

"They are following the American practice in this direction to a great extent and are using American lumber the same as the American car builders do, that is, oak, yellow pine and ash; but for the interior finish I find that in Germany and in France they are using a much cheaper grade of wood than we are, largely yellow pine, and they are not as careful of the selection as we are. It is not an uncommon thing to see knots of good size both in the panels and in the rails."

"Are foreigners building reasonably successful types of trucks, and what types are they employing?"

"This is rather a delicate question for me to answer, because I think that not only are the foreign builders, but that many of the American builders as well, are far from making such successful trucks as are made by my company. In the first place, the foreigners, like the American builders of trucks, are making a composite truck with numerous rivets, bolts, etc., which, when operated or shown beside our solid wrought-forged truck, makes a very poor comparison."

"Has the recent exportation of cars from America been due principally to our natural advantages in climate, material and workmanship, or simply to the fact that we have the plants and experience and can turn out the material cheaper and better than foreign countries; in other words, is the export movement a permanent one, or will it decrease with the increase of electric railway business abroad?"

"Unquestionably, it is due to the natural resources of America and the established factories for the construction of cars, but while we do make them better than those made in foreign countries, we do not make them cheaper, and it seems to me that it is only a question of time when this export movement will fall off."

In conclusion, Mr. Brill was asked how the foreign methods of business in the matter of credits, terms of payment, etc., compare with those of America?

He said: "This question embodies a little more than you have distinctly stated, probably your intention is to ascertain my opinion of the desirability of foreign business. The foreign business involves considerably more outlay at the factory in material and time for the same number of cars and trucks than does the American, for the reason that all of the cars must be taken apart and boxed in sections or boxed whole, and the same treatment is given to the trucks, which makes a delay in the output which is not met with in work for America. In addition to this, the shipping facilities for such bulky articles are so meagre that it is quite difficult to get, on the northern seaboard of the United States, transportation for a large quantity of tram cars unless the shipment is spread out for a considerable length of time. At the same time there are incidental expenses attending foreign sales which add greatly to the cost; I refer to the matter of frequent and costly cablegrams, and to the very much greater cost of selling there either direct or through local agents. The great wealth of European countries and the great competition for business has led to the giving of very long credits, and in many

cases the companies hold back a percentage for a period anywhere from twelve to twenty-four months to insure first-class work, so, ordinarily, the terms of payment are not as satisfactory nor as favorable as in this country. Again, the handling of cars and trucks for foreign account seriously interferes with the total output or capacity of a factory.

## New Elevated Railway in Berlin

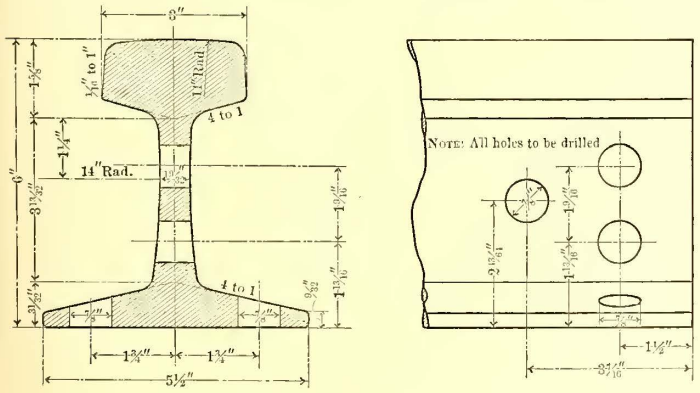
Trial trips are now being made with the first two cars on the Berlin electric elevated road. They were constructed by the firm van der Lypen & Charlier of Koln-Dentz, according to entirely new designs, and were kept for some time at the experimental station of Siemens & Halske in Gross-Lichterfelde. In exterior and interior finish the cars resemble those of the Prussian State roads, and the private imperial cars.

The two cars now in operation are motor cars, and one will be in front and one in the rear of each electric elevated train, with two trailers between them. Such a motor car is 11 meters in length, 2.3 meters in width, and is 3 meters high. It has a seating capacity for thirty-six persons, and a total weight of twenty-one tons. The two ends are fitted with semi-circular plate glass windows, by means of which the air pressure against the platforms is somewhat reduced.

The Berlin public, however, seems to be much dissatisfied with the appearance of the elevated road which is now in course of construction. The taxpayers, particularly in the West End of Berlin and Charlottenburg, demand that the still unfinished portion be built underground, which the builders refuse to do on account of the increased cost. Where the road passes the new Kaiser-Wilhelm Memorial Church, built at a cost of 10,000,000 marks, it has, however, been decided to use sandstone in the construction instead of steel. Two more years will probably be required before the road will be opened to the public.

## Third Rail for Manhattan Elevated Railway

The third rail for the Manhattan Elevated Railroad Company's electrical equipment has been selected and is shown herewith in section and side elevation. It weighs 100 lbs. to the yard and will be supplied by the Lackawanna Steel Company. The rail ends are being drilled for two kinds of bonding, through the web and through each side of the base. The contract for bonds has not yet been awarded.




THIRD RAIL FOR MANHATTAN RAILWAY

The Boston Elevated Railway Company has a man in its employ who wears eight service stripes, denoting forty years of service with the company. This is undoubtedly a record.

# CORRESPONDENCE

## Arrangement of Swing Runs

DETROIT, Nov. 25, 1899.

EDITORS STREET RAILWAY JOURNAL:

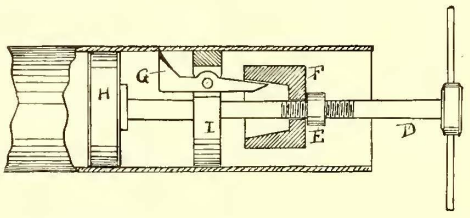
I notice in the proceedings of the American Street Railway Convention, at Chicago, one speaker advocated shorter hours for employees. I believe he was right, and particularly so in the case of swing runs, that now require work for twelve hours or more, that is until 12 o'clock to 1 o'clock at night, and beginning again anywhere from 5 A. M. to 6 A. M. I believe ten hours work would be very much better for both the company and workman. In all cases where a man is over-worked and his rest and sleep broken he is very apt to be cross, to pay less attention to business, and not be so polite and civil as when he is refreshed and well rested. If the time tables were so arranged that the last cars in were the last ones out, and ten hours constituted a day's work, except under extraordinary conditions, the company, men and the public would be better served. A. CARR.

## Pipe Thread Cutting

BOSTON, Mass., Nov. 10, 1899.

EDITORS STREET RAILWAY JOURNAL:

It is often necessary to cut an inside pipe thread in repair shop work, and for doing this I have found the home-made cutter, illustrated below, exceedingly handy. The parts are mounted on a shaft *(D)* which turns in a disc *(I)*, which fits in the pipe as shown. A head having radial slots




is fitted on the shaft at *(F)* to turn with it, the levers carrying the cutter *(G)* being pivoted at *(I)* and operated by the head. This head piece is conical in shape and when moved forward by means of the nut *(E)* is made to expand the cutting tool and cut the interior of the pipe shell as the cutter is turned by a crank keyed on the end of the shaft to turn it. The inner end of the shaft is kept straight by the cylindrical piece *(H)*. F.

Special observation of the interior of the cars will show that the varnish commences to disappear first around the sash—moisture from the windows gathering around the molding which holds the window sash, first discoloring it and gradually working into the sash itself. A car cleaner which is made up largely of oil and dryer, if used about once a week on the window sash and molding, will be found to be a great advantage. From paper at the Boston Convention, 1898.

In the selection of designs for painting of cars, the plainest and neatest design should be selected as a rule. No lettering should be done on the panels, as this increases greatly the cost of maintenance in the paint shop department. In all cases the signs should be put upon sign boards made especially for the purpose. From paper at the Boston Convention, 1898.

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*Special effort will be made to answer promptly, and without charge, any reasonable request for information which may be received from our readers and advertisers, answers being given through the columns of the* JOURNAL *when of general interest, otherwise by letter.*

*Street railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our Directory, our Financial Supplement, or our news columns.*

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

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In a recent communication to the "Electrical World and Engineer" John Lundie suggests a new method of power rating for electric railway motors, which will be most valuable to engineers as a basis for specifications. Mr. Lundie proposes to rate railway, and other motors intended for intermittent service, on the basis of the *average* electrical input in kilowatts which the motor can take care of within the commutation limits, and with a given maximum temperature difference above the surrounding atmosphere. A 30-kw. motor, for example, would be one which would, at 500 volts pressure, take without excessive heating 60 amps. of continuous load, 100 amps. for 60 per cent of the time, 250 amps. for 24 per cent of the time, etc., the maximum limit being determined generally by commutation. In other words, Mr. Lundie claims that, with a well designed motor, however much the current may vary, the sum of the percentages to total input of the $C^2$ R and core losses can be made to be nearly a constant at all inputs throughout the range of practical operation. The correctness of this theory is challenged editorially by the "Electrical World and Engineer," which states that the sum of a constant and square function cannot be a first-power function, overlooking the fact that the second power of C disappears when the *percentage* losses are considered, i. e., $\frac{C^2 R}{C} = CR$, a first-power function. In his reply Mr. Lundie points this out, and also states a fact shown by examination of many motor curves, that the sum of the percentages of copper and iron losses through a range of from 40 amps. to 200 amps. does not vary 2 per cent, and that in one of the best motors ever built the efficiency is practically a constant within working limits. He believes that this is an ideal to be aimed at in designing motors intended for intermittent fluctuating work, and under these conditions the proposed method of railway motor rating completely applies. The convenience of this method is very great, and even if there should be slight variations from exactness it would seem that results would be quite close enough for commercial use—certainly much better than obtained by the present methods of rating. Motors may be thus most easily tested in regular service to see if they comply with specifications, the process simply consisting of taking volt and ammeter readings in regular service of car, together with final temperature of coils after one or more hours' service. Moreover, with a knowledge of the average power requirements of motors on a given railway line, the rated power of motors to be specified immediately appears, though the maximum and minimum operating currents ought also to be specified.

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Two novel methods of foreign practice in electric railway construction are described at considerable length in this issue, one a side slot conduit recently installed at Paris, and the most important conduit line in that city; the other the Burgdorf-Thun three-phase electric railway in Switzerland, the longest and most important three-phase electric railway in the world. Both differ so much from American engineering practice that considerable space has been devoted in this issue to their description. This does not necessarily mean that we believe that the methods followed will obtain wide adoption in this country, but being on entirely new lines they will undoubtedly suggest certain points which can perhaps be utilized to advantage, and as they represent the best engineering practice in these directions in the countries in which the installations have been made, they are undoubtedly of great interest. The side slot conduit in Paris is avowedly patterned in most particulars after that of the Metropolitan Railroad Company, of Washington, with the exception of the position of the conduit, and was, in fact, installed by the same engineer, Mr. Connett. The use of the side slot was obligatory, but as Mr. Connett points out, has a number of disadvantages as compared with the center slot conduit. These are practically insurmountable at switches, so much so, that the conduit had to be diverted to the center of the track at these points. Even under these conditions the necessary width of the slot would, to American eyes, make the system impracticable in American cities. The width of slot admitted by the authorities in some of the foreign cities seems to us almost incomprehensible when we consider that in New York, Chicago and elsewhere, where cable and electric conduits are used, the slot rails form a favorite path for bicyclers, while in Buda-Pest, for example, a bicycle wheel with even a $1\frac{1}{2}$-in. tire would pass through the slot without

difficulty. The slot in Paris is only 1 in., but this is considerably wider than New York or Washington practice.

* * *

The three-phase railway seems to be peculiar to Switzerland. Of the four roads which have been built, in which three-phase motors are employed, three have been within the boundaries of that country, and the fourth, that at Lugano, is practically so, being but a few miles beyond the boundary, in Italy. The reason for this fact is that all of the pioneer work in this direction has been carried on by Brown, Boveri & Company, and they should receive the credit for undertaking this advance work at a time when the proposition was looked at askance by other builders. While the alternating system possesses certain advantages it is noticeable that American practice limits the use of the alternating current to the distribution system. There are plenty of railways in this country with operating conditions very similar to the Burgdorf-Thun line described elsewhere, and others are projected, but in every case where the current is distributed at high potentials, rotaries are used for rectifying the current and reducing it to the standard railway voltage before placing it on the trolley wire. Of course, one more conversion is required, and the economy of the entire system is reduced by the loss in the rotaries; on the other hand it is thought here that the practical benefit is more than made up by the convenience afforded in a simplified overhead system, a more flexible control of the motor speeds, and finally, and most important of all, in the ability to use standard railway apparatus. While the electric motor of to-day may be far from perfect, its ailments and weaknesses are thoroughly understood, and can be guarded against or the apparatus repaired in case of disaster, by men who have gained their experience on any of the existing electric roads. Again, practically every high-speed road which has been built or is projected in this country, runs into some large city over existing city tracks, and as this condition is likely to continue, railway managers would not regard with much favor a proposition to employ one electric system and kind of motors for suburban service, and another for city service, so that, until alternating current engineers are ready to supply an alternating current railway motor and system which would be more desirable for city service than the present direct current motor and distribution system, we do not look for any extended use of three-phase work on interurban railways outside of distribution circuits.

## Will the Proposed Underground Railway in New York Pay?

With all legal obstacles removed, the Board of Rapid Transit Commissioners of the City of New York has issued invitations for bids upon the proposed rapid transit tunnel railway. This railway is to run through a 50-ft., four-track tunnel from a southern (loop) terminal at City Hall Park, north to the Grand Central Station on Forty-second Street, thence west a short distance to Broadway, and thence north through upper Broadway (formerly the Boulevard) to Ninety-seventh Street. From this point two double-track branches will run, one, by combined tunnel and viaduct, north on the west side of the city to a point above 230th Street on Washington Heights, and the other, by tunnel and viaduct, east and north on the east side of the city to Bronx Park.

In laying out this route the Rapid Transit Board has evidently, and perhaps quite rightly, had in mind the upbuilding of the city rather than the construction of an immediately profitable transportation system. In other words, it is proposed to build a "real estate road" on a large scale. For many years past, upper Broadway, or the Boulevard, has been in a languishing condition, and a great disappointment to over-enthusiastic real estate speculators. The upper West Side, which the Boulevard nearly bisects, has been given over almost entirely to the better class of residences, and business interests have been confined to the supply of local trade requirements. Real estate in the "Annexed District" above the Harlem, now to be served by the East Side line, has also been "quiet" through lack of adequate transportation facilities. Unquestionably the new rapid transit railway will, if built in its entirety, add enormously to property valuations along and nearby its routes, and will be of great benefit to the city.

The questions which capital will have to face in acting upon the invitation of the city to build this tunnel are, however, of a different order. It is true that a syndicate may be formed which shall combine the functions of building and operating this railway with those of investment in real estate in this district which the railway is to serve, and such a syndicate may hope to reap either a triple profit, or a profit from the real estate ventures large enough to wipe out possible losses from the building and operation of the railway. Primarily, however, it is certainly desirable that the railway shall be at least self supporting from the start, and shall eventually, through the seventy-five-year lease which the city offers to the constructors, become profitable in an increasing ratio. What are the chances that this may be done?

The entire route is divided into four sections. Section I. comprises the portion below Fifty-ninth Street; section II. the portion north of Fifty-ninth Street to 137th Street on the West Side, and from Ninety-seventh Street to 135th Street on the East Side; section III., the portion north of 137th Street to Fort George on the West Side, and north from 135th Street to Melrose Avenue on the East Side; and section IV., the portion north of Fort George on the West Side, and north of Melrose Avenue on the East Side.

The city, being desirous of limiting its total liability, proposes to reserve by contract, the right to determine whether sections II., III. and IV., either or all, shall, or shall not be built. The bidders, now necessarily ignorant of the city's decisions, which may be made one, two or three years hence, are expected, therefore, to see a profit in the construction and operation of section I. alone, and of the entire road. Otherwise they cannot bid with safety on the present specifications and proposed contract.

They must, therefore, first face the problem: Will section I. alone be profitable?

We have no doubt whatever upon this point—it will never be profitable to operate this section alone until the time comes when both surface and elevated cars operating in the lower end of the city shall be so overcrowded that passengers are absolutely forced, in self-defense, to take the underground as a third alternative route.

Consider the situation. The lower end of Manhattan Island, from Fifty-ninth Street to the Battery, is but 5

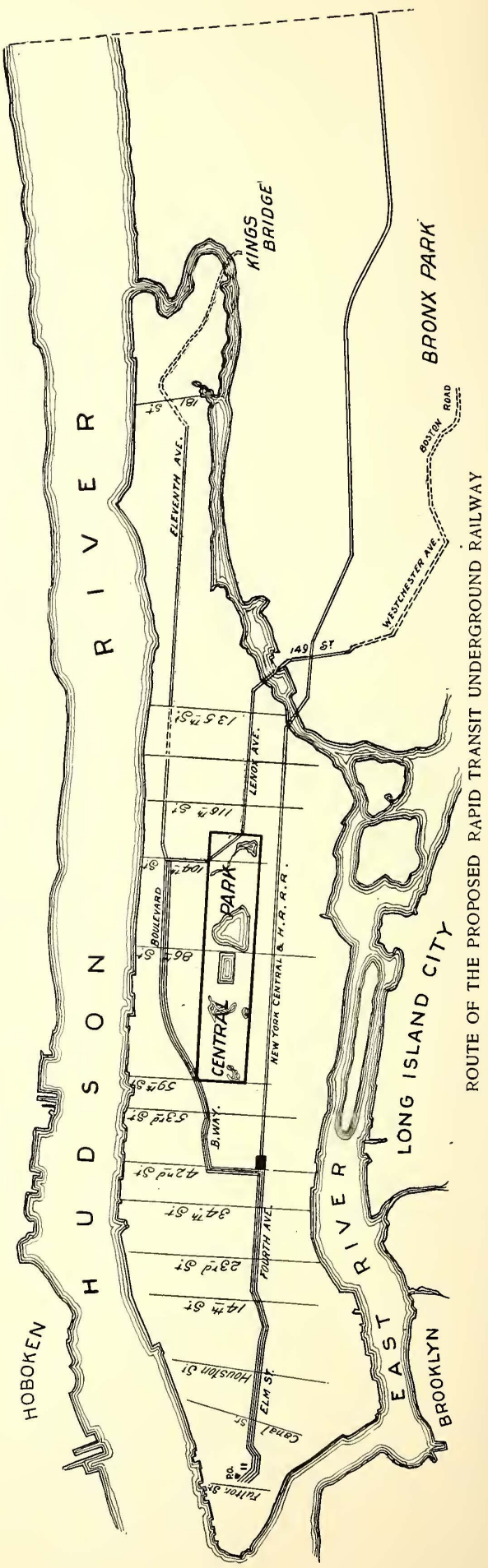
miles north and south, and 2 miles wide at the widest portion. While there is still a large residential population in this territory, it is being steadily crowded northward out of the district by the increasing demands of business, and it will be more true in the future even than now that the great residential areas of the city will be north of Fifty-ninth Street. It follows, therefore, that the entire traffic below Fifty-ninth Street must necessarily be "short distance," and that a tunnel railway limited to this area will not have a large morning and night travel. It cannot possibly compete with the surface lines, or even the elevated in securing short distance riding, partly because people do not like to go up and down stairs, particularly to a dark, and perhaps a noisy tunnel; partly because the tunnel railway runs to City Hall Park only, and does not serve the lower end of the island, nor has it any large attraction at the northerly end; but chiefly because the most generous system of transfers known probably in any city of the world, prevails on the surface lines, and makes it possible for a would-be traveler to go east and west and north and south between any points by the payment of a single fare. We repeat, therefore, that section I. alone for the proposed terminal railway is a proposition likely to be wholly unattractive to capital.

Will sections I. and II., taken together, be profitable?

That portion of Manhattan Island north of Fifty-ninth Street and west of Central Park and Lenox Avenue has been built up during the past ten years with myriads of private, and apartment houses of the better class. It is generally considered to-day the most desirable portion of the city in which to live, except for upper Fifth Avenue along the Park, given over chiefly to the residences of the extremely wealthy. The density of population in this West Side area is not large, however, for the class of people who inhabit it are those who desire more breathing room than can be had in other parts of the city. The East Side of the city, for example, from 125th Street to the Battery, is of enormously greater value from a railroad point of view than is the West Side, for it is here that the "tenement houses" proper are found, together with a busy, humming industrial life, which forms a great contrast to the quiet, peaceful streets of the West Side district.

Now, this West Side district to be served by section II. of the tunnel railway is less than three-quarters of a mile wide, except at the part above the park, where it is approximately a mile and a half. This narrow area is now served by a three-track elevated railway on Ninth Avenue, running rapid express trains night and morning, and soon to be equipped for a vastly superior and more rapid electric service; two electric lines on Eighth and Amsterdam Avenues, now in operation and giving an exceptionally perfect service; a cable line in Columbus Avenue, soon to be converted to electricity; a horse line on upper Broadway, immediately over the proposed tunnel line, electrical operation of which by the underground conduit system will begin within a few weeks, and a horse line on Amsterdam Avenue to be run by electricity in due time.

An independent tunnel railway will hardly get from this district more than the through, or long distance, travel. In competition with it will be the surface lines giving free transfers to any part of the city below Fifty-ninth Street, and the elevated lines, giving a service almost as rapid as the underground, with 3-cent transfers over the upper



Broadway surface line, and many others in the city. The tunnel railway will miss the profitable short distance riding entirely, including the major part of the ladies shopping travel, and if the city insists upon express train service throughout the day, as appears probable, it will unquestionably be conducted at a heavy loss.

The only salvation for sections I. and II., as a railroad proposition, is that through their construction upper Broadway from Forty-second Street north will become a great business street similar to lower Broadway. We doubt if this will happen, for many years to come, at least, for the "feeder district" to such a street is narrow and is populated by a class of people who would resent the introduction of the business element into this region. Eventually, perhaps, when some outlet above the Park has to be given for business development, the existence of such a railway as this would determine the march of progress, and the city would be better balanced than would otherwise be the case. We believe, however, that sections I. and II. of the proposed tunnel railway, taken together, would be unprofitable for a number of years to come.

Sections III. and IV. would be of immense benefit to the "Annexed District" and the upper end of Manhattan Island, and in a comparatively short time after the completion of the road this whole area would form another city. It is probable that the tunnel railway could secure practically all of the business from this area to the lower end of Manhattan Island, and that its morning and evening trains, both express and local, would be crowded. But consider a 5-cent fare for such long distance travel! If a business of this kind is profitable for such an enormously costly railway as is the proposed tunnel line, surely the surface and elevated railways of New York must be Golcondas indeed!

Passing now from the consideration of the details of the project, let us summarize the general financial requirements of this railway, assuming it to be independent of all other transportation systems in the city. The tunnel railway will probably cost as a whole not less than $40,000,000, and its equipment not less than $10,000,000. The rental, and a fair interest on cost of equipment would be not less than $1,500,000 per annum for the first five years. On this railway, built avowedly for long distance traffic on a uniform 5-cent fare, it can hardly be expected that operation at less than 70 per cent of the gross receipts can be achieved. If this is so, the railway must earn $5,000,000 per annum during the first five years in order to save the operating company from loss—to say nothing of leaving it any profit. The network of present transportation lines shown in the map on page 881, a network consisting of four trunk elevated railways from the Battery to the Harlem River and beyond; twelve trunk surface lines north and south on Manhattan Island; innumerable crosstown feeders to these elevated and surface trunk lines; and a widely ramified surface railway system above the Harlem—is earning only about $25,000,000 per annum gross. Can a single line through and to territory such as has been described, and without feeders or crosstown connections, earn one-fifth of this grand total? Frankly, it does not seem to us probable, at least until, as said before, the city shall have so fully outgrown its surface and elevated facilities of travel as to be forced to take to the underground for short distance riding.

We have spoken so far of the tunnel railway as a wholly independent proposition. There remains for consideration the question as to whether or not it will be a profitable adjunct to any of the existing surface or elevated systems. Will the Manhattan, Third Avenue or Metropolitan syndicates see an opportunity for strengthening their grip upon the transportation industry of New York, and of making additional profits for themselves?

It is hard to see how ownership of the tunnel railway by the Manhattan Company would strengthen either property, as there is little chance of cross connection or valuable transfer arrangements. What the Manhattan Company needs to-day more than any other privilege is that of building short connections for its four trunk lines on various important streets across the island. The rapid transit tunnel must be essentially a competitor to Manhattan for long distance traffic, and it is not the long distance traffic which the Manhattan Company needs, or is seeking.

Were the tunnel railway owned by the Third Avenue or Metropolitan Companies a transfer system might be introduced which would be of benefit to both tunnel and surface lines. In this case, the surface lines would be distributing and collecting agencies—the tunnel railway would be one only of the through lines. But the questions arise, first, why either of the great surface companies should go to great pains and enormous expense to give to the people a long distance combined surface and underground ride for 5 cents on a free transfer plan, or, second, whether a sufficient amount of traffic could be secured on a 7-cent or 8-cent joint rate to warrant the arrangement of a costly through service of this kind. The function of the surface lines of New York City is, and always will be, to handle the short distance traffic, and their interests lie in the direction of forcing to the elevated or underground lines the less profitable long distance riding, thus freeing their cars for the better class of traffic. Are they prepared to accept the financial responsibilities of "the other end," i. e., assume the burden of catering to the long distance riders of the city on a 5-cent fare?

It is with the greatest reluctance that we have been forced to the conclusion that the Rapid Transit Commission's present plans and proposed contract do not afford sufficient inducement to capital to warrant the confident hope that the tunnel will be built. We sincerely hope that our view of the case may be a mistaken one, and that the risks may be assumed, for certainly New York City needs now, and will in the future even more urgently need, every transportation agency which can be crowded into Manhattan Island. If responsible parties can be found to undertake the task upon the present basis, we shall be heartily glad, and will be first to congratulate the Rapid Transit Board on its success, though we should not advise the "widows and orphans" to invest their money in securities representing such a railway. If capital says "no," we should strongly advocate a more liberal proposition, such as, for example, the right to charge graded fares up to 10 cents for the longer distances, or the right to charge a 10-cent fare for express train service, with a 5-cent fare for local. We all want better transportation facilities in New York City, and, within reasonable limits, the time saving is of more importance than is the saving of the last penny of transportation cost.

## Transportation Earnings and Profits on Manhattan Island

The changes brought about during the past fifteen years in the transportation conditions of New York City, and particularly of Manhattan Island, are hardly yet fully understood by the people, or even, perhaps, by many of the capitalists interested. A mere examination of the city railway reports from year to year does not convey an adequate idea of the results of the intense struggle for traffic which has been going on, or of the true influences at work, and a retrospect of at least ten or twelve years is necessary if this understanding is to be gained. There were then found on Manhattan Island no less than twenty operating companies, surface and elevated, each working in its own special, but limited, field, and each at peace with its neighbors save for an occasional quarrel over the replacement of a crossing or some small question of trackage rights. Horses were used on all the surface lines except on a single cable road "away out in the country," on 125th Street in Harlem, and no disturbing thoughts of radical improvements in service or the introduction of new motive powers were troubling either the railway companies or the people.

From the standpoint of our present knowledge we can see that the most important event in the transportation history of Manhattan Island, and perhaps in its recent general history as well, was the purchase in 1886 by a small group of Philadelphia capitalists of a controlling interest in the Chambers Street and Grand Street Ferry Railroad Company, and the Houston, West Street and Pavonia Ferry Railroad Company. There was then introduced into the local situation an element of progressiveness and aggressiveness which was destined in a few years to leaven the whole lump, and to turn a comparatively sleepy Dutch city into a modern American metropolis.

For five or six years this long-headed "Philadelphia Syndicate" laid its plans and carried them out quietly but most effectively. Control of one after the other of the local horse railway properties was purchased at prices then deemed extraordinary—even extravagant. The former owners congratulated themselves heartily, and with reason, upon the excellent bargains which they made in disposing of their stock holdings. Purchases were not infrequently made on a 4 per cent or even a 3 per cent basis. These bargains were, in truth, of a kind advantageous to both purchaser and sellers, inasmuch as the latter could never do with their isolated properties what could be accomplished were they welded into one great system, while the purchasers, with a largeness of conception and a wealth of financial resource never before found in street railroading in this or any other country, were able to consolidate into a single great property no less than three-fourths of the entire surface railway mileage of Manhattan Island.

It is not to be supposed that these purchases and consolidations were effected without the opposition of powerful rivals in the field. It was not, however, until the principal work of purchase had been done that this opposition crystallized into any definite form. The Third Avenue Railroad Company, though more than once approached by the Philadelphia syndicate, with a view to purchase, resisted all blandishments, and eventually, though very "late in the game," purchased on its own account control of the two horse railway properties on Manhattan Island, left in independent operation by the Philadelphia syndicate, the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company and the Dry Dock, East Broadway & Battery Railroad Company, while, a little later, control of the Union Railway Company, with its connections, operating under most valuable franchises through the entire "Annexed District," above the Harlem River, was also secured by the Third Avenue Company. Prior to these purchases the Metropolitan Street Railway Company, into which had been consolidated or to which had been leased all the properties purchased by the Whitney-Widener-Elkins syndicate, had built a new cable line on Lexington Avenue, paralleling the Third Avenue main line on the west, and had secured control of the Second Avenue Railway paralleling it on the east, and soon afterward a lease to the Metropolitan Company of the Fourth Avenue line of the New York & Harlem Railroad Company was effected. At the same time general transfers were introduced all over the Metropolitan Company's system, from cross town to north and south lines, and the Third Avenue Company finding itself surrounded by sharply competing lines and in an uncomfortably isolated position, made the purchases referred to in order to obtain outlets and feeders for its main line.

The Manhattan Railway Company, operating all the elevated lines in the city, seems never, until recently, to have taken any interest in the surface railways of New York, and it did not see until too late the tremendous influence which was to be exerted upon its own gross and net earnings by the intelligent competition below its tracks. This competition began to be felt by both elevated and Third Avenue systems even while the Metropolitan syndicate was still operating its purchased lines by horses, and before the great work of improving the motive power was commenced, for what had been at first a mere agglomeration of individualized horse railway lines, each run by its own superintendent, upon different policies of management, were unified in such a way that economies could be effected and the service greatly improved. New routes were laid out for the better handling of traffic, and transfers were introduced, while it will be remembered that the Broadway horse cars were the best equipped and the fastest in the city, in spite of the great congestion of that thoroughfare.

In 1890 the Metropolitan syndicate determined to cable its Broadway line from the Battery to Fifty-ninth Street. At about the same time the Third Avenue Railroad Company obtained the long-sought right to cable its main line on Third Avenue. It was then generally believed by engineers and street railway managers that for a traffic of such enormous density as that of Broadway and Third Avenue—a density greater perhaps than that of any other lines in this country—the cable system was far superior to any form of the electric, and would never be superseded. Following the equipment of the Broadway line, the Lexington Avenue and Columbus Avenue cable lines were built as branches to the main Broadway stem. Thus was the work commenced of improving the motive powers on New York City railways, the Third Avenue Company really taking the lead in the building of its 125th Street cable line in 1886, and the Metropolitan syndicate taking the lead in main line work.

The attempt was next made by the latter to secure the right to introduce the overhead wire electric system on Sixth Avenue under the elevated structure, but the people of New York had just gotten rid of overhead electric wires, literally by main force, and were determined to have no more, so that this attempt completely failed. The situation confronting the syndicate was now most puzzling, and disaster stared it in the face. All plans had been based upon the securing of these overhead electric rights, as had been done with comparative ease in Philadelphia and other large cities of the country. The purchases of horse properties had been made at high prices with this in view, and if they were forced to continue operation by horses or to go

to the enormous additional capital expenditure required for the cable system, success was by no means assured.

In this emergency it was determined, with characteristic courage, to undertake an elaborate experiment with the underground conduit electric system, which had until that time a record of uniform failure wherever tried in this country, though it was claimed to be partly successful in a single European city. The Lenox Avenue line was built with a conduit of such size that if electricity should prove a failure, the cable could be installed. The success of this initial experiment was so pronounced that the decision was made in 1897 to adopt the underground conduit electric system in somewhat modified and cheaper forms for all the north and south lines owned by the Metropolitan Company, the decision regarding motive power for the cross-town lines being left till a later date. As a consequence, there have been put into operation during the past two years the Second Avenue, the Madison Avenue, the Sixth Avenue, the Eighth Avenue and the Amsterdam Avenue lines, all by the underground conduit electric system. The instant success of the new electric cars in winning popular favor and the great increase in traffic over the old horse lines which they replaced, has been so marked that it has been determined to convert all the present cable lines of both the Metropolitan and Third Avenue Companies to underground conduit electric, and in accomplishing this the Third Avenue has led, its complete line from City Hall to Harlem having just been put into operation, while work upon the Broadway system is going on as rapidly as circumstances will permit, and it is expected that the change will be completed next year.

For reasons which will presently appear, the Manhattan Railway Company has determined to make a change of motive power from steam to electricity, and ground has been broken for its new power station, for which a portion of the equipment has been ordered, while contracts for its car and other equipment will shortly be placed.

Having thus briefly reviewed the street railway history of Manhattan Island during the past twelve years, and further referring to the map on page 880, showing the lines of the three competing systems, we are now prepared to examine the diagram, Fig. 1, which shows how all these changing conditions have influenced the relative traffic secured by these systems. In 1888 the Manhattan Company and its later acquisition, the Suburban Rapid Transit Company, the latter operating in the "Annexed District," showed passenger earnings of $8,695,347 gross. The company's earnings steadily increased until 1893, when they became a maximum at $11,070,360. From this point on the record is dark, the falling off in earnings being precipitous for two years, and then more gradual until in the year just ended (June 30), the company is back to almost the starting point in 1888, with but $8,703,996 passenger earnings.

The Third Avenue system on Manhattan Island (by which we mean here and elsewhere in this paper a combination of the Third Avenue Railroad, the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway, and the Dry Dock, East Broadway & Battery Railroad, excluding, therefore the Union Railway and its allies in the "Annexed District") earned in 1888 from all sources $2,693,874, and for the next two years these earnings were slightly increased. Then followed a four-year period of but little change, after which the traffic winning influence of its new main line cable system became evident, a maximum of earnings being reached in 1896, when $4,097,268 was obtained. For two years following this the Metropolitan competition is seen in slightly declining earnings, and in the year just ended this decline is decided, owing no doubt in part to the interruption to traffic caused by conversion from cable to electricity, but in part also to the competition of the Madison Avenue and Second Avenue electric lines, which have been most popular means of surface transportation on the East Side.

What have the Metropolitan syndicate lines been doing meanwhile? In 1888, the fourteen companies then in existence which were later merged into the Metropolitan system, were earning $7,268,901. Now, the Metropolitan system, including the mileage of these fourteen original companies and that of several others built from time to time since 1888, is earning nearly double the income of that year, or $14,133,810.* The course of the line of growth in the earnings of the Metropolitan system may be traced in the diagram, and is sufficiently indicative of the reward given by a great city to enterprise and generosity, in the management of a transportation system.

In examining the course of gross traffic, however, we

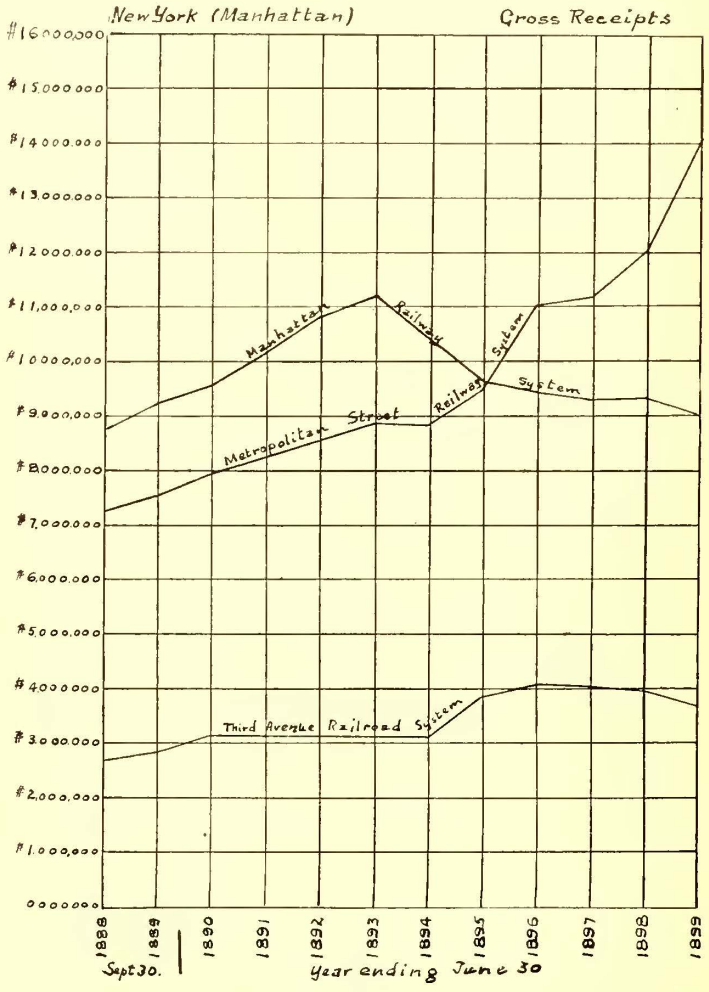



FIG. 1

are taking a merely superficial view of the whole question. The investment and operating costs necessary for obtaining new traffic or for keeping that which is retained are of deeper interest and in some aspects really reach the heart of the transportation problem of this great city, having a bearing upon the possibilities of the new rapid transit railway perhaps to be constructed, and indicating the probable future of the existing systems in competition. We may pass then to the consideration of the financial history of the three great systems, as expressed in the diagrams, Figs. 2 to 7, in which are exhibited in graphical form the relations of capital stock, funded and floating debt, and the disposition of gross earnings.

* This figure includes the operating and other income of the Metropolitan Street Railway Company proper, the Central Crosstown Railroad Company, the Thirty-fourth Street Crosstown Railroad Company, the Twenty-eighth & Twenty-ninth Streets Crosstown Railroad Company, and the Fulton Street Railroad Company.

### The Third Avenue Railroad System

The Third Avenue Railroad system on Manhattan Island consists (a) of the main stem on Third Avenue, now a double track electric railway; (b) of a crosstown line on Forty-second Street from North River to East River, now running by horses, but in process of change to electricity; (c) connecting with this, a line through upper Broadway to Fort Lee Ferry, also running by horses now but to commence electric operation within a few weeks; (d) a crosstown line on 125th Street from river to river, now in operation by electricity; (e) a line from 125th Street to Fort George, at the upper end of the island, now running in part by electricity and in part by horses; (f) a crosstown horse railway line from the East River through 110th Street and St. Nicholas Avenue to Fort Lee Ferry; (g) a crosstown horse railway system in the lower part of the island, and (h) a line on Amsterdam Avenue to be run by electricity. The following figures and the diagrams do not include the Union Railway and its connections in the "Annexed District," control of which is owned by the Third Avenue Railway. This latter system is nearly self-supporting on an interest paying basis, but is not now adding to the dividend earning capacity of the Third Avenue system, though there is no question that in course of time the Union Railway Company's lines will be of great value, from the large growth of population expected in this comparatively new section of the city.

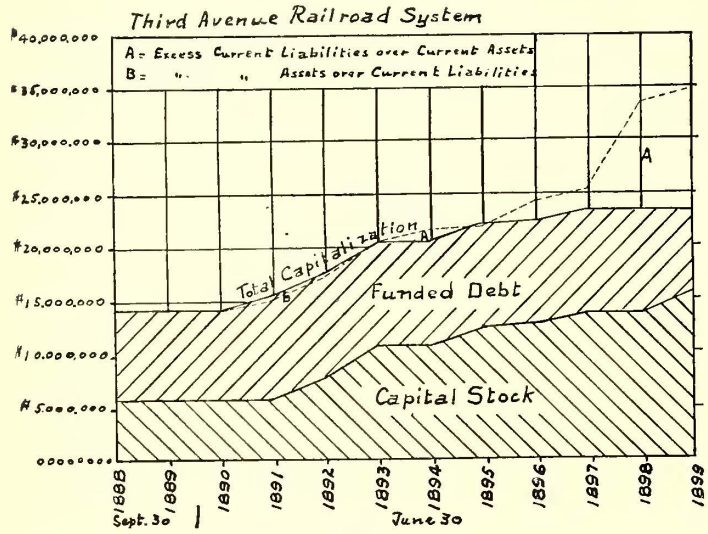



FIG. 2

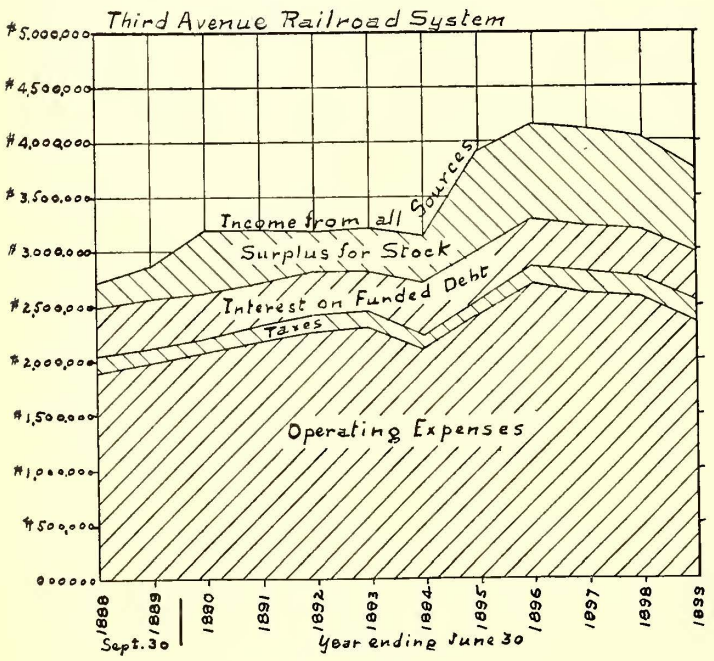



FIG. 3

The following figures and the diagrams do not include the Union Railway and its connections in the "Annexed District," control of which is owned by the Third Avenue Railway. This latter system is nearly self-supporting on an interest paying basis, but is not now adding to the dividend earning capacity of the Third Avenue system, though there is no question that in course of time the Union Railway Company's lines will be of great value, from the large growth of population expected in this comparatively new section of the city.

Referring to Fig. 3 the proportion of the total income paid out by the Third Avenue system in operating expenses, taxes and interest on funded debt for each year since 1888 are clearly seen, and surplus earnings for stock are shown to be at a maximum in 1895. In the three following years they fell off slightly, and in 1899 the reduction is considerable, owing in part, no doubt, to the difficulties incident to the period of reconstruction. The capitalization, both in stock and funded debt, has increased but gradually, but a large floating debt has lately been created, as is seen by the diagram, Fig. 2, so that the total stock and debt at the present time amounts to about $35,000,000. This floating debt doubtless represents in large part the cost of stocks of controlled companies purchased, together with the not yet capitalized cost of electrical construction, and the stock and debt outstanding should be reduced by the par value of the controlled stocks in the Third Avenue treasury, whatever this value may be. For various reasons not connected with the present discussion, the company has chosen to finance its electrical reconstruction by the proceeds of stock sales instead of bonds, and the entire capitalization (in stock and funded debt) of the whole Third Avenue system will probably be eventually about $50,000,000.

If, now, a return of 5 per cent is to be made on both stock and bonds of the Third Avenue consolidated system, a gross earning power of between $5,000,000 and $6,000,000 must be reached in order to obtain the necessary $2,500,000 for stock and bonds. The present earning power of the whole system, including not only the lines on Manhattan Island, but those in the "Annexed District" and Yonkers, is approximately $4,500,000.

### The Manhattan Railway System

In the diagram, Fig. 5, is seen the disposition of the income from all sources of the Manhattan Railway system, including the "Suburban" extension in the "Annexed District," whose earnings cannot now be separated from those of the system on Manhattan Island. It will be seen that the surplus left for stock was large in the earlier years of the enterprise, and reached a maximum in 1893, since which time it has fallen to comparatively small proportions, and is now (year ending June 30, 1899) smaller than ever before in the twelve-year period, except in 1896, when it was but $2,000 less.

There is another most significant feature of the Manhattan diagram. It is here brought out in the clearest and most unmistakable way how the fact that the Manhattan Company has lost its short distance riders to the surface lines, and has retained only the long-distance traffic, affects profits. It is seen that in spite of the great reduction in gross income, the operating expenses have been reduced but slightly, while the expenses and taxes combined have been on an almost constantly increasing scale. Ordinarily in railroading expenses are increased and reduced in some proportion to gross income, but the Manhattan Company has been apparently unable to do this. The well known fact that a seat can now be generally obtained in the elevated cars except in the rush hours, is collateral evidence that the Manhattan Company is keeping up its train service with diminishing traffic, and it is probable that were this not done the falling off in traffic would be even more serious than now.

It goes without saying that the short distance riding on any railroad where uniform fares are charged is the profitable traffic, the long distance the less profitable or unprofitable. If the proportion of the short distance riding is large,

the percentage of operating expenses to gross receipts will be small. If the long distance riding predominates the percentage is larger. The Manhattan Company's experience is instructive, and the following table, showing the percentage of operating expenses to receipts from operation during the past twelve years, is even clearer evidence as to how great is the loss of short distance riders.

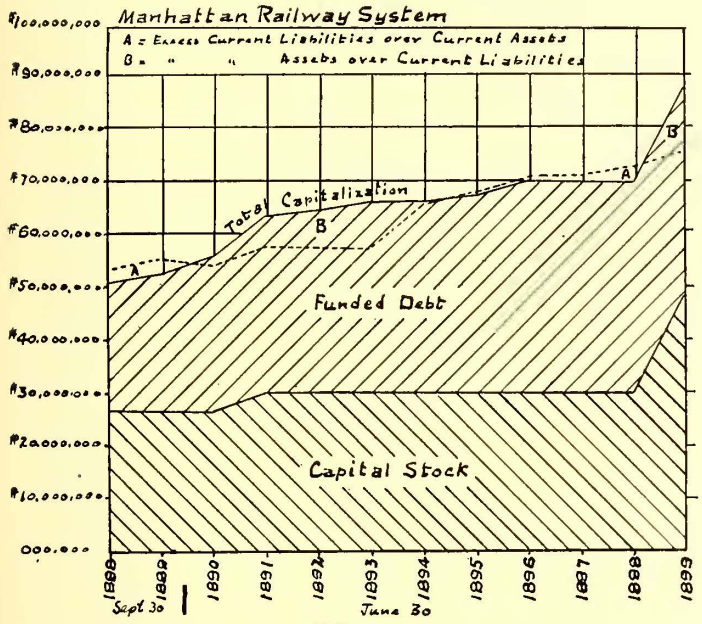



FIG. 4

Percentages of operating expenses to operating income of the Manhattan Railway system, 1888-1899.

| | Per cent | | Per cent |
|---|---|---|---|
| 1888 | 55.1 | 1894 | 54.5 |
| 1889 | 54.5 | 1895 | 57.6 |
| 1890 | 52.7 | 1896 | 59.7 |
| 1891 | 50.9 | 1897 | 57.9 |
| 1892 | 50.7 | 1898 | 58.0 |
| 1893 | 50.3 | 1899 | 60.3 |

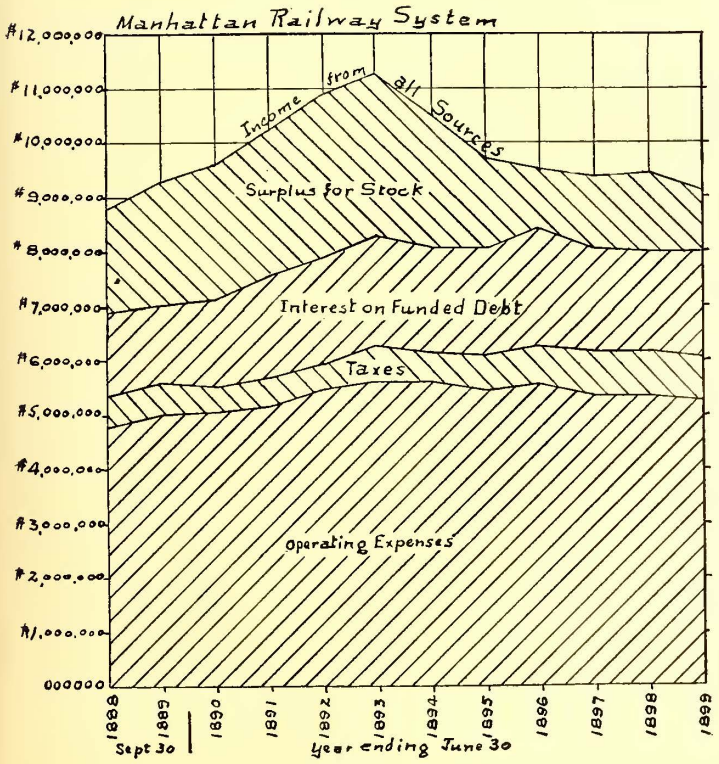



FIG. 5

What does the future hold in store for the Manhattan Company? Can it regain its lost earnings, gross and net? What will be the effect of electrical equipment upon its dividends? These are the questions which are puzzling the managers of this great enterprise.

This may be said broadly, that in the course of time, perhaps ten years hence, perhaps even less, every transportation agency on Manhattan Island will be taxed to its ut-

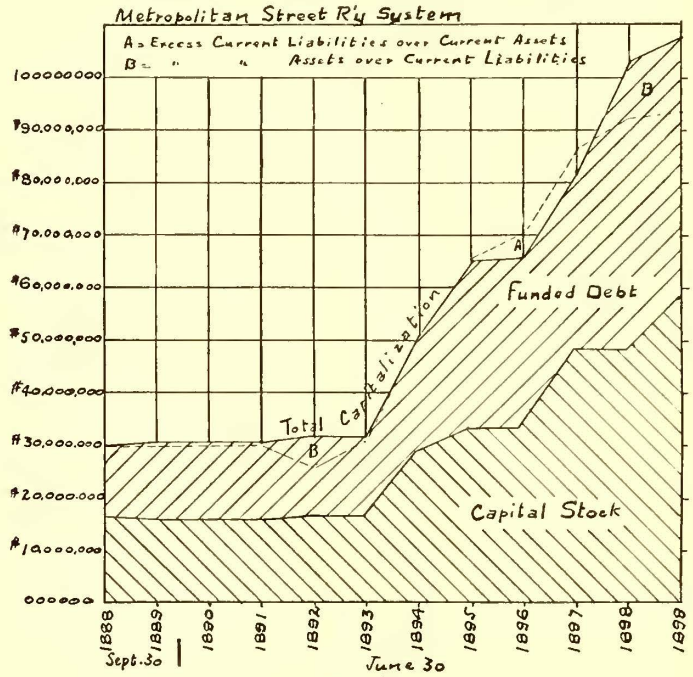



FIG. 6

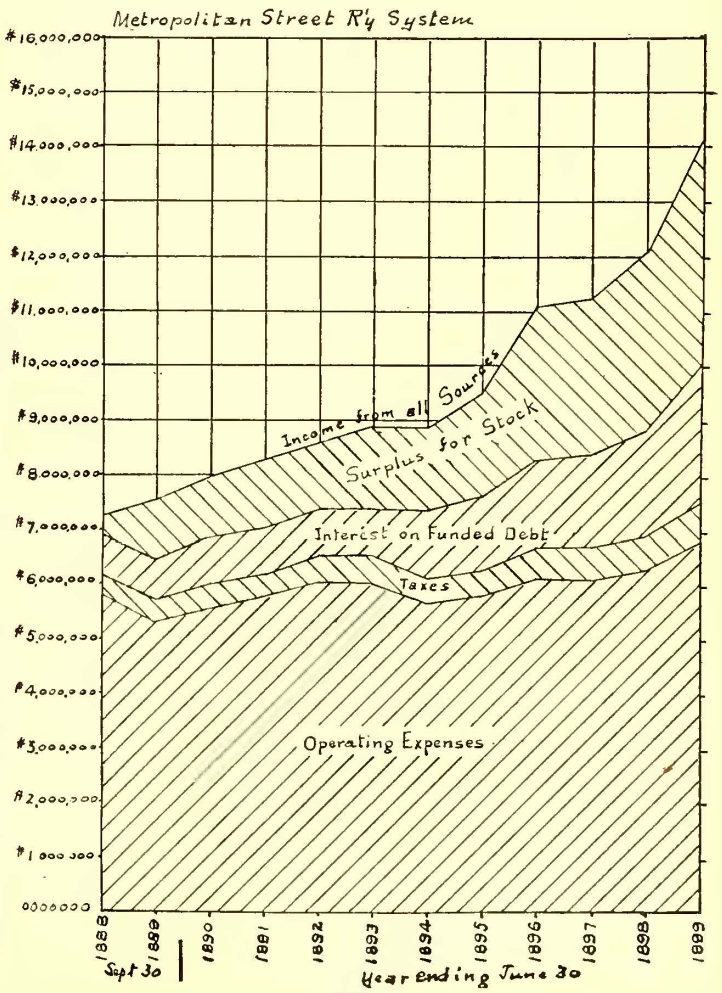



FIG. 7

most to provide accommodation for a traveling public greater by far in numbers and in freedom of patronage than exists to-day. Even should the Manhattan Company

fail to make any great improvements upon its system, its cars would probably, in time, get back much of their lost business, from the simple inability of the people to crowd upon the surface cars. The next few years of such a policy would, however, be disastrous to the company, and, in fact, for the next three or four years at least, if not for more, during the period of electrical equipment, the Manhattan Company must look forward, with what grace it may, to the prospect of diminishing gross and net earnings, since in addition to the still increasing facilities offered by the surface lines, there will be the interruptions to traffic coming with the physical work of electrical equipment.

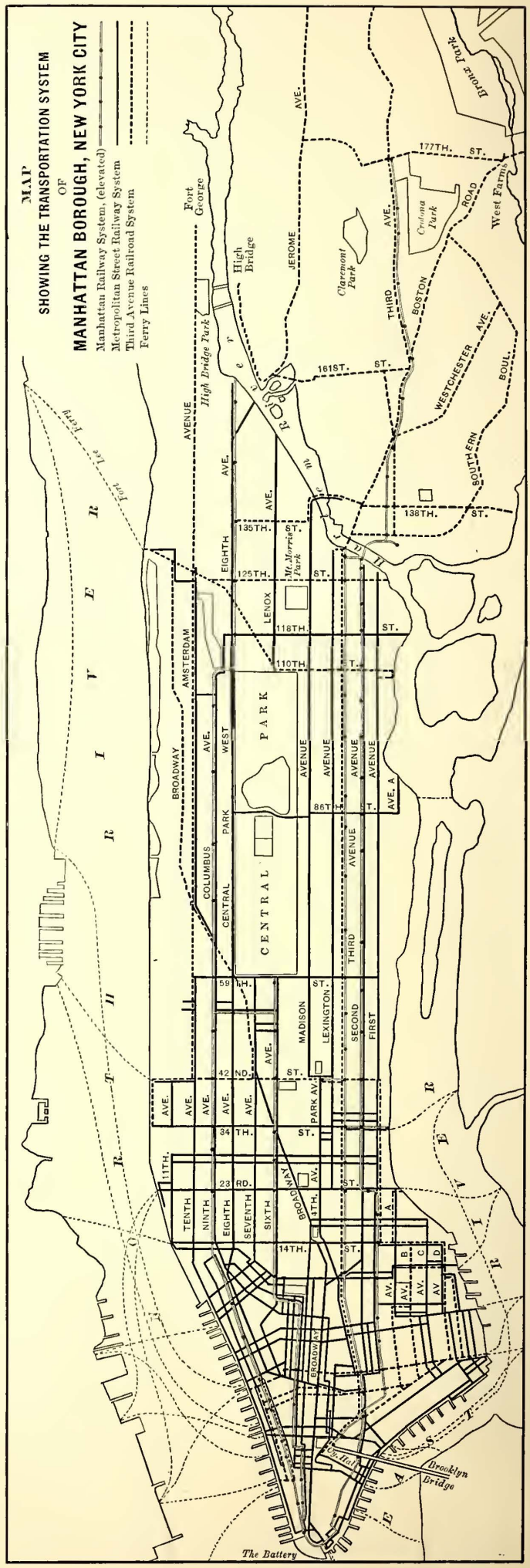
What electricity should do for the Manhattan system is to advance by a few years the period of returning traffic. How many years this will be advanced depends upon the wisdom of the decisions made by the present management. If they go into electrical equipment with the idea of saving money in operating expenses rather than of working up an increased traffic, they will miss their real opportunity, and will suffer in consequence. The cheapest thing which any electric railroad or street railway can buy or make is *power*—the most expensive thing is *labor*. If the Manhattan Company is "penny wise and pound foolish" it will buy motors and equip its power station with the idea of running its cars at the present schedule speeds, or but very little faster. If it deals with the subject in a broad and comprehensive way, determining to give the people what the people need—genuine rapid transit—it will buy large motors and large generators, and spend power freely in sending its trains over the road at much higher speeds than could ever be obtained by steam; it will put electric elevators at all its stations throughout the city; it will adopt types of cars attractive to the public, both in summer and winter; and, in short, it will be generous to the people, of New York City, who are, perhaps, of all city peoples, most quick to appreciate and use the best things of all kinds offered to it.

The immediate future of the Manhattan Company is measurably in its own hands. It is only a pity that in an age of progress and rapidly changing conditions it should have delayed so long in taking advantage of its immense potentialities. It might have controlled the transportation industry of New York City—it has let the opportunity slip from its grasp, and it can never be regained.

### The Metropolitan Street Railway System

The remarkable growth in gross earnings from $7,071,940 in 1888 to $13,423,020 in 1899 has already been referred to. A more remarkable thing is that with this 90 per cent increase in gross, the operating expenses show an increase of but 17 per cent, namely, from $5,797,912 in 1888 to $6,783,913 in 1899. This is an exact reversal of the Manhattan history. For return on capital investment there was left in 1888 but $853,970, of which only $118,510 was appliable to dividends on stock, equivalent to less than three-quarters of one per cent upon the $16,221,800 of combined capital stocks of the fourteen, then existing, Metropolitan properties. For the year just ended, the net earnings for interest and dividends amounted to $6,639,816, nearly eight times as much as in 1888, and the surplus left for stock was equivalent to $4,154,506*, or 7 per cent on $58,498,500. Truly a remarkable showing is this, and one which reflects the greatest credit upon the ability of a management which, it is probably safe to say, has few equals and no superiors among the street railway properties of the United States.

What is the future of the Metropolitan system? The




* This figure includes the operating surplus for stock of the Metropolitan Street Railway Company, the Central Crosstown Railroad Company, the Thirty-fourth Street Crosstown Railroad Company, the Twenty-eighth & Twenty-ninth Streets Crosstown Railroad Company (def.), and the Fulton Street Railroad Company (def.), together with the guaranteed dividends on all other properties controlled by the Metropolitan Street Railway Company and the Central Crosstown Railroad Company, through lease.

answer is simple. With continued good management it can hardly fail to become one of the great investment properties of New York City. At present, on a 7 per cent dividend paying basis, it has still over 100 miles of track, representing nearly half its entire mileage, operating by horses —the most antiquated motive power of all. When the complicated network of crosstown lines in the lower end of the city is equipped with some of the cheaper forms of improved motive power, such as compressed air or storage battery, with which enormous investment for conduit construction is not required, the amount of short distance business riding will be vastly increased; when the new power station at Ninety-sixth Street, now nearly finished (from two to three years ahead of the Manhattan and Third Avenue power stations, work on whose foundations has but recently commenced), begins to furnish power for the entire system; and when the new cars constantly building for the Metropolitan Company to supply its urgent demands have arrived in sufficient quantities to take care of the traffic offered; service on the north and south and crosstown lines can be brought to a point more nearly meeting the requirements and largely increased gross and net earnings will inevitably result.

### The Proposed Rapid Transit Tunnel Railway

A tunnel railway is projected by the Board of Rapid Transit Commissioners of New York City, and bids for its construction and operation have just been invited. The question as to how such a railway as this would, if built, influence the earning power of the present companies is an interesting one. The answer probably is that irrespective of what the effect might or might not be were the new road at present in operation, the city will, during the five-year period allowed by the Commission for construction, quite certainly grow to the additional facilities which it will offer, and the deliverance from the daily woes of travel which it will offer will be but temporary. The underlying fact which impresses itself upon all who study New York transportation conditions is that in this long, narrow island, upon which a mass of travel surges down in the morning and up at night—this metropolis of America, which is daily attracting more and more permanent residents and temporary visitors—the demand for transportation facilities will always and inevitably be far ahead of the possible supply and every means of relieving the congestion should be welcomed. The proposed rapid transit tunnel will serve to populate, and immensely increase the value of, the upper portion of Manhattan Island and the Annexed District, and it will carry express traffic, not local. Eventually the 6-mile to 10-mile travelers will use the tunnel railway, and 3-mile to 6-mile travelers the elevated system, and the half-mile to 3-mile travelers the surface lines. The surface lines will make much money, the elevated some, and the tunnel railway, it is very much to be feared, will make, for some time at least, but little, if a 5-cent fare is insisted upon.

## Electric Railways in Japan

BY W. DELANO EASTLAKE

The street railroad question has reached Japan, and is at present disturbing the Oriental equanimity of the Japanese authorities more than anything else has done for many years past. The government has long since been alive to the fact that an adequate system of urban transportation is a necessity in many Japanese cities. The old style "kago" or sedan chair, long ago was superseded by the more rapid "Kuruma," or jin-riki-sha, those quaint little carts which are pulled by coolies at a breakneck speed. But even the kuruma has proved its inadequacy, and the authorities have started out to find a satisfactory substitute.

Some years ago a trolley line was equipped in Kyoto, and still remains as a monumental evidence of Japanese confidence in American integrity, and the marvelous intrepidity of whatever firm sent out the plant. To say that it is the worst sort of a failure would be to put it very mildly indeed. To be sure it is still in operation, but its uses are now similar to those of a merry-go-round at an American pleasure resort. People from the country, when visiting Kyoto, ride on the electric monster with a dare-devil spirit that is truly enviable. It is a single track system, with a switch at every few blocks, in which the uptown car must wait until passed by the downtown car. These waits are never less than ten or fifteen minutes, and I have frequently known them to last half an hour or more. To be sure, walking is a much quicker way of getting to one's destination, but then think of the excitement of the thing!

It were almost needless to say that the line does not pay were it not for the fact that it declared a 10 per cent dividend last year, and there is another short trolley line in Nagoya, equally as curiously equipped, which is paying 7 per cent dividends. Tokyo, the capital of the empire, a city of over a million and a quarter inhabitants, rejoices in a horse car line, some 8 miles in length, double track, with a capital of one million yen, or $500,000, which is now paying annual dividends of 35 per cent. Even this line, which is the best in the country, would shame the most backward village in the States, but it is enormously profitable for all that. Besides this stupendous dividend, the Tokyo Tramway Company, as it is called, also declared a reserve dividend of 10 per cent last year, which was added to the capital. The present Tokyo systems include, besides the above mentioned tramway company, the Shinagawa Tramway Company and the Senju Tramway Company. The prospective lines include a complete system in Osaka, the next largest city to Tokyo, which is already in the course of construction, or, at least, was to have been started this month; a line between Tokyo and Yokohama, which will be 18 miles long; a line between Kobe and Osaka, and lastly and most important, a complete system for Tokyo, including a belt line. There is one other existing electric road in Japan, which runs—no, moves—between Kodzu and Imoto-Hakone, called the Odawara Electric Company, and which is paying 7 per cent dividends.

Again, there is talk of converting the present Tokyo Tramway into an electric line at an early date. The specifications, among other things, call for rails weighing 50 lbs. per ft., wheels 30 ins. in diameter, and a distance of 7 ft. between the front and rear wheels, or not less than 6 ft. 6 ins. The length of each car is to be 24 ft., their weight, with fifty-two passengers, not to exceed 10 tons; the cars to run at three and five minutes headway, and to make from eight to thirteen round trips daily. Total length of track, 16 miles.

But all this is still on paper, for the authorities have not yet decided upon the system which, if adopted, will become universal in Japan. Not long ago an official (Mr. Fujita) came to this country for the special purpose of looking into the various systems now in vogue, both in this country and in Europe, and while his report was most careful and valuable, it did not bring the authorities to any conclusion. The opinion seems very strong in Japan that the overhead trolley system will soon be superseded by a more modern and perfect one, and so long as they have waited thus long they consider it wise to wait until whatever system is adopted has at least passed beyond the experimental point in foreign lands. There is, however, no doubt but what some system is soon to be adopted, and it largely depends upon the zeal of our manufacturers as to whether that system shall be an American one or not.

# LEGAL NOTES AND COMMENTS*

Edited by J. Aspinwall Hodge, Jr., of the New York Bar

## A Book on Patent Law for Laymen as Well as Lawyers†

It is seldom that a law book is useful in the hands of the layman; but Mr. Greeley's work on foreign patents and trade mark laws is an exception to this rule, especially in the latter half of the volume which treats of trade mark laws.

We venture to assert that the legal status of trade marks, even in our own country, and especially the legal effect of the registration thereof, is not understood by nine-tenths of the owners of trade marks in the country, and if we are mistaken in this statement, we still believe that it is true, concerning the nature of foreign trade marks.

Mr. Greeley's work, therefore, written in terse English, concisely and to the point, bringing down the laws which, of course, are subject to frequent changes, to date, is almost invaluable. It would be so were the laws which he digests, easily obtainable in the English language by those who are in the vicinity of Washington and New York.

A compendium of such laws, published in foreign languages, and some of them to be found only in the annual volumes of foreign laws, adds much not only to the usefulness, but to the virtual necessity of the volume to anyone who would treat with foreign countries understandingly.

There are other works upon foreign patent laws, and standard ones, but they are ten years old or more, and so, in many cases are not reliable when consulted for the existing law. They do not give, as does the volume under discussion, a satisfactory compendium of the trade-mark laws. We quite agree with the author's comment in his preface, that to the business man the trade mark and a knowledge of the trade-mark law is more likely to be useful, and when it is useful, is more advantageously so than a like knowledge of the patent law.

A perusal of the work has suggested that some of our readers may be interested in a few of the essential characteristics of trade-mark laws.

The original trade-mark rights recognized by the courts were recognized not so much to protect the user of the trade mark, as the public, and it is interesting to read the original decisions which look at the matter from that standpoint. It was thought that the public was injured when an article was passed off upon them which was not what they supposed they were obtaining. Afterward, trade marks were recognized as property which should be protected, because people would suppose that A. B. using a certain trade mark was producing inferior goods, since they had bought goods with that trade mark which were not up to the standard; so that A. B. upon showing these facts was able to succeed in the legal contention that arose out of the fact that the inferior goods were being manufactured by some rival.

The registration acts of the various nations, requiring or allowing the user of a trade mark to register the same, vary much; but they can be easily divided into two classes, and there is not much difficulty in classifying the laws of any nation under one or the other of the two classes.

They are either declarative or attributive. Where they are declarative, the property in the trade mark exists quite apart from registration, and the registration of the trade mark is merely declarative of the existence of the property right, and is merely *prima facie* evidence that he who thus registers is the owner and first user;—evidence which can be rebutted by evidence that some one else has used the trade mark prior to the use of it by the person who thus registers it.

Where the attributive law prevails, as it does in many countries, he who first registers, and sometimes irrespective of whether he has used the trade mark or not, has the right to protect himself against all those who attempt to use it, even if prior to his registration thereof they have used it.

A mere statement of these facts shows how important it is that exporters to foreign countries, before the introduction of their goods bearing a trade mark, should protect themselves, especially where an attributive trade mark law prevails.

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

† Foreign Patent and Trade-Mark Laws; a comparative study, with tabulated statements of essential features of such laws. By Arthur P. Greeley, Assistant Commissioner of Patents. John Byrne & Company, Washington, D. C.

## CHARTERS, ORDINANCES, FRANCHISES, ETC.

CALIFORNIA.—Bonds—Issuance—Stockholders' Liability.

Under Civ. Code, Secs. 456, 510, which provide that street railroad companies may issue bonds in payment of contracts for constructing and completing their roads, and section 359, which provides that the bonded indebtedness of a corporation may be created or increased by a vote of the stockholders representing at least two-thirds of the entire capital stock, a stockholder is not liable, in an action to enforce his stockholders' liability, for bonds issued in part payment for the construction of the road, for the issuance of which the stockholders never voted.—(Boyd et al., vs. Heron et al., 58 Pac. Rep., 64.)

LOUISIANA.—Appeal—Jurisdiction—Assessment for Public Improvements—Forced Contributions—Paving Streets—Apportionment of Cost—Space Between Tracks.

On motion to dismiss. 1. The matter at issue, being a question of local assessment or charge upon the property of abutting proprietors in a municipality, levied upon compulsion of law alone, to pay the cost of street improvement, and without their knowledge or consent, is a tax, in the sense of the constitutional provision conferring appellate jurisdiction on this court.

2. There can be no difference or distinction in principle between a forced contribution for levee purposes and a forced contribution for street improvement.

3. While it has ever been held with practical unanimity in numerous decisions of this court that the portion of the cost of the paving and improvement of streets and banquettes in cities and towns, which is, under the law, chargeable to abutting property-owners, is not a tax, in the sense of the jurisdictional article of the constitution, yet the reason for so holding evidently is that, under the provisions of the different city charters, such assessments were based primarily upon petitions signed by the abutting property-owners, and consequently not predicated upon the fiat of the Legislature, notwithstanding same are levied upon the theory of local benefits conferred upon the property of said abutting proprietors.

4. The feature which distinguishes local assessments for public State purposes from those for city street improvement is, in all laws except the one under consideration, the assent of the property-owner.

5. This court affirms the proposition announced in State vs. Judges of Court of Appeals, 16 South. 219, 46 La. Ann. 1292, to the effect that "the use of the words 'all cases,' and of the words 'any tax, impost or toll whatever,' clearly indicates on the part of the framers of the constitution an emphasized intention to give to the terms 'tax,' 'toll,' and 'impost' the widest meaning to which they are susceptible, and to allow every citizen to have submitted to the test of legality and constitutionality, by the highest court of the State, any charge upon his property imposed by the State or its subordinate political agencies, when claimed to be legally and constitutionally imposed by them in aid of governmental purposes, whether extending over the whole State, or over particular localities;" and, further, that "it is manifest that the word 'tax,' in this part of the constitution, is used in its largest sense. After the words describing the jurisdiction of this court as extending to all cases involving the legality or constitutionality of any tax, toll, or impost, there is added the word 'whatever;' i. e., whatever the character of that tax, toll, or impost."

6. The present controversy comes clearly within the reason and spirit of that decision, because the cost of the local assessment therein involved is a tax, within the intendment of the jurisdictional article of the constitution.

On the Merits. 1. This suit involves an interpretation of an ordinance of the city of Shreveport which requires that abutting property-holders throughout the length of a street that has been paved shall pay two-thirds of the cost of same, each one paying in proportion to frontage; that the street railroads shall pay in proportion to the space occupied by their roadbed, compared to the width of the street; and that the city shall pay the remainder, this assessment having been made in pursuance of Act No. 10 of 1896, and wholly without the assent of the abutting property-holders. The ordinance is founded upon the supposed authority that is conferred by the second section of said act, which provides that abutting owners shall pay two-thirds of the entire cost, and the corporation shall pay one-third from its general resources, and provided that, where a railway bed or track occupies a part of the street, it shall pay in proportion to the space occupied by its roadbed, compared with the width of the street. Finding, upon comparison of the city ordinance with the statute, that the former has transposed the terms of the latter by stating (1) the share of the abutter to be two-thirds, (2) that of railroad companies in proportion to the space occupied by them, (3) the city should pay the remainder, whereas the latter states (1) the share of the abutter shall be two-thirds, (2) the city one-third, and, (3) provided

that a street railway occupies a portion of the street, it shall pay in proportion to said space, same are irreconcilable.

2. Entertaining the view that the ordinance is not in keeping with the terms of the statute, the true import of which is to require the portion of the cost due for street improvement by railroad companies to be first deducted from the total amount, and the remainder distributed between the abutters and the municipality, two-thirds to the former and one-third to the latter, same is declared null and void.

3. The uniform current of judicial opinion affirms the principle that the right of occupancy of a portion of the streets of a municipality by a street railway corporation is property which is benefited by a street improvement, to the extent of the space occupied by its roadbed and tracks, which renders same liable for its proportionate share of its cost, just as the property of abutting property-owners is liable; that the railway company using the streets for the operation of its cars is in duty bound to pay for the work on the streets which its track alone makes necessary—that is to say, all expense for that portion of the work lying between the exterior rails of the track of the road, and for a distance of 2 ft. from the exterior to the track on each side thereof.

4. That in no case can any portion of the cost of such improvement be attributed to, or assessed against, the abutting property-owners.

5. That, when a statute or municipal ordinance makes provision for the assessment of a street railway corporation for the pavement of such space as its tracks and roadbed occupy, such provision is mandatory, and any portion thereof which is put upon the abutting property-owners is illegal and void.

6. The very object and aim of such a statute as the act in question is to relieve the municipality and abutting owners, proportionately, from defraying any portion of the cost incident to the part of the street improvement covered by the tracks of a street railway.

7. The space occupied by a street railroad company is matter of proof, to be administered and determined in some proceeding contradictorily between all parties in interest—the municipality, the abutting property-owners, and the street railway companies; and the ordinance which arbitrarily fixes said space, without a contradictory hearing, cannot be sustained as valid.—(City of Shreveport vs. Prescott et al., 26 So. Rep., 664.)

## UNITED STATES COURTS

NEW YORK.—Appealable Decrees—Violation of Injunction.

An order imposing a fine for violation of a preliminary injunction cannot be reviewed except upon an appeal from the final decree in the cause.—(Nassau Electric R. Co. vs Sprague Electric Railway & Motor Co., 95 Fed. Rep., 415.)

PATENT DECISIONS.—Suit for Infringement—Preliminary Injunction.

Where the question of infringement is a doubtful one, and to sustain the claim requires a broader construction of the claims of the patent than has been given in prior adjudications, such question should not be determined on a motion for preliminary injunction.—(Sprague Electric Railway & Motor Co. vs. Nassau Electric R. Co., 95 Fed. Rep., 821.)

Anticipation—Buffer Spring for Trolley Arm.

1. A patent for a buffer spring so constructed as to come into operation when the upwardly pressed trolley arm of an electric railway car has assumed a vertical position, and, by engaging therewith, prevent damage being done to the trolley, or by it to the car on which it is placed, was anticipated by the prior use of similar springs as recoil buffers to receive the shock of the projector arm in devices for throwing glass balls as targets.

Same.

2. The Baker patent, No. 437,961, for an improvement in trolley devices for electric railways, was anticipated by the Holden patent, No. 244,897, and the Bloom patent, No. 313,804, covering analogous devices in traps for throwing glass balls, and also by the Van Depoele patent, No. 405,750, for an improvement in trolley devices.—(Thomson-Houston Electric Co. vs. Rahway Electric Light & Power Co., 95 Fed. Rep., 660.)

## LIABILITY FOR NEGLIGENCE

CONNECTICUT.—Action for Injuries Causing Death—Evidence—Photographs—Argument and Conduct of Counsel—Reading Reports.

1. In an action against a street railroad company, where it was charged with negligence in allowing the rails of its track to project above the roadway, testimony as to the condition of the street at places other than place of accident was inadmissible.

2. In an action against a street railroad company for negligence in maintaining its roadway, testimony showing the condition of the track at and near the place of the accident within a year prior thereto is admissible.

3. In an action against a street railroad company for negligence in allowing the rails of its track to project above the roadway, a photograph of the street, including the place of the accident, is not admissible to show the height of the rails and the condition of the roadway, without any evidence as to its accuracy.

4. Where counsel, in his closing argument to the jury, attempts to influence them by reading findings of fact in a similar reported case, the court may properly dismiss the panel.—(Cunningham vs. Fair Haven & W. R. Co., 43 Atl. Rep., 1047.)

MINNESOTA.—Injury to Passenger—Excessive Damages—Evidence.

1. Evidence considered, and held sufficient to justify the jury in finding that defendant's servants were negligent.

2. Damages held not to be excessive.

3. Certain questions of practice and admissions of evidence considered and disposed of.—(Fonda vs. St. Paul City Ry. Co., 79 N. W. Rep., 1043.)

MASSACHUSETTS.—Obstructing Streets—Contractors—Injury to Pedestrians—Negligence.

1. A woman walking along a street in the evening, not noticing rails temporarily left in the highway to be placed in defendant's street car track, fell and was injured, though her daughter, who preceded her, passed without accident. There were many lights in the vicinty, but the jury might have found that one of the two lights placed there as a warning had gone out. *Held*, that the question of her due care was properly left to the jury.

2. Defendant's railway was then in operation, and a contractor was taking out the old rails and putting in new ones. There was no evidence whether the contractor was acting independently or as employee of the railway company, but defendant, within whose peculiar knowledge it was, offered no evidence to prove the relation between it and the contractor. *Held*, that the evidence justified a finding that defendant was responsible for the rails being there. (Slayton vs. West End St. Ry. Co., 54 N. E. Rep., 351.)

MINNESOTA.—Negligence—Evidence.

1. In an action for damages for the death of plaintiff's intestate, caused by the alleged negligence of the motoneer of one of defendant's cars, *held*, that the evidence was conclusive that the deceased was guilty of contributory negligence.

2. Also, that there was no evidence that the motoneer was guilty of any wanton or willful negligence in failing to make proper efforts to avoid injury after he discovered the deceased in a place of danger. (Gagne vs. Minneapolis St. Ry. Co. et al., 79 N. W. Rep., 671.)

MINNESOTA.—Injury to Passenger.

Plaintiff, a street car passenger, signaled for the car to stop so that she might alight, and as it commenced slowing up she went upon the lowest step of the car, and stood there for a moment, while the car was slowly moving, holding on to the car rail to steady and protect her from falling, when the car, before stopping, started forward with a jerk, and threw her to the ground, whereby she sustained personal injuries. *Held*, that the defendant's negligence and the plaintiff's contributory negligence were questions for the jury. Saiko vs. Railway Co., 69 N. W. 473, 67 Minn. 8, distinguished. (Currie vs. Mendenhall, 79 N. W. Rep., 677.)

MINNESOTA.—Collision with Fire Department—Contributory Negligence.

1. *Held*, the duties of a member of the city fire department, when driving fire apparatus on a call to fire, may require him to take risks which it would be negligence for a private person to take in pursuit of his private business.

2. In an action by such a member against a street railway company for damages for an injury to him resulting from a collision, at a street crossing, between a street car and a hook and ladder truck driven by him, *held*, that the question of defendant's negligence and of his contributory negligence were both for the jury. (Warren vs. Mendenhall, 79 N. W. Rep., 661.)

NEW JERSEY.—Punitive Damages—Torts of Servant.

1. A principal, whether an individual or a corporation, cannot be charged with punitive damages for the illegal, wanton, or oppressive conduct of a servant, unless the principal participated in the wrongful act of the servant, either expressly or impliedly, by his conduct authorizing or approving it either before or after it was committed.

2. Punitive damages are in the nature of a penalty, especially designed as a punishment for the wanton conduct or malicious motives of a tort feasor, and can lawfully be imposed only when the reprehensible act is brought home to the defendant. (Forhman vs. Consolidated Traction Co., 43 Atl. Rep., 892.)

NEW JERSEY.—Injury to Passenger—Negligence—Riding on Platforms—Contributory Negligence.

1. The occurrence of a sudden lurch or jerk of a street railway car, of sufficient violence to throw a passenger off the platform, who was there preparing to alight, and awaiting the stoppage of the car for that purpose, justifies an inference of a breach of duty

upon the part of those operating the car, within the maxim "Res ipsa loquitur." Traction Co. vs. Thalheimer, 37 Atl. 132, 59 N. J. Law, 474. That the car was following another closely, which was stopping and starting suddenly, is a fact for the consideration of the jury, in determining the cause of the sudden lurch or jerk, and as bearing upon the questions of negligence arising in the cause.

2. It is not negligence per se for the passenger to ride upon the platform of an electric street railway car, nor to get up and go there from inside the car before the car has stopped, to await an opportunity to alight.

3. The railway company operating such a car is bound to exercise a high degree of care to carry its passengers safely in or upon whatever part of the car they are permitted to ride.

4. Whether a passenger riding upon a platform, or standing there awaiting an opportunity to alight, while the car is moving, should, in the exercise of ordinary care for his own safety, take hold of the hand rail there, is a question which, under all the circumstances, must be determined by the jury.—(Scott et al. vs. Bergen County Traction Co., 43 Atl. Rep., 1060.)

NEW YORK.—Collision Between Street Cars—Contributory Negligence of Motorman.

1. Under a rule of defendant, a street railway company, if a car going east after starting from the station was found to be defective it was to be brought back to the station over the west-bound track. About 5 o'clock on a morning that was so foggy that a car could not be seen more than 15 ft. or 20 ft. distant, a car going east was started on the east-bound track, and after it had gone about a half of a mile the motorman found it had no fender; and, instead of returning on the east-bound track, he proceeded 2 miles to a switch, and returned over the west-bound track. About twenty minutes after five, another car, with a conductor and a motorman, was started from the station, going east, over the west-bound track. As to whether this was by order of the train dispatcher, the evidence was conflicting. Both the conductor and the motorman knew of the rule stated. The car was proceeding at the rate of 4 miles an hour, the motorman ringing the bell continually; and when it had gone about 2 miles he saw the headlight of the returning car about 15 ft. in front of him, and when too late to prevent a collision by which he was injured. Held, that the proximate cause of the accident was the negligence of the conductor and motorman in taking out the car on the wrong track on a densely foggy morning, and that the company was not liable.

Conductor and Motormen Fellow Servants.

2. The conductor and motorman on an electric car are fellow servants, and the negligence of the former is imputable to the latter.—(Savage vs. Nassau Electric R. Co., 59 N. Y. Suppl., 225.)

NEW YORK.—Injury to Children—Negligence.—A boy of six, of average intelligence, was permitted by his mother to play after dark on the street in front of the house, under her control. The father was on the opposite side of the street, and the boy, while his mother was temporarily in the house, and the father was not watching, started from the curb to cross to the father. The place was 50 ft. to 60 ft. from the crossing, and a street car, 37 ft. to 75 ft. away, was approaching at about six miles an hour, its usual rate in that locality. The curb was 18 ft. from the track, and the view of the car was unobstructed. The boy struck the car at the edge of the fender or the dashboard, and was injured. The motorman was prudently operating the car, and stopped it in 20 ft. *Held*, that the company was not liable. (Adams vs. Nassau Electric Ry. Co., 58 N. Y. Suppl., 543.)

NEW YORK.—1. Injury to Employee—Contributory Negligence.—An employee of an electric railway company, who while accompanying a flat car a short distance in the discharge of his duty, rides thereon instead of on the motor car, which is designed for the accommodation of passengers, cannot, as a matter of law, be said to be guilty of contributory negligence, if injured while so doing.

2. Same.—Nor can he be said to have been guilty of contributory negligence, as a matter of law, for sitting on a corner of the car, so that one of his legs was between the flat car and the motor.

3. Same—Obligation of Master.—It is the duty of the master to exercise reasonable care in furnishing safe and suitable appliances for the servant to work with, and the servant has a right to rely on the discharge of this duty.

4. Same—Notice of Defect—Character Thereof.—In an action to recover for personal injuries, evidence that an accident was due to the sudden falling off of the brake shoes of a car shows such a defect as would authorize the jury in finding that the defendant, in the exercise of reasonable care, should have had notice thereof.

5. Same.—In an action by an employee to recover for personal injuries, evidence that an accident was due to the sudden falling off of the brake shoes of a car shows a defect of which he, being temporarily engaged with the car, could not reasonably be supposed to have notice. (Butler vs. New York & Q. C. Ry. Co., 58 N. Y. Suppl., 1061.)

NEW YORK.—1. Damages—Injury to Vehicle—Cost of Repairs.—Evidence of the cost of repairing a vehicle injured by the alleged negligence of defendant is insufficient, as a basis of damages, without further evidence that such cost was the reasonable worth of the necessary repair.

2. Same—Usable Value of Vehicle.—While the usable value of a coach, for the period during which it was being repaired, is a proper element of the damages accruing from the injury to the coach, yet the evidence of such value must not be so uncertain as to require the jury to guess and speculate. (Volkmar vs. Third Ave. Ry. Co., 58 N. Y. Suppl., 1021.)

NEW YORK.—Driving Across Track—Contributory Negligence.—Where a driver of an express wagon attempted to cross car tracks on a street where the company's cars had the right of way, and when a car was only 100 ft. away, and, finding his mistake, attempted to get over by whipping his horse, but too late, he was guilty of contributory negligence. (Reiss vs. Metrop. St. Ry. Co., 58 N. Y. Suppl., 1024.)

NEW YORK.—Appeal—Review.—Where, in an action for collision on a highway, plaintiff's servant testified to circumstances from which his freedom from contributory negligence and defendant's servant's negligence might be found, despite the latter's contradictory statements, a judgment for plaintiff should not be disturbed. (Seaman vs. Metropolitan St. Ry. Co., 58 N. Y. Suppl., 1053.)

NEW YORK.—Carriers—Injuries to Passengers—Sufficiency of Evidence.—Plaintiff testified that the street car started suddenly while she was alighting, throwing her to the ground. The conductor, the motorman, and three passengers testified that the car came to a full stop before plaintiff attempted to alight, and that it made no movement until after she had fallen. *Held*, that a judgment for plaintiff would be reversed. (Hart vs. Metropolitan St. Ry. Co., 58 N. Y. Suppl., 1088.)

NEW YORK.—Appeal—Review—Excessive Damages.—Unless it is manifest that the verdict in an action for personal injuries was the result of passion, prejudice, or corruption, it will not be disturbed as excessive.

2. Same—Error Cured.—In an action for personal injuries, the defendant moved to strike out the value of the doctor's services. The court denied the motion, saying, "I will deny the motion, but she [plaintiff] cannot recover for it here," but charges that there was no evidence of payment to physicians sufficient to warrant recovery for medical services, and that the doctor's bill was eliminated from the case, were given at the close of the case. *Held* that, if there was error in denying the motion, it was cured by the subsequent charges. (Polak vs. Metropolitan St. Ry. Co., 58 N. Y. Suppl., 1133.)

NEW YORK.—Elevated Station in Street—Right to Erect.

1. A street railway company cannot erect an elevated structure in a street for the storage of its cars or accommodation of its trainmen, to the injury of an abutter.

Same—Cleaning Cars in Street—Injunction.

2. Where a street railway company's charter prohibits it from washing its cars in a street, an abutter may have it restrained from so doing.—(Waldmuller et al. vs. Seaside & B. B. El. R. Co. et al., 58 N. Y. Suppl., 7.)

NEW YORK.—Negligence—Question for Jury.—Plaintiff was knocked down by a cable car, and, after being dragged some distance, was run over. The gripman, who was an inexperienced man, testified that the car was stopped almost as soon as plaintiff was struck. A number of the witnesses who saw the accident contradicted the gripman's statement that the gong was rung, and also testified that the car went about 75 ft. after plaintiff was struck. An expert witness testified that the car could have been stopped within 25 ft. *Held*, that the question whether there was negligence in not stopping the car sooner should have been left to the jury.

2. Same—Effect of Contributory Negligence.—Although plaintiff was negligent in being struck by defendant's car, he may recover, if his injury was caused by defendant's subsequent negligence in failing to stop the car in time after he was struck. (Green vs. Metropolitan St. Ry. Co., 58 N. Y. Suppl., 1039.)

NEW YORK.—1. Carriers—Defective Appliance—Curtain Rods—Liability.—An open electric car was provided with curtains, at the bottom of which was an iron rod, with brass shoes on each end, which worked in a groove. On the day of a high wind, when the curtains were pulled down on the windward side, a shoe broke where it was inserted into the rod, and the end of the rod struck and injured plaintiff, a passenger. The break was clean, and showed no flaw. The car was built and the curtains put in by a firm of high standing in 1895, and the car had been used only dur-

ing the summers of 1895 and 1896. Similar curtains were in general use on a great many other roads. No similar accident was shown, and there was evidence that none such had occurred on defendant's road. It was not shown that the rod had ever been examined. *Held*, that defendant is not liable.

2. Same—Degree of Care.—An electric railway company is not bound to use the highest degree of care in respect to the curtain rods of its cars. (Leyh vs. Newburgh Elec. Ry. Co., 58 N. Y. Suppl., 479.)

NEW YORK.—Injuries to Passengers—Contributory Negligence.

1. Plaintiff signaled a street car approaching the crossing on which he was standing to stop, and it slowed down, but did not stop completely, whereupon he attempted to board it while in motion, and after it had passed the crossing, and in doing so was injured. It did not appear that the slowing down of the car was in response to plaintiff's signal. *Held*, that plaintiff was guilty of contributory negligence.

Same—Failure to Stop for Passenger—Negligence.

2. A street car, on being signaled to stop, merely slackened its speed, without stopping, whereupon plaintiff attempted to get on it while in motion, and was injured. There was no evidence that the car had slowed down in response to the signal, or that the conductor or motorman knew of the attempt to board it. *Held*, that a finding in an action to recover for such injuries, that the persons in charge of the car were negligent, was not warranted. —(Reidy vs. Metropolitan St. Ry. Co., 58 N. Y. Suppl., 326.)

NEW YORK.—Injuries to Passengers—Defective Appliances.

A finding by a jury that a construction by a railroad company of overlapping swinging doors leading to a platform that was used daily by several thousand persons, and was long enough to enable the company to build doors, so that they could not overlap, was negligence, so as to justify a recovery by a passenger injured thereby, will be sustained; it being the company's duty to furnish its patrons with reasonably safe means of ingress and egress to and from the platform.—(Kiernan vs. Manhattan R. Co., 58 N. Y. Suppl., 394.)

TEXAS.—Damages—Personal Examination.

Where plaintiff in an action for personal injuries has exhibited them to the jury, and physicians have testified in relation to them, defendant is entitled to have an examination by experts of its own selection.—(Chicago, R. I. & T. Ry. Co. vs. Langston, 51 S. W. Rep., 331.)

NEW YORK.—Collision Between Electric Cars—Injury to Passenger.—An electric car, running at a high rate of speed, came into collision with a car on a parallel track, which had collided with a beer wagon a few seconds before. There was no evidence as to the manner of operating the car which collided with the beer wagon, nor as to who was answerable for such car being thrown on the track of the car on which plaintiff was a passenger. The distance between the cars at the time of the first collision was about 150 ft., and the interval of time about five seconds. *Held* to justify a finding that defendant was not guilty of negligence. (Snediker vs. Nassau Electric Ry. Co., 58 N. Y. Suppl., 457.)

NEW YORK.—Evidence—Expert Testimony.—In an action against a street railway for injuries to a child three years old, it appeared that the motorman was justified in believing that the child would cross the track safely, until the car was within 20 ft. of the child. At this distance the motorman applied the brake, and stopped the car within 20 ft. to 25 ft., but not in time to prevent the accident. An expert witness called by plaintiff testified that, by proper application of the brake, the car could be stopped within a distance of from 20 ft. to 25 ft. *Held* that, as the evidence was competent and material to issue, it was error to strike it out at the request of plaintiff. (Frohle vs. Brooklyn Heights Ry. Co., 58 N. Y. Suppl., 561.)

NEW YORK.—Damages—Personal Injuries. In an action for personal injuries, an instruction that, if the jury found for plaintiff, he was entitled to recover what would be his reasonable expense incident to his condition in the future, is erroneous, where there is no evidence as to what he would be required to pay because of his injuries in the future. (McKenna vs. Brooklyn Heights Ry. Co., 58 N. Y. Suppl., 462.)

PENNSYLVANIA.—Accident to Passengers—Instructions.

1. There being conflicting evidence as to whether a passenger got off a street car before it stopped, or did not leave it till it stopped, and it started with a sudden jerk while she was getting off, causing her to fall, and nothing to take the case out of the rule that it is negligence for a passenger to alight from a moving train, it is error to charge that, if the jury take the version that the car had not stopped when she undertook to get out, they might find her guilty of contributory negligence, and in that case she would not be entitled to recover, and that, if she undertook to get off the car before it stopped, they might ascertain that she ought to have waited.

2. There being no evidence that the car was going so slowly as to be substantially stopped when the accident occurred, it is error to introduce that element into the answer to a requested instruction.—(Neff et al. vs. Harrisburg Traction Co., 43 Atl. Rep., 1020.)

PENNSYLVANIA.—Carriers—Injury to Passengers—Evidence.

An electric car on an up grade stopped, and could not be moved. An employee of defendant (though in what capacity it did not appear) gave instructions to the motorman, sanded the track, and, when all attempts to move the car proved futile, told the motorman that he would procure another car, which he did. In bringing up the relieving car, from some cause it ran into the disabled car, and injured a passenger. Held, that the burden was on defendant to rebut the presumption that the injury was by its negligence, by showing that such employee on the relieving car was a mere intruder, acting without authority.—(Madara et ux. vs. Shamokin & Mt. C. Electric Ry. Co., 43 Atl. Rep., 995.)

PENNSYLVANIA.—Contributory Negligence — Non-suit.—A woman stopped at the curb of a street, and looked before attempting to cross. The trolley car that subsequently struck her was then approaching at a distance of 185 ft. She stood there "some time" after looking, and while crossing the track she was struck. The evidence was conflicting as to the speed of the car and its distance from the woman immediately before she stepped on the track. *Held*, that the question of contributory negligence was for the jury. (McGovern vs. Union Traction Co., 43 Atl. Rep., 949.)

TENNESSEE.—Appeal—Objections—Harmless Error—Trial—Instructions—Negligence of Motorman.

1. An objection to the admission of evidence cannot be first raised on appeal.

2. A charge that it is the duty of a motorman to keep a vigilant lookout for children on the street, and upon the first appearance of danger, or probable collision with a child, to stop the car in the shortest time and space possible, does not impose too great a degree of care on the motorman, where it is charged, in the same connection, that he is bound to act only as a man of ordinary prudence.

3. In an action for death by negligence, the court said that it was natural for the jury to have their sympathies aroused, and that "this [was] entirely proper," but that, as jurors, they must not forget their duty to render a verdict according to the law and the evidence, and also cautioned them not to allow their sympathy to affect their verdict. *Held*, that there was no reversible error.

4. Special requests need not be given, when they are embodied in the main charge. (Citizens' St. Ry. Co. vs. Dan, 52 S. W. Rep., 177.)

TENNESSEE.—Negligence—Street Crossing Accidents—Contributory Negligence—Burden of Proof.

1. In an action for negligence, the burden of proof is not on plaintiff to show affirmatively that he was exercising ordinary care.

2. In action for personal injuries, brought by one who was run down at a crossing by a vehicle, a charge that defendant might presume that any one crossing the street would see the way in which he was using it, and not attempt to use it right in front of him, so as to make it impossible for him to avoid a collision, is erroneous, as ignoring the circumstances of the collision, and the rate of speed at which defendant was driving. (Burke vs. Citizens' St. Ry. Co. et al., 52 S. W. Rep., 170.)

TEXAS.—Speed—Instructions—Evidence.

1. In an action to recover for damages occasioned by a collision with one of defendant's street cars, it is not error to charge that it is negligence to run its cars at a greater rate of speed than is allowed by ordinance.

2. Error cannot be predicated on a part of a charge where, when considered as a whole, the charge fully protects appellant's rights.

3. In an action for damages resulting from a collision with a street car, it is not error to permit a witness to state that "the car was going faster than any horse and buggy would travel over a good road at any kind of a trot," as the latter fact is a matter of common knowledge and observation.

4. In an action to recover for personal injuries sustained by reason of a collision with a street car, testimony that witness saw plaintiff a few days after the accident, and that he was limping, is competent, as showing present pain.

5. In an action to recover for personal injuries, the admission of testimony "that witness saw plaintiff a few days after the accident, at a place other than plaintiff's home, and that plaintiff said he was hurt, and wished that he had not come," is harmless error where the fact that he was hurt is not controverted, and the verdict is not complained of as excessive.

6. Where the evidence shows that there were two people in the wagon at the time of the accident, testimony by the motorman that "they said they did not blame" him is incompetent where

offered as a part of the res gestæ, and it is not shown that it was plaintiff who spoke the words.

7. Where it is shown that the mules drawing the wagon in which plaintiff was riding were frightened, and ran in front of the car, testimony that there was nothing indicating that they were going on the track was properly excluded, as calling for the conclusion of the witness.—(City Railway Co. vs. Wiggins, 52 S. W. Rep., 577.)

## Patent Decision

A decision was rendered Nov. 10 in the United States Circuit Court of the Eastern District of New York in the case of the Thomson-Houston Electric Company, against the Nassau Electric Railway Company. The suit was brought on claim of infringement of the Elihu Thomson patent on magnetic blow-out issued to the plaintiffs in 1883, and is of particular interest from the fact that the defendants were using the apparatus of the Lorain Steel Company. The decision which was rendered by Judge Thomas was in favor of the defendants on the ground of wanting of novelty in the invention.

Judge Thomas also rendered a decision the same day in the case of the Sprague Electric Railway & Motor Company vs. the Nassau Electric Company, for alleged infringement of patent 324,892, issued to F. J. Sprague on Aug. 25, 1885, relating to the suspension of electric motors under cars. The judge considered that the defendant in its equipment infringed claims 2 and 6 of this patent, and stated that the complainant should have a decree enjoining the defendant from infringing these claims.

## The Distribution of a Fare

At a meeting of the Metropolitan Street Railway Association, composed of employees of the Metropolitan Street Railway Company, held Nov. 4, President Vreeland, of the company, delivered an address to his men concerning management and operation. "To the minds of people like us," said he, "engaged in a business the financial foundation of which is a five-cent piece, the mention of millions of dollars really conveys only a dim idea. There is a certain point at which the mind loses grasp of the significance of figures; it is like talking of the vast interstellar spaces. We know they are very great and we let it go at that. When it comes to five cents, though, that is right in our line, and in order to bring within the understanding of every one just how each five-cent piece you men collect is divided, I have made the following analysis from the company's records to show where we stand with the capitalists who own the property we operate. You will observe they do not get much the best of us on the divide, for this is how the nickel is distributed:

| | |
|---|---|
| Labor | .0195 |
| Material | .0048½ |
| Taxes | .0026½ |
| Interest | .0144 |
| Total | .0414 |
| Leaving for stockholders | .0086 |
| Total | .0500 |

"The fact that less than seven-eights of one cent out of every fare goes to the owners—in other words, the stockholders of the property—will, I doubt not, be interesting to a great many public instructors, who continually discuss the railroad business as one where there is nothing but income to embarrass the management. Another interesting fact was developed in this investigation of mine, and that was that out of every dollar spent in operating the Metropolitan system, 80 cents went for wages, and only 20 cents for material."

## Street Railways for Removal of Refuse

H. S. Beattie, treasurer of the Metropolitan Street Railway Company, of New York, contributes in the last issue of the "Municipal and Railway Record" an article on this most interesting subject. Mr. Beattie states that he does not care to say how practicable such an undertaking as the transportation of express over the the lines of his company, after they are all operated by mechanical power, would be, but strongly advocates the employment of street railway cars to carry off ashes, garbage, snow, ice, etc. Mr. Beattie's plan is to have a sufficient number of vans operated over the railway lines to one dumping place. Taking New York as an example, he says in part: "All the details of this plan, from the loading of the vans, at the point of collection, to the automatic dumping of their contents into sea-going, self-dumping scows, at the chosen central, single dumping station, received the unqualified indorsement of practical men, every one of them an authority in transportation matters, prior to the introduction of cable or electric power. How much easier of accomplishment should it now be, when the Metropolitan Street Railway and Third Avenue Railroad companies are operating over 120 miles of their lines by mechanical power! How much easier still will any such undertaking be, when the horse shall no longer be used by any railroad in the city, when the conditions that must obtain under an ideal system of underground electric traction shall have been realized, and each car of a line may be operated as independently of another as if they ran on separate tracks.

"The withdrawal of over 300 horses and carts from the most congested strips of the streets of New York during the busiest hours of the day is in itself a benefit, the commercial value of which would require many figures to express.

"The water front of the city is more valuable than that of any known maritime municipality. The annual rentals paid by most of our shipping interests run up into the tens of thousands of dollars. Yet thirteen of the most desirable locations on the East and North Rivers are abandoned to the uses of the Department of Street Cleaning as dumping stations, when one would be sufficient. Considering the rental value of these dumping stations were they released to the commerce of the port, and the depreciation in value which their existence occasions to the property adjacent to them, it is safe to state that the city treasury would be the beneficiary by their abolishment to the extent of not less than $1,000,000 per annum. And this amount would not be diminished by any increase of expenditure as a consequence of the proposed change in method. On the contrary, there should be a saving of one-third in the cost of carting, or not less than $250,000 per annum, if the appropriation for that item of the work of the department for the year 1895 is to be as large for 1896 and succeeding years.

"Furthermore, the cost of final disposition for the current year, considerably over $400,000, should be reduced at least one-half, through the concentration of the scows and steam tugs of the department at one point; the rentals paid for hired scows would be rendered unnecessary by the almost instantaneous loading of those vessels, to fill some of which now requires more than two days by the ordinary cart dumping method."

## New Construction at Staunton, Va.

R. D. Apperson, general manager of the City Street Car Company, of Staunton, Va., advises us that his company is figuring on building a new car house and power station with steel-trussed roofs, one 50 ft. x 100 ft., the other 30 ft. x 115 ft., arranged for slate covering. The company also wants prices and all information at once for shafting, clutch pulleys, clutch couplings, bells and mechanical draft.

## New Traffic Arrangements in Brooklyn

The Brooklyn Rapid Transit Company, which controls all the street railway and elevated lines in Brooklyn, with one exception, has just placed in operation a system for the interchange of traffic between the elevated and surface lines, the like of which is to be found in no other portion of the United States. The congested state of traffic on the surface lines had been bothering the officials of the company for some time prior to the acquisition of the elevated railroads in January, and since that time they have been strenuously wrestling with this weighty problem. On Nov. 1, a system of transfers was finally put in operation which gives promise of accomplishing this task. The system provides that all long distance riders, particularly those to the suburbs, use the elevated trains for transportation to their termini, after which a transfer is given to the surface lines if the passenger desires to continue further. It is also practically obligatory for the passenger to patronize the elevated roads as a second fare is charged on the surface cars which parallel these lines and heretofore carried passengers direct to the suburbs for a single fare. In returning from the suburbs the same methods are in vogue, thus when a passenger reaches the termini of the elevated lines he is given a free transfer to the elevated, but if he desires to continue the entire distance by the surface cars, he is required to pay an additional fare. The system will be of advantage to the long-ride passenger, as the elevated railways make better time than the surface cars within the congested district. It will also be of advantage to the short-haul passengers, for by the time a car had reached the city proper, under the old method, there was little chance of the short distance rider securing a seat.

## Test of 300-kw. Units at Richmond

In a paper presented at a meeting of the American Institute of Electrical Engineers, in New York, Nov. 22, E. J. Willis, superintendent and engineer of the Richmond (Va.) Traction Company, gave some figures of a test made by him March 30, 1897, of two 300-kw. direct-connected railway units at different loads The equipment tested is described below:

| Card Numbers. | Time. | Boiler Pressure. | Receiver Pressure. | Vacuum. | Feed Temperature. | Throttle Temperature. | Injector Temperature. | Overflow Temperature. | Draught Flue Temperature. | R. P. M. | Mean Pressure H. P. Cylinder. | Mean Pressure L.P. Cylinder. | Volts. | Amperes. | Water Feed. | Coal Feed. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 & 2 | 12.10 P. M. | 108 | 4 lbs. | 25½ | 190½ | 343 | 65 | 90 | 360 | 101 | 25.76 | 6.55 | 550 | 205 | | |
| 3 & 4 | 12.30 " | 110 | 5 " | 26½ | 190 | 343 | 65 | 90 | 360 | 101 | 29.75 | 6.25 | 550 | 210 | | |
| 5 & 6 | 12.45 " | 118 | 6 " | 26½ | 190 | 343 | 65 | 91 | 350 | 101 | 24 37 | 6 60 | 550 | 200 | | |
| 7 & 8 | 1.00 " | 125 | 7 " | 26½ | 186 | 350 | 65 | 91 | 320 | 101 | 29.50 | 6.42 | 550 | 195 | | |
| 9 & 10 | 1.15 " | 115 | 5 " | 26½ | 186 | 343 | 65 | 91 | 320 | 101 | 28 12 | 6.40 | 550 | 192 | | |
| Totals..... | | 576 | 27 | 131½ | 942 | 1722 | 325 | 453 | 1710 | 506 | 137.50 | 32.22 | 2750 | 1002 | 3469 | 345 |
| Averages.... | | 115 | 5 2-5 | 26½ | 188 | 344 | 65 | 91 | 342 | 101 | 27.50 | 6.44 | 550 | 200 | | |
| 11 & 12 | 1 19 P.M. | 112 | 7 lbs. | 26 | 186 | 346 | 65 | 97 | 360 | 101 | 39 50 | 8.60 | 550 | 298 | | |
| 13 & 14 | 1.36 " | 115 | 8 " | 26½ | 185 | 346 | 65 | 100 | 380 | 100 | 39 60 | 8.90 | 550 | 300 | | |
| 15 & 16 | 1.50 " | 114 | 7 " | 26½ | 183 | 340 | 65 | 97 | 400 | 101 | 40.00 | 8.37 | 550 | 297 | | |
| 17 & 18 | 2 05 " | 115 | 8 " | 26½ | 183 | 343 | 65 | 98 | 400 | 101 | 37.75 | 8.70 | 550 | 300 | | |
| 19 & 20 | 2.23 " | 115 | 7 " | 26½ | 183 | 343 | 65 | 98 | 400 | 101 | 41.50 | 8.25 | 550 | 300 | | |
| Totals..... | | 571 | 37 | 132½ | 920 | 1718 | 325 | 490 | 1940 | 504 | 197.75 | 42.82 | 2750 | 1497 | 4912 | 455 |
| Averages..... | | 114 | 7 2-5 | 26½ | 184 | 344 | 65 | 98 | 388 | 101 | 39.55 | 8.56 | 550 | 299 | | |
| 21 & 22 | 2.25 P.M. | 113 | 10 lbs. | 26½ | 185 | 341 | 65 | 111 | 400 | 102 | 48.75 | 11.45 | 550 | 400 | | |
| 23 & 24 | 2.42 " | 100 | 6 " | 26½ | 185 | 329 | 65 | 111 | 460 | 100 | 48.87 | 11 87 | 550 | 400 | | |
| 25 & 26 | 2.51 " | 115 | 9 " | 26½ | 185 | 343 | 65 | 111 | 500 | 101 | 46.50 | 11 15 | 550 | 400 | | |
| 27 & 28 | 3.10 " | 113 | 8 " | 26½ | 185 | 342 | 61 | 111 | 500 | 100 | 50.37 | 11.00 | 550 | 395 | | |
| 29 & 30 | 3.25 " | 118 | 5 " | 26½ | 185 | 344 | 61 | 100 | 500 | 100 | 49.50 | 10.60 | 550 | 393 | | |
| Totals..... | | 559 | 38 | 132½ | 925 | 1699 | 317 | 544 | 2360 | 503 | 243.99 | 56 07 | 2750 | 1988 | 5141 | 575 |
| Averages..... | | 112 | 7 3-5 | 26½ | 185 | 340 | 63 | 109 | 472 | 101 | 48.80 | 11.21 | 550 | 397 | | |
| 31 & 32 | 3 25 P.M. | 110 | 10 lbs. | 26 | 185 | 340 | 61 | 100 | 520 | 101 | 58.87 | 15.05 | 550 | 500 | | |
| 33 & 34 | 3 50 " | 110 | 10 " | 26 | 185 | 340 | 61 | 100 | 540 | 101 | 57.00 | 14.20 | 550 | 500 | | |
| 35 & 36 | 4.05 " | 110 | 10 " | 26 | 180 | 339 | 61 | 100 | 560 | 101 | 55.75 | 14.55 | 550 | 500 | | |
| 37 & 38 | 4.20 " | 108 | 10 " | 26 | 180 | 339 | 61 | 100 | 580 | 101 | 58.87 | 14.07 | 550 | 500 | | |
| 39 & 40 | 4.35 " | 110 | 10 " | 26 | 180 | 340 | 61 | 103 | 580 | 101 | 56.25 | 14.07 | 550 | 500 | | |
| 41 & 42 | 4.50 " | 110 | 10 " | 26 | 180 | 340 | 61 | 103 | 580 | 101 | 58.25 | 14.50 | 550 | 500 | | |
| 43 & 44 | 5.05 " | 110 | 10 " | 26 | 180 | 340 | 61 | 102 | 580 | 101 | 58.50 | 14.57 | 550 | 500 | | |
| 45 & 46 | 5.20 " | 110 | 10 " | 26 | 180 | 340 | 61 | 102 | 580 | 100 | 60.25 | 14.70 | 550 | 500 | | |
| 47 & 48 | 5.35 " | 110 | 10 " | 26 | 180 | 340 | 61 | 102 | 580 | 101 | 57.00 | 14.80 | 550 | 500 | | |
| Totals..... | | 988 | 90 | 234 | 1630 | 3058 | 549 | 912 | 5100 | 908 | 520.74 | 130.51 | 4950 | 4500 | 14486 | 1690 |
| Averages..... | | 110 | 10 | 26 | 180 | 340 | 61 | 101 | 567 | 101 | 57.86 | 13.39 | 550 | 500 | | |

### CALCULATED RESULTS.

| LOAD. | POWER. Indicated H.P. | Electrical H.P. | Kilowatts. | Evaporation Water per lb. of coal (actual). | Water per lb. of co.l from and at 212° F. | Coal Consumed. Per indicated H.P. hour. | Per electric H.P. hour. | Per K.W. hour. | STEAM. Per indicated H P. hour. | Per electric H.P. hour. | Per K.W. hour. | EFFICIENCIES. Indicated H P. per electric H.P. | Electric H.P per indicated H P. | Indicated H.P. per K W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 Amperes. | 216 | 146 | 110 | 10.05 | 10.71 | 1.45 | 2.18 | 2.90 | 14.8 | 21.9 | 29.1 | 1 48 | .68 | 1.96 |
| 300 " | 299 | 220 | 164 | 10.8 | 10.75 | 1.43 | 1.94 | 2.60 | 15.3 | 21 9 | 28.1 | 1.36 | .74 | 1.82 |
| 400 " | 373 | 293 | 219 | 8.94 | 9.53 | 1.54 | 1.96 | 2.63 | 13.8 | 17.53 | 23.46 | 1.27 | .79 | 1.70 |
| 500 " | 469 | 369 | 275 | 8.57 | 9.18 | 1.66 | 2.11 | 2.83 | 14.25 | 18.1 | 24.3 | 1.27 | .79 | 1.70 |

Boilers.—One 300-h.p. Campbell & Zell water-tube boiler with 3000 sq. ft. submerged heating surface.

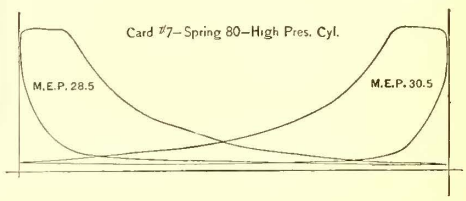
Engine.—16-in. and 30-in. x 42-in. Hoover, Owens & Rentschler horizontal tandem compound condensing engine, double eccentric, 100 r.p.m.

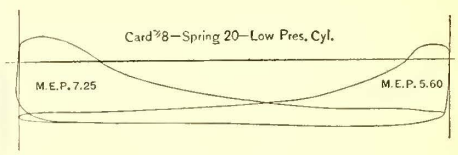
Generator.—300-kw., six-pole, steel-frame General Electric railway generator.

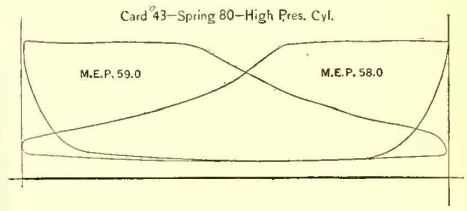
Piping.—The piping is practically what is known as standard, being an 8-in. spring from boiler to 14-in. steam-header and 6-in. spring from steam-header to throttle. A short 14-in. exhaust pipe exhausts through a Hartford heater into a Deane jet condenser.

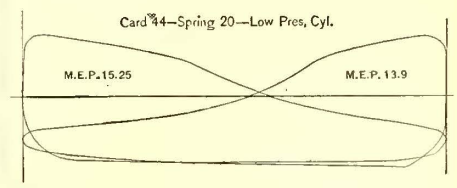
A large water rheostat was provided, capable of handling the full output of the generator, and a Weston ammeter and voltmeter were placed upon the circuit of the generator. By this means the output of the generator could be fixed, maintained and measured at any desired point. The system of piping permitted the feed-pump and condenser to be operated by a separate boiler, so that all the steam generated by the boiler passed through the engine. All valves were tested and made tight. A Worthington hot-water meter was thoroughly overhauled before the test and was accurately tested before and after the run. The water and steam consumptions are those given by this meter. The coal fired during the test was Pocohontas run of mine, giving probably 13,000 B. T. U. The draught at the grate during the run was 5/8 in. Indicator cards were taken as nearly every fifteen minutes as possible off both ends of each cylinder, and also simultaneous readings of coal, water, electrical output and the other items mentioned in the table. Sample cards are shown herewith. The object was to determine the steam, water, coal consumption and indicated horse-power of this unit at different loads. The load was as follows: For one hour at 200 amps., the next hour at 300 amps., and so to 500 amps. It was intended to place the load the next hour at 600 amps., but the machine became too warm, and instead the load was continued for two hours at 500 amps.

It is regretted that the point of load could not be carried higher, but it is to be remembered that railway generators are usually designed for fluctuating loads, and that such a steady loading as given in this test is likely to cause considerable heating. It is further unfortunate for the sake of accuracy that on account of the need of the generator for the operation of the load, the duration of each test could not have been made greater, since the determination of coal and water consumption for such short periods of time is almost always attended with unavoidable inaccuracies. The water rheostat was composed of two sheets of boiler plate 5 ft. x 6 ft. each. By means of soda the conductivity of the liquid was brought to the desired point. With light loads and before the water commenced boiling completely there was some fluctuating in amperage, but after the water got to boiling thoroughly the load could be maintained perfectly steady. At 500 amps. there was



about 15 sq. ft. of each plate submerged. The water evaporated by the boiling was replaced by a hose connection and the water level in the rheostat tank thereby maintained constant. The writer would state that in his experience with rheostats of any size, if a steady load is required, it is better to let the water come to a boil and the plates remain steady, replacing the evaporated water with a running connection, than to attempt the continual raising and lowering of the plates.

This test was made to confirm the writer's opinion that it is advisable with railway units carrying fluctuating loads to install a double eccentric undersized engine, and that better running economy can thereby be obtained than by the installation of the usual larger and more expensive engine. It will be noticed that the engine gave its best steam economy at about 400 amps., and as the average load on this engine is lower than this, the wisdom of the installation for this plant of so small an engine for the 300-kw. units is plainly shown.

## The Design of Fusible Cut-outs *

BY B. H. GLOVER

The simplest, and therefore most common, method of protecting electrical circuits is by means of the fusible cut-out. While much might be said about circuit breakers, switches and special combinations for opening and controlling circuits, the object of this paper is not to enter into a discussion of the relative merits or proper adaptation of these fittings, but simply to put before you some facts demonstrated by exhaustive tests and extended practice, and from this information and experience derive a few conclusions regarding the proper design of fusible cut-outs.

That the present cut-outs are not entirely satisfactory goes without saying. If they were the subject of this paper would not have been suggested.

It is a strange characteristic of this age of progress that sometimes the most common and necessary articles are accepted in the crude, and often unfinished, form in which they have originated, and are apparently forgotten and neglected in the mad rush for something new or strange. The return swing of the pendulum is, however, inevitable, and we now hear of new forms of arc lamps and renewed interest in the perfection of various forms of lamps depending on the incandescence of heated conductors or metallic oxides. The thermal cut-out is still one of the most unreliable of the many devices employed on electrical circuits. Its use is universal, but beyond a few practical details the device is but little understood. Such improvement as has been made has largely been due to the vigilance of the various insurance boards. As a source of vexation and uncertainty the fusible cut-out is probably unrivaled.

Speaking from the standpoint of the fire underwriter, the proper design of cut-outs is an important subject, inasmuch as a very considerable fire waste has been, and continues to be, occasioned through the faulty construction and design of these fittings. All tests and treatments have shown the common cut-out to be subject to such variations and modifying influences that but little of practical value can be deduced from analytical investigations.

A cut-out may be said to consist of three principal parts—(a) the base and its cover, (b) the terminals, and (c) the fuse. These will be taken up in the order given so far as is possible.

(a) In the earlier days of electric lighting wooden bases were used, but were soon abandoned, due to continual trouble with "grounds" and "shorts," resulting from absorption of moisture and the loosening of contacts and charring due to the combustibility of the wood. Porcelain is now almost universally used. The base and cover being much the larger portion of a cut-out, the porcelain manufacturer has taken it upon himself to design and sell these goods. Important electrical details are often sacrificed for convenience in getting out the porcelain, and "any old thing will go" seems to be the motto followed in some cases, no regard being paid to the various and excessive demands made upon the product. It is poor practice to use short fuses in order to economize in porcelain.

The quality of porcelain used and its glazing is seldom given any consideration by contractors or engineers except, perhaps, for use with very high potentials. The subject of glazed and unglazed porcelain in itself opens up a large field for discussion. A glaze with an excessive coefficient of expansion will in time become full of cracks or become "crazed," as the porcelain manufacturers express it. These cracks retain moisture and offer paths of comparatively low resistance between terminals of opposite polarity or to ground.

The use of lead in the glaze usually results in a metallic film upon the blowing of a fuse. The parts of a cut-out about the fuse itself should preferably be left unglazed. The fuse should not be in contact with any surface of the base. If supports between the terminals are necessary they should be in the form of traverse ribs with smooth rounded tops.

While an air space is desirable about the fuse the ends of the block should not be left entirely open. As a fuse usually ruptures at or near the center, the aim should be to provide a proper vent at this point and still retain sufficient pressure to cause a blow-out of the metallic vapors and suppression of the arc formed. For these reasons a rather restricted air space at the ends and an enlarged air chamber with vents, near the center of the fuse gives more reliable action. A cover for the base should always be used. The fire risk is made less and the sensitiveness of the fuse is thereby increased, especially for small fuses.

(b) Terminals are universally made of brass in the form of stampings, castings or sections of square or round bar. The following modes of connection to the wires have been noted: a screw and washer, a screw with one upturned lug on terminal, with and without washers; a set screw, two set screws, an angular bottom piece with a clip above, held by one or two screws; double clips with a center V groove, and several others.

In the construction of switches it is considered quite proper and necessary to provide lugs, firmly bolted to the switch, into which the conducting wires shall be soldered. This applies to switches of over 25 amps. capacity. If for switches and bus-bars and in making connections to dynamos and motors, why not for cut-outs?

Connections for currents up to 25 amps. should be made to terminals provided with screws and washers with a turned-up lug on both sides to prevent this wire from slipping out. When the capacity of the cut-out exceeds 25 amps. connections should be made with lugs firmly screwed to the terminals on a flat surface, and into which the conducting wires can be soldered. This may seem like excessive care, but when it is considered that very appreciable losses are due to the many poor contacts and connections made in a circuit, too much attention cannot be given to this matter of contacts. The terminals should be set in from the ends of the blocks so that live portions of the circuit will not be exposed. The proper distance between terminals has long been a disputed question.

A catalogue of a well-known manufacturer of these goods shows, for 110-volt circuits, break distances of from ¼ in. to 2½ ins. He no doubt strikes an average somewhere.

An engineer of a prominent company stated two years ago: "We are redesigning our link cut-outs so that the fuse metal tips shall be fully 1 in. apart. Some of our cut-outs are much less than this, and we believe it is safer to have a longer break distance than what we are now using." A Chicago engineer, whom you all know, said a few years ago: "I have always felt that the emphasis of experimental evidence should be directed to convincing the people of the advisability of using long fuse blocks, thereby contributing to the reliability of such protecting devices."

This is all reliable testimony, and should be given careful consideration, not only by manufacturers, but by contractors and engineers as well. There are many goods on the market with a ½-in. break distance between terminals.

A current of 20 amps. will invariably establish a vicious arc between terminals at this distance, and the terminals will frequently melt with explosive violence. The terminals are not only fused, but often the entire base and cover are shattered into fragments. Such results are aggravated by the enormous capacity of our modern stations in populated districts. For a given fuse, blown in a given time there is a critical length. Careful experiments have shown these lengths to be as follows:

| | Inches |
|---|---|
| For 3-5 amps | 2½ |
| For 10-15 amps | 3½ |
| For 20 amps | 4 |

Or for each 5 amps. an increase in length of ½ in. These lengths seem excessive when judged by common practice, but the data clearly indicate where practice might be improved.

Realizing that extended reforms cannot be instituted at once, the rules of the National Electrical Code specify 1¼-in. break distance between terminals for 110 volts, and 2½ ins. for 220 volts, the fuses to be held free from contact with the base and be provided with tips of hard metal. In the open type of cut-out the terminals usually have a greater distance between them than in the covered style, but a serious fault in their design is that the terminals are set in flush with the surface of the porcelain. Terminals should be secured to the base by at least two screws, so as to prevent turning and loosening. Screw-heads on the back should be countersunk and the heads covered with a moisture-proof and insulating wax or compound. These points should go without saying, but an inspection of stock being sold shows that there is neglect along these lines.

* Paper read before the Chicago Electrical Association, Nov. 17, 1899.

(c) The ordinary fuse is made from an alloy, the greater part of which is lead. This alloy is used in the form of wire, wire links or strips. The opening of the circuit is caused by the melting of the fuse. The necessary heat is obtained from the energy developed in the fuse by the current. But the blowing of a fuse is not immediately an electrical act. The current fuses the metal, the cross section is reduced at some point due to gravity, unequal expansion or "sweating," the heat intensifies at this point and a globule falls, breaking the circuit and establishing an arc, which soon burns out a length of the fuse. The time required for this action may vary between considerable limits under different conditions. In some cases this fact is an advantage, while in others it might be fatal.

A combination intended to increase the accuracy of operation and to reduce to a minimum the radiation and conduction of heat is found in the enclosed fuse.

A fibre tube is filled with a porous powder and the fuse is soldered to the brass ends of the tube, being imbedded in a powder except in the center of the tube, where a small capsule forms an air chamber. These fuses will operate at a predetermined point for any overload, and can be relied upon within very close limits. An objection has been made to their use, as there is no exterior indication to show when a fuse has opened. A new design is about to be put on the market with the object of overcoming this objection. It consists of an inclosed fuse with a shunt of fine high-resistance wire between the terminals on the outside of the fibre tube. The blowing of the fuse diverts the current through the shunt wire, which immediately blows and serves as an outside indicator. Enclosed fuses without the air chamber are not as sensitive or reliable as those with the air chamber.

An ideal fuse would be one that would act at nearly a constant time interval for all currents in excess of its normal. In this respect it would resemble a magnetic cut-out. Its curves would be a straight line from the point of its rated capacity and slightly approaching the vertical axis for all excess currents. In practice the curves of all thermal cut-outs must be more or less modified hyperbolas. The ideal curve could only be obtained were it possible to eliminate conduction and radiation losses. This line of attack should be followed in designing a sensitive fusible cut-out. Small fuses approach this condition to a greater extent than large ones.

For sudden heavy overloads a multiple fuse of several small wires is much more sensitive than one large one of the same capacity. For the same reason a thin, flat ribbon may be considered more reliable than a round fuse.

## Invitation to Contractors for the New York Tunnel Railway

The following invitation for bids for the construction and operation of a tunnel railway has been issued by the Board of Rapid Transit Railroad Commissioners of New York City.

OFFICE OF THE BOARD OF RAPID TRANSIT RAILROAD COMMISSIONERS OF THE CITY OF NEW YORK.

The city of New York (hereinafter called the city), acting by its Board of Rapid Transit Railroad Commissioners, proposes to build a rapid transit railroad in the city of New York. By this advertisement the Board invites proposals to construct the railroad, to equip the same, to put the same into operation and thereafter to use and operate the same upon a lease thereof from the city for the term of fifty (50) years with a right to a renewal of the lease for a further term of twenty-five (25) years, all upon the term and conditions set forth in the draft of contract hereinafter referred to.

Payments to the contractor will be made for construction as the work proceeds as provided in the form of contract.

The annual rental to be paid by the contractor under such lease, after completion, will, except as provided in the contract, amount to the interest paid by the city on its bonds for the cost of construction (including interest during construction, but excluding bonds issued to pay for easements and the like), and in addition 1 per cent on such cost of construction with provision for contingent abatement or reduction of such 1 per cent during the first ten years of the lease, and, in addition, if the proposal of the contractors shall so state, in years when the gross receipts from the operation of the road exceed five million dollars ($5,000,000), a sum equal to the percentage of such excess stated in such proposal.

The points within the city of New York between which the said road is to run and the route or routes to be followed are as follows, namely: From the corner of Broadway and Park Row under Park Row to Centre Street, under Centre Street to new Elm Street, under new Elm Strect to Lafayette place, to and under Fourth Avenue and Park Avenue to 42d Street, under 42d Street to Broadway, under Broadway to 59th Street, under Broadway (formerly the Boulevard) to 124th Street, then by viaduct to 134th Street, under Broadway and Eleventh Avenue to a point about 1350 ft. north of 190th Street, to the southeast end of Ellwood Street, over Ellwood Street, Kingsbridge Road and Riverdale Avenue to Kingsbridge Station of the New York & Putnam Railroad, together with a loop under City Hall Park and Broadway connecting Centre Street and Park Row, and a branch as follows: Running from 103d Street to and under 104th Street, crossing Central Park, to Lenox Avenue and 110th Street, under Lenox Avenue to 142d Street, easterly to and under the Harlem River, to and under 149th Street to Third Avenue, to and under and by viaduct along Westchester Avenue to Southern Boulevard, to Boston Road and Bronx Park.

The general method of construction shall be such as to provide for the portion of the route on the loop south of the City Hall and for the portions of the route on both the east and the west side lines north of 103d Street, two tracks, and for the portion of the route between the City Hall loop and 103d Street, four tracks. These tracks shall be of the standard gage, that is to say of a width of 4 ft. 8½ ins. between the rails. The roof of the tunnel shall be as near the surface of the street as street conditions will permit, and is to have a height of not less than 13 ft. in the clear and with a maximum width in the clear, except as influenced by local conditions, of 50 ft. where there are four tracks and 25 ft. where there are two tracks. There shall also be suitable stations, turnouts, switches and cross-overs. The portion of the route underground shall be constructed with steel girders, with brick or concrete arches or masonry walls and arched roof. The viaduct portions shall be of steel and masonry. The manner of construction of the portions underground shall be by tunneling or open excavation.

The railroad is, for the purposes of the contract, divided into four sections: Section I, including the part from the southern terminus at the City Hall to 59th Street; section II, including (a) the part on the west side from 59th Street to 137th Street, and (b) the part on the east side beginning with the branch at 103d Street and the Boulevard, and extending to 135th Strect and Lenox Avenue; section III, including (a) the part on the west side from 137th Street to Fort George, and (b) the part on the east side from 135th Street to Melrose Avenue; and section IV, including (a) the part on the west side north of Fort George, and (b) the part on the east side north of Melrose Avenue. The city expects that the entire railroad, that is to say, all of such four sections, will be constructed and operated. But the city desires to restrict its entire pecuniary liability for rapid transit at any one time within the limits deemed consistent with its other obligations and interests. The railroad is, therefore, to be constructed and equipped in sections. The contractor shall begin with section I. If and when, within one year after the commencement of work on section I the city shall so elect, the contractor shall construct section II. If and when, after the commencement of section II, and within two years from the commencement of section I, the city shall so elect, the contractor shall construct section III. If and when, after the commencement of section III and within three years after the commencement of section I the city shall so elect, the contractor shall construct section IV. The railroad shall, so far as concerns the rights and obligations of the parties under the contract, be deemed to include only section I, and in addition the other sections II, III and IV, which the city shall determine to construct within the limits of time aforesaid.

The term of years for which the contract is proposed to be made extends for fifty years after the completion of the road and its readiness for operation as declared by the Board, with an option to the contractor to extend the lease for twenty-five years at a rental to be fixed as in the contract provided, but not less than the average rental for the last ten calendar years before the contractor's demand for renewal.

Other requirements, provisions, details and specifications are stated in the printed form of contract now on file at the office of the chief engineer of the Rapid Transit Board, 22 William Street, New York City, where copies of the same and of the forms of bonds and contractor's proposal may be had. Such printed form of contract is to be deemed part of this invitation.

Sealed bids or proposals for the construction and leasing of such rapid transit road indorsed: "Proposals for constructing and leasing Rapid Transit Railroad," with the name of the person or persons, corporation or corporations making the same will be received at the said office of the Board at 320 Broadway, Borough of Manhattan, New York City, until Jan. 15, 1900, at 12 o'clock noon, at which time or at a later date to be fixed by the Board, the proposals will be publicly opened at the said office and the award of the contract, if awarded, will thereafter and within thirty days after the opening of the bids be made by the

Board to the person or persons, corporation or corporations, if any, whose proposal shall, in its opinion, be for the best interest of the city. The bidder or bidders whose proposal shall be accepted shall in person or by duly authorized representative attend at the said office of the Board within ten days after the notice of a delivery by the Board and deliver a contract in the form referred to duly executed.

At the time of the delivery of the contract the contractor shall give security as follows:

(1). By deposit of one million dollars ($1,000,000) in cash or in securities of the character of securities in which savings banks of this State may invest their funds and which securities shall be approved by the Board. Such one million dollars ($1,000,000) shall be security for construction.

(2). By a continuing bond in the penalty of one million dollars ($1,000,000) to secure construction, operation, payment of rental and all other obligations of the contractor.

(3). By a bond in the penalty of five million dollars ($5,000,000) to secure construction and equipment.

[The forms of the bonds are prescribed in the contract, and further provisions follow in the invitation to bid, covering various details connected with the presentation of bids, certification of deposits, etc.]

## Notes on Railway Motor Rating

John Lundie, the well-known transportation engineer, has recently contributed the following paper to the "Electrical World and Engineer," which we reproduce herewith, with the kind permission of its editors:

MR. LUNDIE'S ORIGINAL PAPER

The following notes on motor rating comprise a summary of results which the writer had intended to reserve for publication in an extended paper, justifying the somewhat radical statements made, but which are published now, believing they may be of value to others working along similar lines.

The power rating of an electric motor under actual conditions of operation, on either constant or frequent intermittent load, should be directly proportional to the average electrical power input, independently of variations in current, except as maximum current may be governed by commutation.

The sum of the percentages of $I^2R$ losses and core losses at all inputs throughout the range of practical operation can be made practically a constant. In order, however, that a proper balance of heating in different parts of the motors may be maintained, whether the heating be due to $I^2R$ or core losses, the range and method of regular operation of the motor should be taken into account in its design.

Thus a motor may be specified of a certain kilowatt capacity to be operated within given limits—the kilowatt capacity being the rate of input which the motor could take constantly with a given maximum temperature difference above the surrounding atmosphere with the motor designed for constant uniform work. The following relation would practically govern the operation on frequent intermittent work:

$K$ = Kilowatt capacity.

$t$ = Percentage of time motor is worked on any current $I$.

$E$ = Voltage (practically constant).

$K \times 100{,}000 = \Sigma\, EIt$.

For example, a motor for heavy traction service might be designated a 30-kw. motor, to be operated in service on a line voltage of 500 within the limits of 100 amps. and 250 amps. The commutation limit of the motor would be about five times the standard rating, or

$$5 \times 30 \times \frac{1000}{500} = 300 \text{ amps.}$$

which, in the case assumed, would not be reached in operation, the limits indicating that the capacity of the motor is governed by heating.

This motor on intermittent service ought to operate anywhere within the following conditions:

$$\text{On 100 amps.,} \frac{6000}{100} = 60\% \text{ of the time;}$$

$$\text{On 250 amps.,} \frac{6000}{250} = 24\% \text{ of the time;}$$

or on any products of amperes and percentage of time within these limits integrating 6000, it being, of course, assumed that running on resistance is at all times reduced to a minimum

With such a standardization of motor rating, many advantages would become apparent to those seeking motors for specific service, amongst which may be noted:

(1). The rating of the motor is directly proportional to the average input.

(2). The sum of the operating motor capacities on cars would equal the load on the station, due allowance for outside losses being made

(3). The relation between this method of rating and that at present in use is simple. Calling kilowatt input equal to horse power at the rim of the wheel, to allow for efficiency, then approximately horse power (present rating) $= \frac{10}{3}$ kilowatts (proposed rating).

DR. HUTCHINSON'S COMMUNICATION

The "Electrical World and Engineer," having editorially criticised Mr. Lundie's paper on several grounds, Dr. Cary T. Hutchinson addressed the following letter to the editors, further explaining and indorsing Mr. Lundie's plan:

Mr. Lundie's suggestion is to rate motors intended for intermittent service, such as railway service, on a basis of the average electrical input regardless of the method in which the load varies, assuming always that the variation of load is so made that the temperature attains a constant value; that is to say, assuming that the motor is not allowed to cool down between applications of the load.

This suggestion has for its justification the fact, which seems to be borne out by an examination of a number of test records of railway motors of different sizes and makes, that the $I^2R$ and core losses of a given motor are a constant percentage of the input at constant potential over a large range of input. If this is the case, it is obvious that there will be the same total energy spent in heating the motor whether a certain current is applied all the time or double the current for half the time. Your editorial assumes that the energy losses are constant in amount and not in percentage.

This suggestion to rate a motor on its average input obviously coincides with the present method of rating for continuous duty, since the rated load and the average load then coincide. Equally clearly it does not take into consideration the limitation fixed by commutation. This is a matter which must be considered separately. The present practice in rating railway motors is to specify a temperature elevation of 75 degs. C. for a continuous run of one hour. The rules of the American Institute of Electrical Engineers specify a temperature rise of 50 degs. C. for an intermediate period, the wording of the rule being as follows: "In apparatus intended for intermittent service, as railway motors, starting rheostats, etc., the rise of temperature should be measured after a shorter time, depending upon the nature of the service, and should be specified." That is to say, this rule does not give any definite rating for motors for intermittent service. The question of the time was purposely left open since the conditions of service were so different that it was impossible to specify times in the different cases. You will see that as far as the suggestion to rate on an average load is applicable, the question of time is entirely eliminated, and the rating very much simplified.

Whether the sum of $I^2R$ and core losses in motors other than railway motors is a sufficiently close approximation to a constant percentage of the input, is a matter that can only be determined after a careful examination of data of tests in each particular case. Probably a better way to put the matter would be that the range within which the sum of these losses is a practically constant percentage, would have to be determined separately for each class of motors. For railway motors it seems to be a fact that the sum is a constant percentage throughout the range of practical operation of the motors. It is not constant at very low loads or at very high loads, but this is a matter of no special consequence, since the motors are not expected to operate at either extreme.

This suggestion does not take into account the temperature of the field coils and armature of the motor separately. The temperature elevation is supposed to be measured by resistance, and is the average of the two. To guard the matter carefully, a clause should be added limiting the maximum temperature elevation in either part. The field and armature should be so designed that the temperature elevations of the two parts shall be the same for the load rated in accordance with this method, and the two elements should be separately designed so that neither will attain a dangerous temperature within the range of load permitted to the motor. It is clear that when the temperature of the two parts is not equal, one must be higher than the average, and the other lower.

Motors rated in this manner are rated on a basis of continuous duty with a given temperature elevation. Railway motors, and all motors intended for intermittent service, work on loads which are heavy overloads as compared with their load for continuous duty. Hence, the figure giving the rating of a railway motor in accord-

ance with this suggestion, expressed in kilowatts, would be very low; a 100-h.p. motor would become approximately 30-kw. This would probably not be acceptable to the maker. To avoid this difficulty the motor might be given an arbitrary designation expressing the produet of the current and the percentage of time for which the current could be applied. In the case cited by Mr. Lundie, the motor might be called A-B 6000, meaning that it would take 100 amps. for 60 per cent of the time, 250 amps. for 24 per cent of the time, or any intermediate values of which the product is 6000; the limits between which the sum of the two losses is a constant, in this case being 100 and 250 amps.

This matter, I think, is deserving of consideration, as it seems to offer a more satisfactory method of rating motors for intermittent work than any I know of.

MR. LUNDIE'S SECOND COMMUNICATION

Mr. Lundie has also addressed the following letter to the editors of the "Eleetrical World and Engineer," still further explaining his position:

Your editorially expressed objections to the proposed method of motor rating are essentially that the following two assumptions cannot be true: First, that the electrical efficiency of the motor should be constant at all loads within the commutation limit; second, that the temperature should be the same whether an excessive load were applied at the beginning or at the end of a cycle of test. You sum up by stating that while the advantages of the proposal are not to be gainsaid, yet the uncertainty of the fundamental assumption is too great to warrant its adoption.

No precise criticism can be made of your objections, as they are based on your statement (which is correct) that the assumption is not strictly true. As, however, the proposition is to secure a method of rating which within service limits will represent the capacity of the motor, your objections may be met as follows:

As to your first objection, you support it by stating that the combined copper and iron losses cannot be constant because the copper losses are approximately proportional to the square of the input, while the iron losses, although very complex, are roughly constant, and the sum of a constant and a square function cannot be a first-power function.

Replying to this objection, the *percentage* copper losses are proportional to the square of the input divided by the input, or are directly proportional to the input—a first-power function. If the iron losses were considered constant, the percentage losses would be inversely proportional to the input—a hyperbolic function, but approximately a first-power function on the branch of the hyperbola. The iron losses, however, are not constant in a series motor, and are such as to make the approximation of the percentage losses still closer to a straight line function than if they were constant. In the characteristics of a motor before the writer, the iron losses are approximately proportional to the square root of the input, and the percentage losses, consequently, inversely proportional to the square root of the input. The sum of the percentage copper and iron losses in this motor throughout a range of from 40 to 200 amps., does not vary 2 per cent. Surely this is close enough to a first-power function to satisfy almost the laboratory, not to mention the demands of railway service.

The ideal to be worked towards in motors intended for intermittent, fluctuating work should be that of practically constant electrical efficiency throughout the whole range of service operation.

Your second objection as to the final temperature depending on whether overload were impressed in the beginning or end of a test cycle, will not hold in frequent intermittent service, as we are not dealing with one cycle, but with a continued repetition of cycles in rapid succession, and the maintaining of a given maximum temperature is simply a question of the rate of radiation of heat. With a given average rate of generation of heat, and the same rate of radiation, the temperature remains a constant. The short time between applications of load in railway work does not permit of an appreciable drop in temperature, and the rate of radiation is a function of this temperature.

As to your suggestion that the testing of a motor would be a lengthy and elaborate process, this again is a result of your considering only a single cycle of test. As a matter of faet, the motor in service is under continuous test, the average rate of input as the load fluctuates anywhere within the range of operation, being a measure of the capacity under which it is being operated. This fact is one of the strongest arguments in favor of the proposed method of rating.

The writer is well aware that there are many points which will have an important bearing on the method of rating proposed, such as restrictions to free radiation, unequal heating of field and armature, etc., but believes that they may all properly be made subservient to the general proposition.

## Recent Shipments to Havana

The Morris Electric Company, which received recently, orders for a large amount of railway apparatus for the new electric street railway system of Havana, has already made a number of shipments. On Nov. 27, fifty car loads of Mason terra cotta ducts were shipped from Philadelphia on the Earn Line steamer "Hindoostan." Other shipments which will follow soon are 2200 iron poles, made by the Electric Railway Equipment Company, of Cincinnati, Ohio, 54 miles of overhead line material made by A. & J. M. Anderson; 54 miles of trolley wire from the Waclark Wire Works, a lot of galvanized iron span wire from Washburn & Moen, two trolley wagons made by J. A. McCardell & Company, and thirty car loads of 1,000,000 c.m. feeder cable, made by W. R. Brixey, making altogether 182 car loads, besides the terra cotta shipment.

The Morris Electric Company is also doing a large business with other companies, both in this country and abroad. Among its shipments outside of this country during the past month have been 30 miles of trolley wire, two Trenton trolley wagons, hydraulic rail benders and track tools to Lisbon, a large shipment of miscellaneous equipment to Cape Town, and 280,000 lbs. of copper wire with all necessary brackets and fittings for the new extension for the Mexico Street Railway.

Among his domestic orders, Mr. Morris includes orders for bonds for Elmira, N. Y.; Akron, Ohio; Anderson, Ind.; New York, New Haven & Hartford Railway, Euclaire, Wis.; Detroit, Mich.; Union Railroad, New York, and elsewhere. To facilitate his city work, Mr. Morris has fitted up a shop at Twenty-seventh Street and Ninth Avenue, which contains a brass foundry and full line of machine tools, and will be designed for the manufacture of bonds and general railroad supplies.

## Soap for Car Cleaning

A pamphlet containing the papers and discussion at the thirteenth annual convention of the Master Car and Locomotive Painters' Association of the United States and Canada, held at Philadelphia, Sept. 12, 1889, on the subject of the cleaning of passenger cars and locomotives, has recently been published by the Modoc Soap Company, of Cincinnati, Ohio. The discussion on this subject is quite remarkable in showing the universal indorsement by the delegates present of Modoc soap and Modoc car cleaner and the methods employed by them in its use will be of interest to street railway superintendents. The first paper was by T. J. Rodabaugh, master car painter of the Pittsburgh, Ft. Wayne & Chicago Railroad. He stated that he had found that washing cars every day with a window-brush and cold water killed the luster of the varnish and produced in a few weeks a dull, flat looking car. He now employs Modoc liquid for the inside and outside of the cars every thirty days; between these times the cars are wiped off every trip with cotton waste. Every five months Modoc powdered soap is used. Thos. Byrne, master car painter of the Chesapeake & Ohio Railroad, and H. M. Butts, of the New York Central & Hudson River Railroad, gave similar testimony to the value of this soap and cleaner in papers on the same subject. In the discussion which followed various delegates described their methods of cleaning cars, and the discussion elicited the fact that practically all present were users of these products, and that the method of their employment was practically the general directions issued by the Modoc Soap Company. On some roads where there were many tunnels or other conditions which required more frequent cleaning of the cars the latter were cleaned with the liquid more often than on other roads, but the general method of cleaning was practically the same in all.

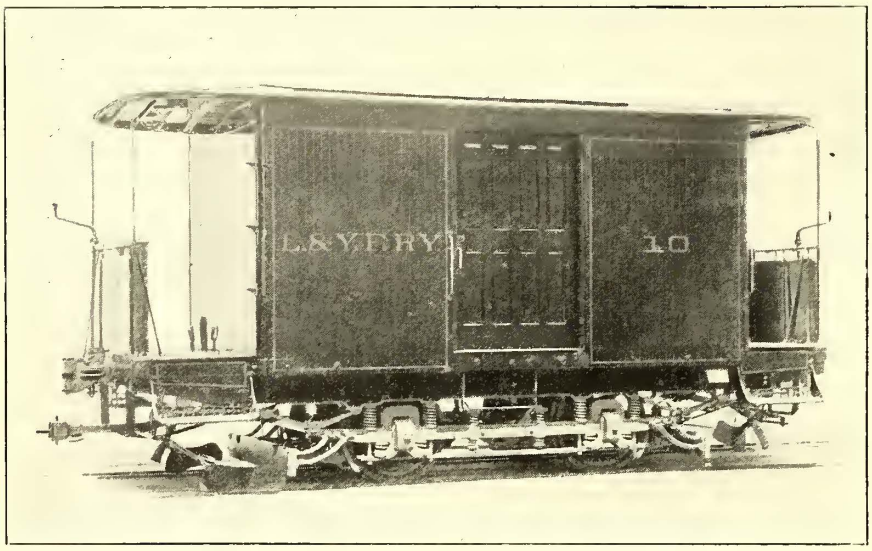
The Modoc car cleaner is used for ordinary cleaning, and is usually sufficient. In cases, however, where it has not been used regularly and the car has been neglected, a preliminary cleansing with Modoc soap is recommended. This is a mild soap, designed to do the least possible harm to the car. The manufacturers claim that for steam railroad service the cars should be cleaned not less frequently than once every thirty days, and that the cost of treatment is not more than $1.25. It is not economical to allow cars to run five or six months without cleaning.

The Federal Steel Company has just closed a contract with the Corporation Tramways of Glasgow for $500,000 worth of steel rails, special work, etc., for the new electrical equipment. The girder rails will be manufactured at the Lorain Steel Company's shops and the special work at the Johnstown plant.

## Heavy Freight Car

The Lewiston & Youngstown Frontier Railway Company, of Lewiston, N. Y., has purchased from the J. G. Brill Company a freight car which is also an electric locomotive and is of rather unusual design. It is represented in the accompanying illustration. The body is 14 ft. long and has the usual sliding side doors, but is otherwise completely enclosed. The width at the sills is 7 ft. 8 ins., and the height inside is 6 ft. 8 ins. There are two platforms, one at each end, fitted up with controllers, brake handles, bells, etc. The construction is unusually heavy for the reason that the locomotive not only has to carry a load of 6 tons, but is also intended to haul standard freight cars. For this reason it is fitted with Master Car Builders standard couplers in addition to the radial draw bar for street railway cars. There are two G. E. 1200 motors. The car is mounted on No. 21-E trucks with a 6-ft. wheel base and 33-in. wheels.

Each platform is fitted with a sand box and Littell track scrapers. In the engraving these track scrapers are shown dropped in position on the left hand end and raised at the opposite end. The car weighed with two motors 18,250 lbs., all of which was, of course, available for adhesion. While the spring arrangement of the No. 21-E truck will make it light and easy riding, the great weight gives it sufficient tractive power to enable it to handle very considerable loads in ordinary steam freight cars.




FREIGHT CAR AND LOCOMOTIVE, LEWISTON

## Porcelain Insulators for High-Tension Work

The accompanying engraving shows four new types of porcelain and glass insulators for high-tension work, manufactured by Fred. M. Locke, of Victor, N. Y. Mr. Locke has devoted a great deal of attention to this subject, and his insulators are used extensively on high-tension lines in this country. Fig. 1 shows a porcelain outer shell and glass center insulator manufactured for 50,000-volt lines and tested up to 100,000 volts at the works at Victor. Fig. 2 shows a glass triple petticoated insulator for 20,000-volt lines. Fig. 3 shows a glass insulator for use in transposing telephone lines, and Fig. 4, a similar insulator made of porcelain.

The demands for high-tension insulators have grown so rapidly as to compel the erection of new works at Victor by Mr. Locke. They contain the latest appliances used in the manufacture of insulators, and are two stories in height. The first floor contains the separating and mixing vats and molding process, where the water is squeezed out of the clay; also a great kiln for firing the insulators. The second floor is used for molding, shaping and drying. The insulators are burned at a very high temperature, and are vitrified throughout, increasing both their electrical and mechanical strength. The factory has a capacity of 60,000 insulators a week.

FIG. 2

FIG. 1

FIG. 3

FIG. 4

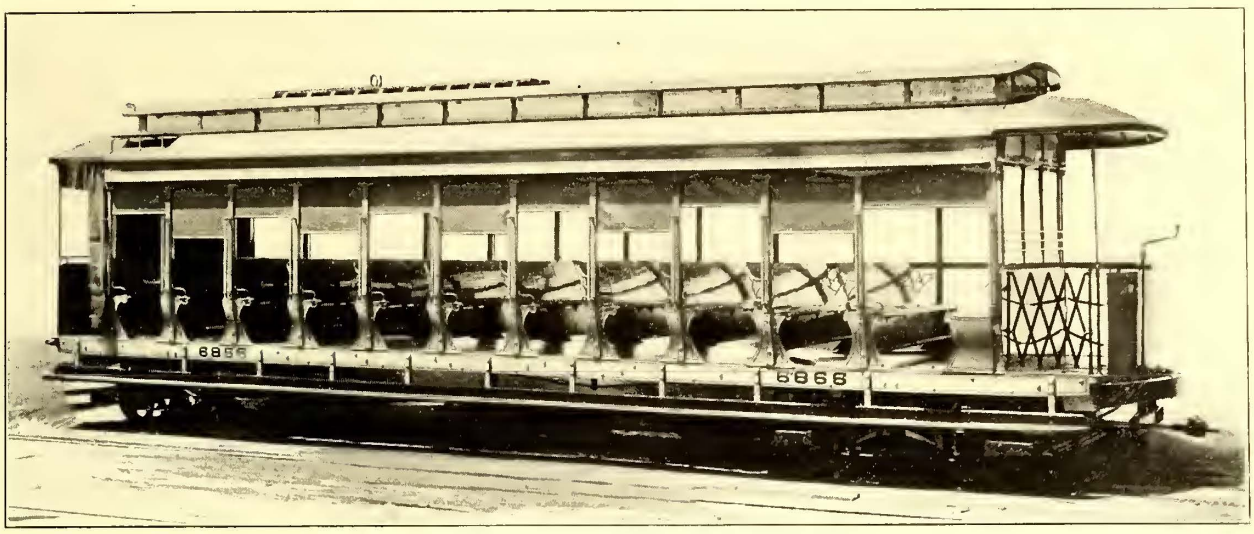
## Consolidation of Pennsylvania Roads

All the street railway companies operating in and around Allentown have been merged into one company known as the Lehigh Valley Traction Company. As heretofore constituted, the system in and about Allentown consisted of nine companies, namely: Allentown Passenger Railway Company, Catasauqua & Northern Street Railway Company, Bethlehem & Allentown Street Railway Company, Bethlehem & South Bethlehem Street Railway Company, South Bethlehem & Hellertown Street Railway Company, Allentown & Emaus Street Railway Company, Lehigh Valley Traction Company, Allentown & Lehigh Valley Traction Company, and the Allentown & Bethlehem Rapid Transit Company. The lines of all these companies were operated on lease by the Allentown & Bethlehem Rapid Transit Company, and later by the Allentown & Lehigh Valley Traction Company as lessee. The consolidation has been brought about by each of the seven street railway companies ratifying the agreement of their directors by which the six street railway companies first mentioned are consolidated with and merged into the Lehigh Valley Traction Company, and by a transfer by the Allentown & Bethlehem Rapid Transit Company and the Allentown & Lehigh Valley Traction Company of all their power plants, cars, equipments and assets to the new company, the Lehigh Valley Traction Company. The officers of the new company will be Albert L. Johnson, president; Tom L. Johnson, vice-president, and J. E. Kenney, secretary. The directors are Albert L. Johnson, Tom L. Johnson, Samuel Harris, R. E. Wright and W. J. Hartzell.

## Long Open Car for Atlantic City

The West Jersey & Seashore Railway Company, of Atlantic City, has just put in service a number of open cars, whose construction has been modified to suit the requirements of its service.

These cars form a very good example of what is now becoming very popular for street railway men, that is, the specializing of standard types to meet purely local conditions, thus obtaining all the advantages of standard cars, while adopting such features as make them peculiarly well fitted for the work which they are to perform. These cars have four 1-in. truss-rods, secured to the




NEW OPEN CAR FOR ATLANTIC CITY

The cars are intended to run in one direction only around a loop, and have therefore been designed with strict regard to this service by the J. G. Brill Company, which built them. The body is within a fraction of an inch of 38 ft. in length, and is 43 ft. 9 ins. over the dashers. It is 7 ft. wide at the sills and 7ft. 8 ½ ins. wide over the posts. The platforms are short, that in the rear being 3 ft. 3 ins. and that forward 3 ft. 6 ins. These platforms are not intended for passengers. They have no seats, and that in front is closed on one side by the guard-rail, which runs from dasher to dasher, and is screwed fast, and on the other side by a Brill folding gate. The trolley board is placed at the rear end of the car, its center being 10 ft. 6 ins. from the rear end. As the car is to be operated in one direction, only one bulkhead is used, which is at the forward end. There is but one step, 11 ins. wide, having a 16½-in. riser. It is 20 ins. from the head of the rail.

The car is mounted on a pair of No. 27-G. trucks. There are two Westinghouse No. 38-B motors on the inside of the rear axles, with nose suspension. The forward axle is arranged for a Westinghouse compressor.

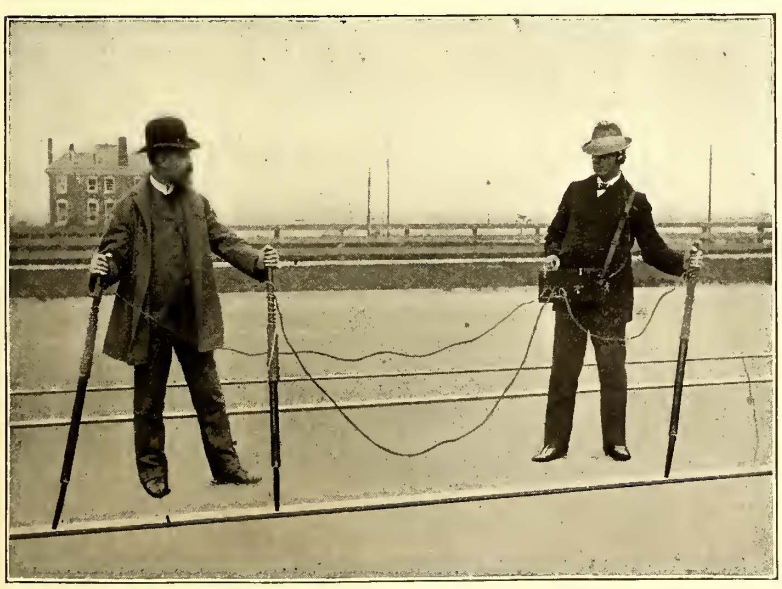
The inside of the car is finished in cherry and ash. The seats are reversible except the one against the bulkhead. The panels are of the round-corner, seat-end type. A rather unusual feature is the covering of the roof with tin instead of canvas. There is one gong, one sand-box and a pilot on the front end of the forward truck.

insides of sills below the bolster. This is necessary, as the weight of the car without motors is 20,700 lbs. The trucks weigh 5000 lbs. each.

## A New Method of Testing Rail-Joints

A new method of testing the resistances of rail-bond has been invented by R. W. Conant, electrical engineer of the Boston Elevated Railway Company, and is in use on the lines of that corporation. A great advantage of the device is its quickness, as well as its accuracy, and its ability to make measurements rapidly enables the company to make frequent tests of its rail-bonds, an advantage which is self-evident.

The accompanying engraving shows the method of its practical application. The joint being tested is between the left-hand and center poles, and the inspectors are determining the resistance introduced into the rail circuit by reason of this joint. The method employed is the simple one of balancing the resistance of two circuits against each other and of determining when they and the other resistances are equal by telephonic means. The two circuits used are that between the center pole and the left-hand pole and that between the center pole and the right-hand pole. If there was no joint it would be necessary, of course, in order to make the circuits of equal resistance, to have the center pole midway between the two outside poles. If, however, the joint adds a resistance to a 30-ft. rail equal to, say 3 ft. of track, the center pole will have to be 3 ft. nearer the left-hand pole when these two span a joint. This joint represents a fairly good condition of track. With poor joints, however, the right-hand, or indicating pole, would have to be shifted anywhere from 6 to 30 ft. away from the center pole, depending on the condition of the joint, while with bad joints it would be over 30 ft.



TESTING RAIL BONDS IN BOSTON

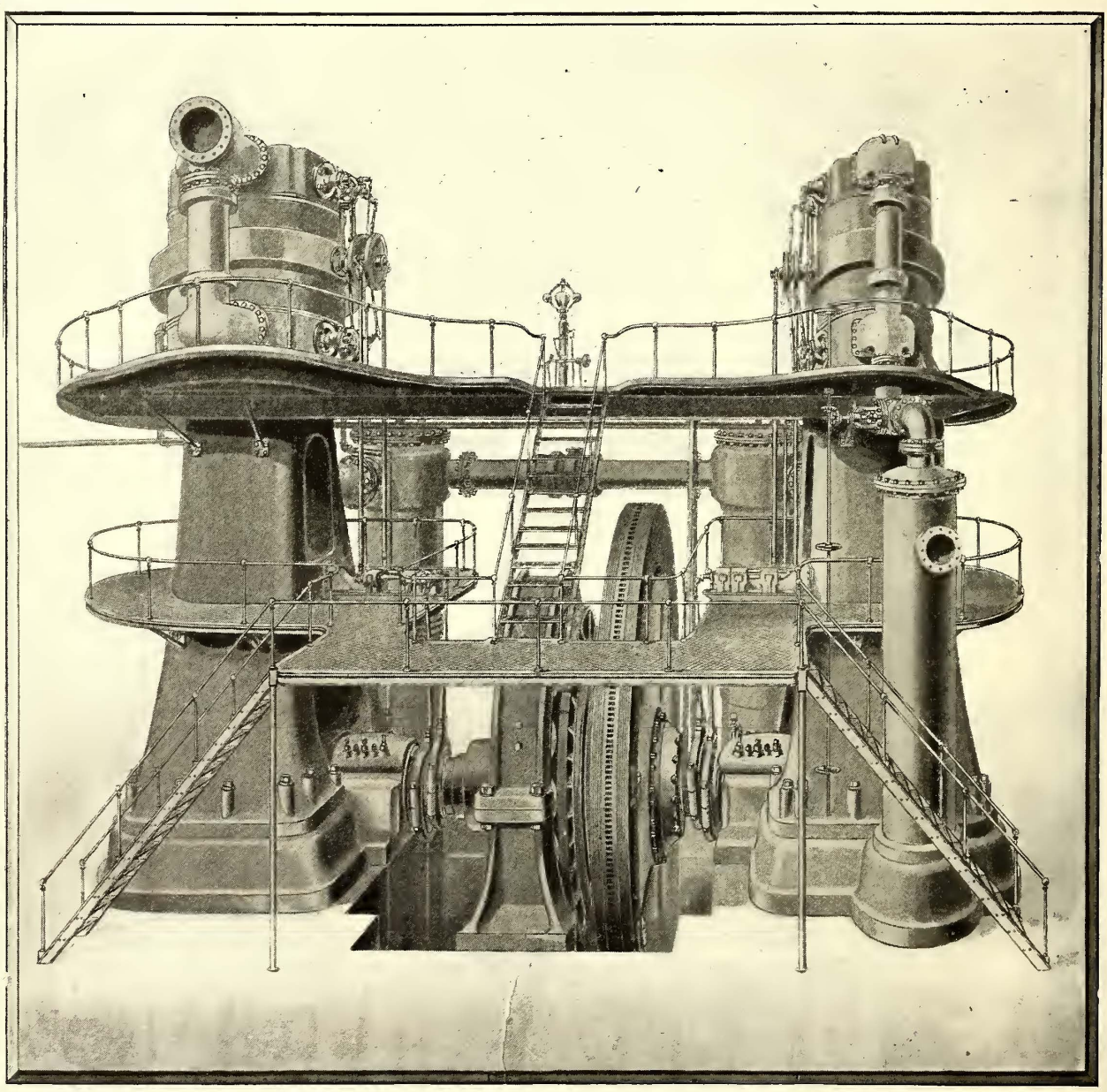
As will be seen, the Conant rail-joint testing instrument utilizes the current already on the track by reason of the car service, and no matter how variable this current may be, since the variation through the joint and adjacent rail is precisely the same, it introduces no error. The operator, having the case slung over his shoulder, directs his assistant to strike his two connecting poles into the rails, spanning the joint, with about 3 ft. between the poles. He then strikes his indicating pole into the rail, say 4 ft. from the center pole, and listening at the telephone attached to the box, which has a continuous interrupter in circuit, he throws a switch alternately to right and left and compares the two sounds heard from joint and 4 ft. of rail. Finding in the above case that the sound from the joint is the louder, he shifts his pole so as to span a greater length of rail. When the sounds are found to be approximately equal, a final test of balance is made by leaving the switch on the box in the middle position, when no sound should

be heard. In case a slight sound is noticeable he shifts his pole until it is entirely killed. This then gives the length of rail equivalent to the joint, from which, if it is desired, knowing the weight of the rail, the resistance may be calculated.

An intensifying attachment on the instrument allows of its use with very weak track currents, and the complete instrument is a simple and durable piece of apparatus. The instrument is being placed on the market by the Chase-Shawmut Company, of Boston, Mass.

## Large Corliss Engine

The largest direct-current generating unit in the world is now approaching completion at the works of the International Power Company, at Providence, R. I., and will be installed in the power station of the Boston Elevated Railway Company. The indicated horse power of the engine at maximum efficiency is 4000 h.p., but this load can be varied 12 per cent to 15 per cent either way without materially effecting the efficiency. The engine, which is illustrated herewith, is of the vertical type, compound condensing, with cylinder dimensions 42 ins. and 90 ins. by 60 ins. stroke, and will run at 75 r.p.m. under a steam pressure of 180 lbs. The valves are of the Corliss type, but are located in the heads, instead of on the sides, of the cylinder, the usual practice. In this way, the clearance is reduced to a minimum, that in the low-pressure cylinder being less than 2 per cent. The cylinders are jacketed, barrel and head.



4000-H.P. CORLISS ENGINE FOR BOSTON ELEVATED RAILWAY

The pistons are of the box type. The rods are 9 ins. in diameter, have a 3-in. hole throughout their length, and are of nickel steel of 50,000 lbs. elastic limit. They are hydraulic forged and oil tempered, and are packed with Tripp metallic packing; below the metallic packing box is another of soft packing to prevent the passage of oil. The cross-heads are of air furnace charcoal gun iron. The connecting rods are all hydraulic forged nickel steel. They are circular in section, 9½ ins. in diameter near the cross-head and 13 ins. near the crank-pin. A 3½-in. hole extends through the rods from end to end. The distance between pin centers is 13 ft. 9 ins. The cross-head pin and crank-pin are all open-hearth forged nickel steel, bored out and oil tempered.

The engine shaft, which is furnished by the Bethlehem Steel Company, and illustrated in the Street Railway Journal for August, is of hollow forged nickel steel 27 ft. 10 ins. in length, 32 ins. in diameter in the bearings, and 37 ins. in the body, with a 17½-in. hole through its length. The weight of the engine shaft is 65,410 lbs., of the crank disc 58,004 lbs., of the armature 125,000 lbs., and of the fly-wheel 265,515 lbs., making a load on the bearings aside from the connecting rod, pistons, etc., 513,929 lbs.; 143 lbs. per square inch of projected area.

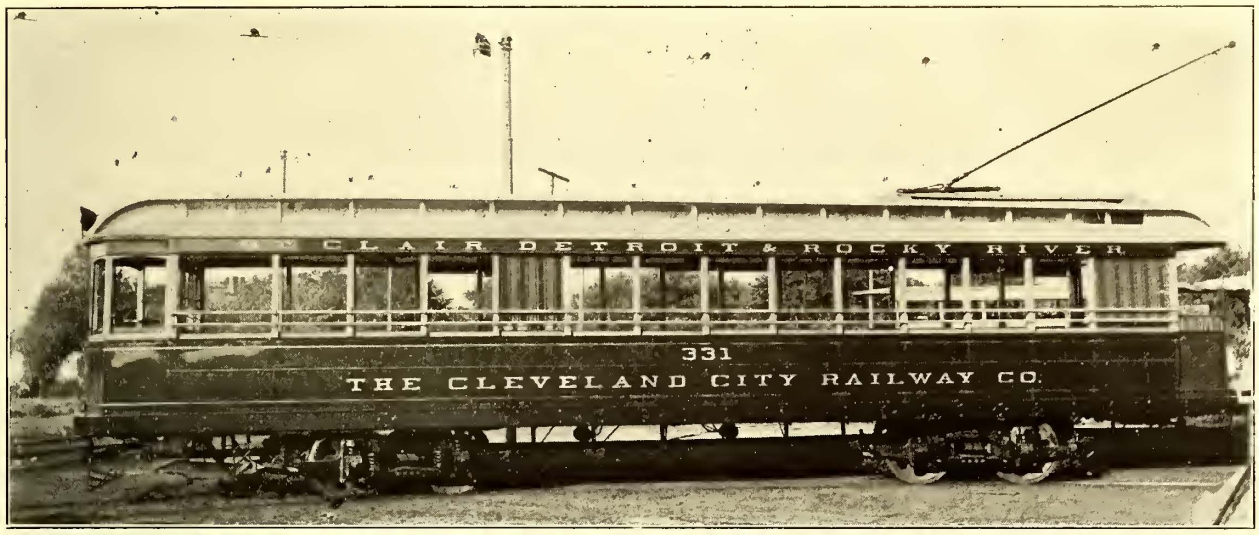
The fly-wheel is 28 ft. in diameter; the main bearings are 32 ft. in diameter, 56 ins. long and 19 ft. 9 ins. center to center. Both top and bottom shells are water jacketed, and oil is fed to the bearings at both top and bottom.

The cylinders are set 29-ft. 2-in. centers, with crank at 90 degs. Steam is brought to the engine by a 16-in. main, which enters first a receiver 3 ft. in diameter; from the receiver it passes through a 12-in. globe throttle valve to a 12-in. pipe, which conducts it to the steam valve chambers of the high-pressure cylinder. The valve gear is so arranged that the governor may control the cut-off in both cylinders, or the low-pressure cylinder may be run

on the fixed cut-off. The change can be made while the engine is in motion. The engine is guaranteed to regulate as to speed within 1 per cent under practically constant load, and to vary not more than 3 per cent with sudden changes of 25 per cent in load.

## New Long Car for Cleveland

A type of car which is proving very satisfactory for long distance riding on the Cleveland City Railway is illustrated in this




LONG DOUBLE-TRUCK CAR FOR CLEVELAND

connection. It is used on the St. Clair, Detroit & Rocky River Line, which is controlled by the Cleveland City Railway Company.

The car, which was built by the G. C. Kuhlman Company, has a length over all of 47 ft., and contains fifteen benches, each capable of seating six passengers, or a total of ninety passengers in all. The width over the posts is 8 ft. 4 ins., and that over the steel sill plates 7 ft. 9 ins.

The car is finished in white oak, with cherry trimmings, and bird's-eye maple ceilings. The metal trimmings are of polished bronze. The car is vestibuled in front, and is equipped with four 35-h.p. Westinghouse motors on Brill No. 27 trucks.

This car has been adopted as the standard for this class of service on the Cleveland City Railway, and the Kuhlman Company is now engaged in building twenty similar in general character to that illustrated.

## Track Scrapers

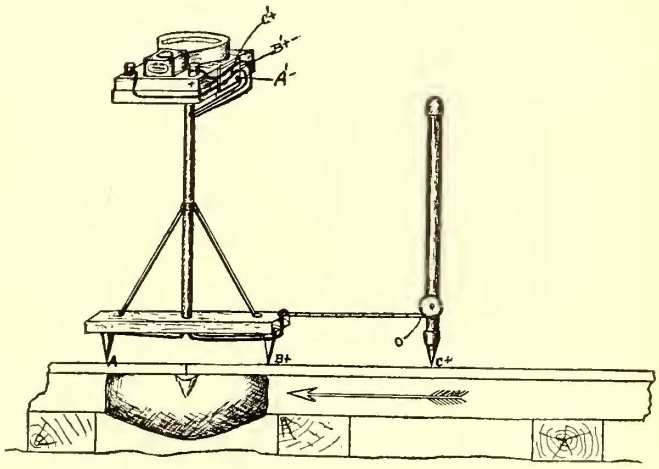
There is one piece of apparatus of the greatest value to street railway companies which receives little attention—this is the track scraper. In summer and winter, and on almost all lines except those running on the cleanest city streets the track scraper can be applied to advantage. In the winter time it performs invaluable service, and cars during early hours of snow storms can keep up to the schedule until the snow plow or sweeper is put at work. In the summer time mud and dirt on the rails can be removed and not only a better contact, but much easier riding, can thereby be obtained.

One of the best known devices of this kind is the Littell track scraper, as built by the J. G. Brill Company. Its action is automatic and its construction is of the simplest character. A heavy bar is bent into a rectangular U-shape. This is fastened to a board by a pair of bearings. At the outer ends of the bar the two scrapers are attached and at the bottom of the U, a lever leading to the platform is attached. The normal position of the scraper is up or raised from the track and the treadle hooked to the platform in a position where a touch of the foot will drop the scrapers upon the track. It is always ready for service at a moment's notice, a touch of the toe being all that is necessary to drop the blades upon the rails. The application is practically instantaneous, the blades may be dropped, the obstruction removed and the scraper lifted by a downward motion of the foot. This form of scraper has repeatedly been used as a life saving device, the blades being dropped the instant a person was discovered on the track. When lifted the blades are entirely out of the way and not liable to be interfered with. The whole arrangement is very light and strong and can be readily applied to any car by simply bolting Youngstown Frontier freight car, published elsewhere in this issue. the plank upon which it is mounted to the platform timbers. A view of the device is shown in the engraving of the Lewiston &

## Device for Testing Rail Bond Resistances

The accompanying sketch shows an instrument for determining the resistances of rail-joints, invented by Chas. J. Schnaus, of the Missouri Railroad Company, of St. Louis, Mo. As shown, it is applied to a cast-welded joint, but readings can be made of any type of bonded joint.

The apparatus consists of a voltmeter, reading tenths of volts, mounted on a stand made of pipe, and with a wooden base. The latter is fitted with two hardened steel points, *A* and *B*, which serve as contacts, and are connected by wires passing through the rod to two points, *A'* and *B'*, on the two-circuit switch, attached to the voltmeter. The apparatus is also furnished with a third rod, *C*, which has a hardened steel point at its base, and is connected to the base of the stand by a steel tape line. The tape reel, which




DEVICE FOR TESTING RAIL BOND RESISTANCES

winds up automatically, is attached to the rod *C*, and the outer end, which is attached to the stand, is connected electrically to the voltmeter at the joint *C'*. The points *A* and *B* on the stand are spaced so that they just bridge the joint, if the track is cast welded, or if a fixed distance, say 30 ins. apart for an angle-plate joint. Readings are taken during the day while the regular schedule is in force.

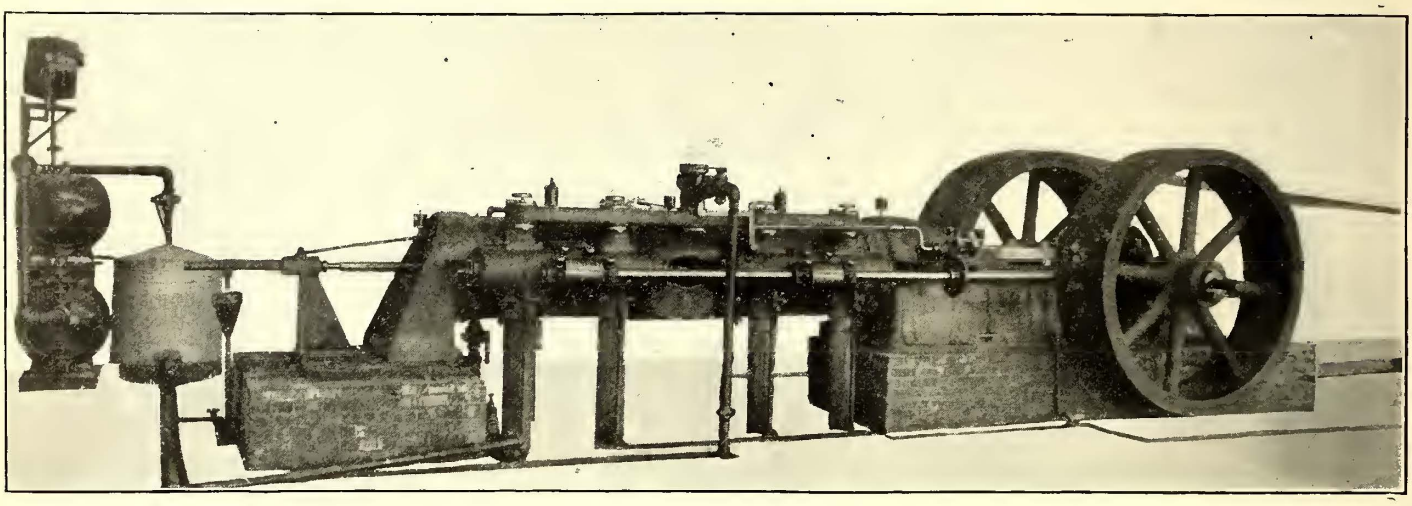
The instrument is first placed over a joint and the drop in voltage between *A* and *B* is taken on the voltmeter. The rod *C* is then drawn away from the stand until the resistance between *B* and *C*, as determined by the voltmeter reading, is the same as that between *A* and *B*. This distance is then read from the tape, and the difference between the length *A B* and *B C* represents the resistance of the joint in terms of inches of rail length. For convenience in reading this distance the zero point of the tape can be set at 30 ins. from *B*, or the distance between *A* and *B*. The re-

sistance in fractions of an ohm can easily be obtained from this measurement if desired.

The advantages claimed for this instrument are, that it is portable, does not interfere with the running of the cars, requires only the ordinary contact with a rail, is easily manipulated and fairly rapid. Experience with this instrument in St. Louis shows that two men can measure 2 miles of double track laid with 30-ft. rails in a day.

## The Standard Automatic Gas Engine

The use of gas engines for power station service presents many advantages, and it is claimed that in some cases they are more economical than steam power, especially in space, first cost, attendance and fuel. A new engine of this type is that built by the Standard Automatic Gas Engine Company, of Oil City, Pa. While the company is comparatively unknown as yet to the majority of present or prospective gas engine users, and while many of the details of the engine as described below are radically novel, the fact that neither the company nor the engine is in inexperienced hands is proven by mentioning the name of the president of the one and the designer of the other, J. W. Raymond, designer of the improved Raymond engine, built for many years by the J. I. Case Threshing Machine Company.



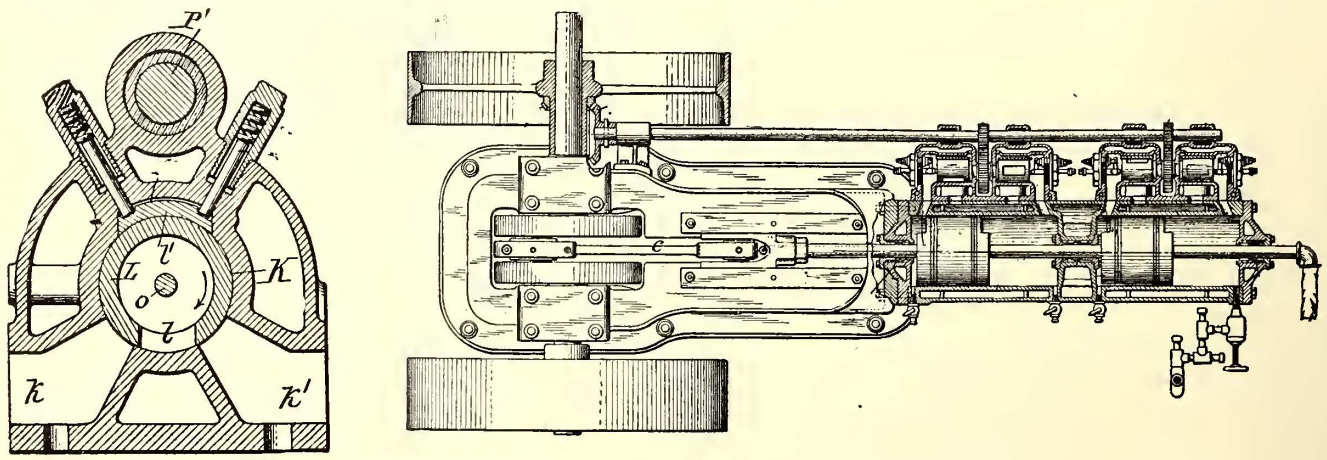
THE STANDARD AUTOMATIC GAS ENGINE

The engine operates upon the familiar Beau de Rochas, or four-stroke cycle, commonly known as the Otto, giving per single-ended cylinder one impulse during two revolutions. The special features deserving, perhaps, first mention, are the valve and valve gear. There is only one valve for both admission and exhaust, and this valve is a hollow cylinder of cast-iron, chilled and ground. The interior of the valve is open to the engine cylinder and as the valve turns in the valve chest, an opening in the valve alternately connects the cylinder with an admission and an exhaust port. A cross section through this valve is shown in Fig. 1. *L* is the cylindrical valve rotating in the valve chest, *K*, and held up against the valve seat by the springs and piece, *l'*. As it rotates, the port, *l*, connects the interior of the valve—which is open to the cylinder—alternately with the admission chamber, *k*, and the exhaust chamber, *k'*. The valve does not oscillate or have a reciprocating motion of any kind, but simply rolls continuously around in one direction, being turned by a horizontal shaft, driven by mitre gears from the main shaft, and turning the valve stem by 2 to 1 spur gears. The absence of poppet valves, cams, springs, and so forth, makes the engine remarkably noiseless.

The ignition is electrical in character, accomplished by a wiping spark between side tool-steel electrodes. The moving contact simply rotates with the valve, and the stationary contact is held by springs outside the valve chest and adjustable while the engine is in operation.

The governing of this engine is not accomplished by missing impulses, but by varying the quantity of the charge by throttling. The mixture is throttled by one plain balanced butterfly valve as simple as the damper in a stove pipe and almost entirely free from friction, since all points of the butterfly, except the stem, are out of contact with the walls of the valve chamber except when the valve is shut tight. For this reason the force which the governor must apply to move the valve is much less than that required for piston or other forms of valves, the leverage and necessary extent of motion of the fly balls is reduced and the regulation is correspondingly perfect. The proportions of the mixture are determined by entirely independent valves in the incoming air and gas pipes, the constituents being pulled through these and the mixture being pulled through the governing valve by the suction of the filling stroke.

The engine is horizontal and, in small sizes, 15 h.p. and upward, is of the ordinary single-acting form, with a trunk piston acting as a cross-head. In sizes of 50 h.p. and up, the engine is made with two single-acting cylinders tandem on the same piston rod. The cycles of the two cylinders are displaced one revolution from each other, so that one impulse per revolution is obtained, the expansion stroke in one cylinder occurring immediately before the compression stroke in the other.




FIGS. 1 AND 2.—CROSS SECTION THROUGH VALVE AND HORIZONTAL SECTION AND PLAN OF ENGINE

Naturally, some means must be devised for cooling the piston rod, which runs out through the explosion chamber of the cylinder nearer the crank to the piston of the other cylinder. The piston rod is extended out through the head of this cylinder also, in the form of a tail rod, and is made hollow. A long pipe is then in-

serted into the hollow rod and is packed at the tail rod end. Cooling water is injected through this long pipe clear into the rod in the second cylinder and flows back inside the rod, but outside the pipe, to a drip at the tail rod end. The piston rod is packed with non-inflammable packing where it comes through the cylinder head.

The company has recently completed a still more interesting engine with two 18-in. x 18-in. double-acting cylinders, tandem on one piston rod, with outside cross-head of standard steam engine construction. The two double-acting cylinders give two forward impulses per revolution simultaneous with the compression strokes in the other end of the cylinders. The heavy compression both ways gives very smooth running, even with considerable slack in the cross-head and crank-pin boxes. The piston rod of this engine, owing to the heavy strains it is called upon to bear, is made of nickel steel, drawn with the hole for the cooling water in it. The water in this case is introduced through the cross-head and discharged through the tail rod. One balanced-pressure sight-feed lubricator on the center of each cylinder lubricates the pistons with a high fire-test engine oil. Fig. 2 shows a plan of this engine.

The pistons are cored out and the water passing through the rod is compelled to circulate also inside the pistons, thus cooling them. One horizontal shaft runs along beside the cylinders and turns the four valves of this engine (one for each end of each cylinder) through two pairs of cut gears. The governor actuates one butterfly valve, which throttles the mixture to all four cylinder ends. The course of the mixture to any one, two or three of the four cylinder ends may be cut off to increase the compression and economy at low loads. Indeed, any valve chest may be opened and the igniter taken out while the engine is running.

This engine is started by turning it over to the proper point and igniting electrically a charge of very slow burning powder in an enclosure connected with one cylinder head. The connection is made through a number of right-angle bends made in capped tees in such a way that the ash from the powder blows past the bends and is caught in the caps, from which it may be removed from time to time. The engine may also be piped to a compressed air tank or steam supply for starting.

This engine is shown on page 896, set up and belted to a 150-kw. Westinghouse generator for the Oil City Street Railway. A duplicate is under way for the same purpose, and two 500 h.p. each are under order. No storage batteries will be used.

The engines are rated on the basis of mean effective pressure, the one shown in the illustration being conservatively rated at 200 h.p. on the basis of a mean effective of 32 lbs. per sq. in., although much higher mean effectives may be obtained. Indeed, this engine is guaranteed to develop 300 brake h.p. with a consumption of not more than 3000 cu. ft. of natural gas per hour, this gas showing about 990 B. T. U. per cu. ft.

An interesting equipment of engines for which the company has closed a contract will consist of four like that shown in the illustration, which are ordered for use in Germany. These will be made into two engines by coupling two of them together with cranks at quarters, each complete engine thus consisting of two pairs of tandem double-acting cylinders giving four impulses per revolution. Each such engine will be direct coupled to a three-phase 60-cycle alternator mounted between the cranks, and these alternators will be run in parallel and with rotary converters. Another order is for two engines of 350 h.p. each, to carry a street railway load in Western Pennsylvania. These engines will get their gas from by-product coke ovens, a gas which is at present thrown away, and will require no elaborate preparation, such as washing or scrubbing to adapt it for use in the engines. All it needs is to be passed through holders in which it can deposit its tar.

The Standard Automatic Gas Engine Company, of which Mr. Raymond is president, as noted above, is capitalized at $36,000, but expects to increase its capitalization to $100,000 to accommodate increasing business. It has recently erected new shops on the banks of the Allegheny River, about 2 miles below Oil City. The building contains also the new street railway gas engine power house and is about 180 ft. long by 67 ft. wide. The contract will soon be let to lengthen it 150 ft.

## Safety Third-Rail System at New Britain

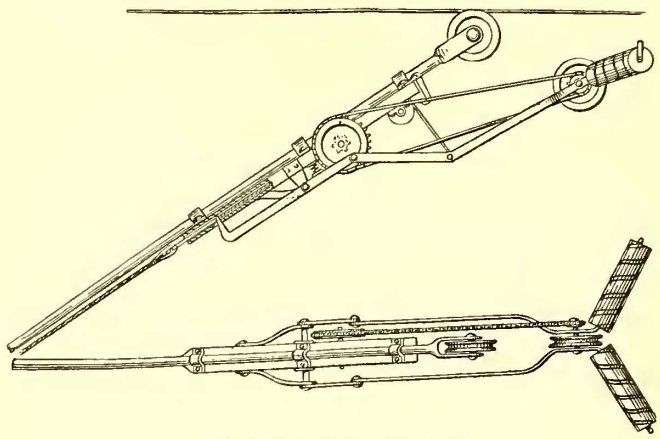
A series of tests were made Nov. 9, of the McElroy-Grunow safety third-rail system at New Britain, Conn., on a section of track belonging to the New York, New Haven & Hartford Railroad Company. The tests were made under the supervision of William Grunow, Jr., the inventor of the system. Owing to the shortness of the section high speed could not be secured, but the switches showed their ability to handle heavy currents. The brakes on the trial car were tightened, enabling the amount of current taken from the rails to reach as high as 1000 amps. at a pressure of 550 volts, but no sticking or arcing of the contact surfaces was discernible after careful inspection had been made.

The system consists of two rails carried between the regular track rails. One of these is a conductor rail, from which the current is taken into the car; the other is used for transmitting the current controlling the switching devices in the section boxes. The main current is not broken until the car begins to take current from the next following section. In this way there can be no arcing in the section box.

## Trolley Pole Replacer

A new and ingenious trolley wire finder has recently been invented by Paul Kaufmann, of Lockport, N. Y., and is illustrated herewith. The frame of device is about 14 ins. long, and is constructed of tubing to render it light. When not in use, it lies from 4 ins. to 5 ins. below the trolley wheel, just low enough to clear the roof of the car when the trolley is running on a low wire. The device is actuated by a spring at the foot of the pole, which spring is connected by a wire to the replacer frame. The connection is not made directly, but through a rack bar shown in the engraving.

The operation of the device is then as follows: When the regular trolley wheel leaves the wire, it carries the replacer up with it until this latter strikes the wire. This actuates the double lever



TROLLEY POLE REPLACER

in the frame of the device, disengaging the rack-bar to which the spring is attached. The spring then draws up the replacer, pulling down the trolley. The grooved deflecting rollers then carry the wire to the auxiliary trolley wheel between them. This auxiliary wheel is connected by a sprocket chain with a gear wheel on the trolley pole, and its revolution turns the latter wheel. This gear wheel engages the rack-bar and retensions the spring until the rack-bar touches a hasp, which holds the frame in replacing or operative position. As the hasp releases its hold, the frame drops down and the regular trolley wheel is guided to the wire. At the same time the bar at the end of the frame engages the rack-bar, and the device assumes its original position.

The engraving does not represent the device in its proper proportions, but the auxiliary apparatus has been enlarged to show it more comprehensively.

## Organization of R. W. Blackwell & Co., Ltd.

The announcement was made last month that Robert W. Blackwell & Company, Ltd., of 39 Victoria Street, Westminster, London, S. W., has been registered with a capital of £200,000. The company has been formed for the purpose of taking over the business of engineers and contractors heretofore carried on by Messrs. Robert W. Blackwell & Company, at London, Liverpool, Paris and New York. The directors of the company are: Robert W. Blackwell, Philip Dawson, Benjamin Hunting Howell, Sir Charles E. Howard Vincent and Francis Henry Barker. The change in organization mentioned has been made to extend the business of the company.

R. W. Blackwell & Company is one of the oldest and best established firms engaged in the electrical contracting and supply business in England, and has established a high reputation in the tramway and lighting fields. It has been the contractor for or has furnished supplies to a very large number of the electric tramway enterprises in Europe, particularly in England, and has branch offices in a number of the European capitals and in New York.

## Annual and Quarterly Reports of New York City Companies

MANHATTAN RAILWAY COMPANY

At the annual meeting of the stockholders of the Manhattan Railway Company, of New York, held Nov. 8, the following directors were re-elected: George J. Gould, Russell Sage, Samuel Sloan, Edwin Gould, R. M. Gallaway, Marcellus Hartley, Thomas T. Eckert, G. P. Morosini, Donald Mackay, Howard Gould, Warren B. Smith, John T. Terry and Alfred Skitt. The officers were re-elected as follows: President, George J. Gould; vice-president, Alfred Skitt; secretary and treasurer, D. W. McWilliams. The company's report of operation is as follows:

| Year ending Sept. 30, | 1898 | 1899 |
|---|---|---|
| Gross earnings | $9,204,466 | $9,325,111 |
| Operating expenses and taxes | 6,066,682 | 6,113,790 |
| Net earnings | $3,137,784 | $3,211,321 |
| Interest on bonds | 1,889,681 | 1,889,681 |
| Balance | $1,248,103 | $1,321,640 |
| Dividends | 1,200,000 | 1,560,000 |
| Deficit | sur.$48,103 | $238,360 |
| Previous surplus | 4,353,104 | 4,401,207 |
| Total surplus | $4,401,207 | $4,162,847 |

Operating expenses, per cent, excluding all taxes, 56.69; operating expenses, per cent, including all taxes, 65.56; number of passengers carried, 177,204,558.

This report, compared with that of 1898, shows an increase in dividends of $360,000, due to the payment of dividends of 2 per cent on $30,000,000 and on $48,000,000, the increased capital arising from the $18,000,000 issue of stock to provide for electrical equipment and to extinguish floating debt and for betterments. The report on passengers carried, 177,204,558, shows a falling off and is attributed to the competition of the surface roads. The figures in 1898 were 179,728,356, in 1897, 183,184,641, and in 1896, 182,437,244.

Of the meeting and the affairs of the company Russell Sage is quoted as saying: "No interest connected with William C. Whitney had a voice at the meeting. I have stated time and again that Mr. Whitney had no investment interest, if any, in Manhattan. Before the election I told Mr. Gould that it would be impolitic, in view of the satisfactory condition of the company and the progress making in changing the motive power to make any change in the directorate or the officers. He concurred in my views. The meeting was entirely harmonious. The subject of electric traction was not brought up formally, but it was discussed between individual stockholders, and full satisfaction was expressed at what has been done and in the plans which are being carried out. No matter what the stock market thinks of our report for the year, we have every reason to be satisfied with the system and its finances."

The annual report of the Manhattan Railway Company, published above, was supplemented during the month by a report for the quarter ending Sept. 30. The figures of this quarter, as compared with that of last year and of 1892, follow:

| Quarter ending Sept. 30 | 1892 | 1898 | 1899 |
|---|---|---|---|
| Gross receipts | $2,468,730 | $1,788,613 | $1,912,829 |
| Operating expenses | 1,294,251 | 1,249,003 | 1,274,019 |
| Net earnings | 1,174,479 | 539,610 | 638,810 |
| Other income | 35,000 | 47,500 | 188,300 |
| Total | 1,209,479 | 587,110 | 827,110 |
| Interest, taxes, etc | 681,089 | 607,172 | 646,045 |
| Surplus for stock | 528,390 | def.20,062 | 181,065 |
| Dividends | a450,000 | b300,000 | c480,000 |
| To surplus account | 78,390 | def.320,062 | def.298,935 |

a, 1½ per cent on $30,000,000; b, 1 per cent on $30,000,000; c, 1 per cent on $48,000,000.

QUARTERLY REPORT OF THE METROPOLITAN STREET RAILWAY CO.

The Metropolitan quarterly report for the year ending Sept. 30, is as follows, comparison being made with 1898 and 1897:

| Quarter ending Sept. 30 | 1897d | 1898 | 1899 |
|---|---|---|---|
| Gross receipts | $2,407,083 | $3,120,371 | $3,560,827 |
| Operating expenses | 1,289,277 | 1,548,396 | 1,716,613 |
| Net earnings | 1,117,806 | 1,571,975 | 1,844,214 |
| Other income | 86,829 | 97,515 | 77,853 |
| Total | 1,204,635 | 1,669,489 | 1,922,066 |
| Fixed charges | 820,448 | 1,117,680 | 1,130,330 |
| Surplus for stock | 384,187 | 551,809 | 791,736 |
| Dividends | 375,000e | 375,000e | 787,500f |
| To surplus account | 9,187 | 176,809 | 4,236 |

e, 1¼ per cent on $30,000,000; f, 1¾ per cent on $45,000,000; d, excluding Second Avenue Railroad.

ANNUAL REPORT OF THE THIRD AVENUE RAILROAD COMPANY

At the annual meeting of the stockholders of the Third Avenue Railroad Company, of New York, held Nov. 15, the old board was re-elected except that William H. Webb, recently deceased, was replaced by George A. Heyl. The statement of operation for the year ending Oct. 31, 1899, with which is compared the report for the last two years, is as follows:

| | 1897 | 1898 | 1899 |
|---|---|---|---|
| Receipts from passengers | $2,570,842 | $2,359,799 | $2,098,871 |
| Operating expenses | 1,444,648 | 1,180,465 | 1,392,400 |
| Earnings from operation | 1,126,194 | 1,179,334 | 706,471 |
| Income from other sources, including dividends on stock of other companies | 47,368 | 42,316 | 680,933 |
| Total earnings | 1,173,562 | 1,121,650 | 1,387,404 |
| Fixed charges | | | |
| Interest on bonds | 250,000 | 250,000 | 250,000 |
| Taxes | 122,286 | 119,578 | 116,020 |
| Net earnings | 801,276 | 752,072 | 1,021,384 |
| Dividends | 850,000 | 800,000 | 840,000 |
| Surplus | def.48,724 | def.47,928 | $181,384 |

It will be noticed that gross receipts have fallen off about 11 per cent, and earnings from operation about 35 per cent. As against this there appears income from other sources this year of $680,933, as against but $42,916 last year. In order to make the showing a fair one, account should be taken of the interest on the floating debt incurred in purchasing the stock of the underlying companies, now in the treasury of the Third Avenue Company. In the balance sheet of June 30, 1899, this floating debt amounted to nearly $13,500,000, the interest on which at 4 per cent would amount to about $540,000, or at 5 per cent, $675,000.

The company's dividends in 1894 were 8 per cent, in 1895, 9 per cent; in 1896, 9¾ per cent; in 1897, 8¼ per cent; in 1898, 7¾ per cent, while in 1899, three dividends of 1¾ per cent were paid and the fourth, just declared at the annual meeting, was 1¼ per cent, making 6½ per cent for the calendar year.

The falling off in earnings shown in the annual report is, of course, due in large part, if not entirely, to the delays and difficulties of traffic in the reconstruction period. With the new long cars now in operation and which are likely to become the most popular cars in the city, the Third Avenue Railroad will doubtless gain traffic from both the Manhattan Elevated and Metropolitan Companies, and will even, perhaps, return to the standard of earlier days.

## New Franchise in Milwaukee

The Milwaukee Electric Railway & Light Company and the special committee of the Common Council have at last agreed on the terms of the new street railway ordinance. It remains now for the Common Council to act on the agreement. The city agrees in the ordinance to grant the extension of all the company's franchises for a term of about ten years, all to end in 1934, and to grant eleven additional franchises to terminate at the same time. In return for these privileges the company agrees to grant workingmen's four-cent fares from 5:30 to 7 A. M., and from 5 to 6:30 P. M., beginning Jan. 1, next, and at the end of five years to give a straight four-cent fare. In return for these concessions the city will abandon all right to regulate or change fares until the new franchises expire in 1934. No provision is made for the readjustment of fares at any time during the next thirty-five years, no matter what the changed conditions may be. The company has accepted this proposition, and on these terms it has made formal application to the Common Council for the additional franchises agreed upon. The ordinance, as it now stands, is somewhat different in terms from that which the committee agreed on a few days ago,

Instead of demanding a sliding scale reduction in fares, reaching a four-cent fare four years hence, the sliding scale is abandoned and the four-cent fare is to be introduced after five years. The workingmen's fares are to go into effect at once and the council committee abandons its demand that the company pay for all original paving between the tracks.

## Electrical Banquet in Philadelphia

The Morris Electric Company, of New York, tendered a banquet to the electrical press and a number of persons in the electrical railway industry on Nov. 14, at the Bingham House. Among those present were: Edward S. King, of the Baltimore & Ohio Railroad; C. B. Fairchild, "Street Railway Review;" George Mason, Potomac Terra Cotta Company, of Washington, D. C.; S. H. Harrington, Harrington Rail Bonding System, of New York; Elmer P. Morris, Morris Electric Company, of New York; John Blair MacAfee, president, Railways Company General and American Engineering Company, of Philadelphia; C. C. Bent, superintendent, Baltimore & Ohio Railroad Company; G. E. Pratt, Hubbard Electric Brake Company, of Chester, Pa.; George F. Porter, W. R. Brixey, New York; D. A. Hegarty, Railways Company General; W. E. Harrington, Camden & Suburban Railroad Company; Ambrose B. Umstead, Earn Line Transportation Company; W. H. Antrome, "Philadelphia Record;" J. Franklin Stevens, Keystone Electrical Equipment Company; Stephen Goddard, "Electrical Review," New York; J. L. B. Hachulen, Baltimore & Ohio Railroad Company; F. B. Franklin, Baltimore & Ohio Railroad Company; W. K. Beard, STREET RAILWAY JOURNAL.

Speeches were made by Mr. Bent, of the Baltimore & Ohio Railroad Company; Mr. MacAfee, and, of course, Mr. Morris. Many of those present, including Mr. Morris, were pioneers in the electric railway field, and their reminscences of the early struggles were of great interest to those who had only lately engaged in the work. Credit was given to the genius of Van Depoele, Sprague, Thomson and other inventors, as well as to the ability of such engineers in developing the work as F. S. Pearson, B. J. Arnold, Louis Duncan, G. F. Greenwood, H. F. Parshall and W. E. Baker. Mr. Morris received many congratulations upon the recent large orders which he had received for the equipment of the Havana Electric Railway, reference to which is made elsewhere in this issue. The dinner was given upon the occasion of the first shipment of fifty car loads of terra cotta ducts by steamer to Havana.

## Consolidation of Well Known Publications

In the final issue of "Paper," published Nov. 10, it is announced that after that date "Paper" will be amalgamated with the "Paper Trade Journal." The conditions which brought about the establishment of "Paper" have now been removed through its agency, for the recent change of ownership in the "Paper Trade Journal," by which one of the best known newspaper men in this country, Col. C. H. Jones, became principal owner and manager of this old and well known trade publication, was due, in large part at least, to the rivalry of "Paper" during the past year. Col. Jones deserves, and will receive a large measure of success in his new venture, and the effect of his remarkable ability and enterprise has already become apparent in the pages of the "Paper Trade Journal."

## Personal

MR. A. K. BAYLOR, of London, has arrived in America.

MR. HARRY W. HEAP, receiver of the Phœnix City Railway Company, was married recently to Miss Helen Wells, of Prescott.

MR. M. ADAMS, of Montoursville, Pa., assumed the duties of assistant superintendent of the Montoursville Passenger Railway Company on Nov. 1.

MR. HENRY N. RANSOM, purchasing agent of the International Traction Company, of Buffalo, was married Nov. 21, to Miss Alice Gillet.

MR. W. C. HELLER has resigned the general managership of the Montgomery & Chester Electric Railway Company, to accept a similar position on the Rapid Transit Railway of Xenia, Ohio.

MR. THOMAS E. MITTEN, general superintendent of the Milwaukee Electric Railway & Light Company, has been traveling in Canada and the East during the past two weeks.

MR. FRANK E. ROWELL has been elected treasurer of the Portsmouth, Kittery & York Street Railway Company, of Portsmouth, N. H., to succeed the late I. C. Libby, of Waterville.

MR. J. C. HUTCHINS, vice-president and general manager of the Detroit Citizens' Street Railway, has been elected president of the Detroit Electric Railway, to succeed the late Albert Pack.

MR. M. M. KOHN, general manager of the Oceanic Gas & Electric Company, Ltd., of Honolulu, H. I., is at the Hoffman House, New York. During his visit here, Mr. Kohn will make purchases in the mechanical and electrical lines

MR. WILLIAM WEAVER, of Ogden, manager of the Ogden Street Railway Company, of Ogden, Utah, has been appointed receiver of the Bear River Irrigation and Ogden Waterworks Company, to succeed William Adamson and S. S. Conklin.

MAJ. L. N. DOWNS, president of the Michigan Traction Company, of Kalamazoo, will remove to Philadelphia shortly to assume the presidency of the Railways Company General. This company recently secured control of the Michigan Traction Company.

MR. H. F. PARSHALL, the widely known consulting engineer of London, arrived in New York on Nov. 25, and will remain here for several weeks. He is accompanied by Mr. A. R. Monks, managing director of the British Thomson-Houston Company.

MR. FRANK M. HAYNES, president, purchasing agent and superintendent of the Lorain Street Railway Company, has tendered his resignation to accept a similar position in London, Eng., on lines recently acquired by A. J. Moxham and Tom L. Johnson.

MR. NELSON C. DRAPER, until recently mechanical engineer with the Central Railway Company, of Peoria, has been appointed constructing and mechanical engineer of the Peoria & Pekin Terminal Railway, with headquarters in Peoria. This company operates both steam and electric railways.

MR. J. BRODIE SMITH has been elected general manager of the Manchester Street Railway, of Manchester, N. H., to succeed Mr. E. P. Shaw, Jr., of Boston, who is forced to resign owing to the pressure of his other business connections. Mr. Smith will assume the general managership of the road Dec. 1.

MR. F. M. ZIMMERMAN, superintendent, purchasing agent and chief electrician of the Atlanta Railway Company, has resigned that position to accept a position with the Lorain Street Railway Company. Mr. Zimmerman will succeed Mr. Frank M. Haynes, who has connected himself with Mr. Johnson in his London project.

MR. E. J. BARNEY, president of the Barney & Smith Car Company, tendered his resignation as president of the company at the quarterly meeting of the directors, held Nov. 14. The resignation will take effect Jan. 1. At the meeting it was announced that the business on hand at the present time amounted to more than $2,000,000, and that the aggregate business which will be done this year will exceed that of last year by at least $600,000.

MR. A. N. CONNETT, engineer-in-chief of the works department of the Compagnie Francaise Thomson-Houston, of Paris, arrived in this country on Oct. 21, and returned to Paris during November. Mr. Connett is accompanied by Mr. J. A. Aubaret, engineer with the same company, who will remain in this country about six months studying street railway management in its different phases. Mr. Aubaret will reside in Washington while in this country.

CAPT. CHARLES E. HALL, master of construction for the Chicago City Railway from 1881 to 1897, and previously from 1857 to 1863 engineer in charge of nearly all the railways in Cuba, died in Chicago recently. Capt. Hall was born in Copenhagen, Denmark, and came to the United States as a child. He served in the war of the rebellion as captain in both the Fourth and Forty-ninth Wisconsin regiments.

MR. ROBERT F. FOX, formerly superintendent of the Scranton Railway Company, of Scranton, Pa., died a short time ago at his home in Meadville. Mr. Fox was well and favorably known in the East, and was at one time connected with the Brooklyn roads as assistant engineer. This position he resigned to accept the position at Scranton. From Scranton Mr. Fox went to Wil-

mington, Del., to assume the general managership of the lines of that city, and of Chester, Pa., which are controlled by the same interests as the Scranton company, but was compelled to resign the latter place owing to the failure of his health.

MR. F. J. O'DONOGHUE, superintendent of the Nashua, (N. H.) Street Railway, died at Nashua, Nov. 10, after a brief illness. Mr. O'Donoghue was well known in New England, and was connected with the Lowell & Suburban Railway before accepting the position at Nashua in 1896. Mr. O'Donoghue was born in Ireland forty-three years ago, but came to this country at an early age. He received his schooling in Boston and removed to Lowell when a young man, continuing to reside here until accepting the position in Nashua. His mother, two sisters and five sons survive him.

MR. R. W. BLACKWELL, of London, is in New York and will remain here for some weeks on business connected with his large European and American interests. Mr. Blackwell's business has reached such large proportions that additional working capital has become necessary, and a limited liability company, under the name of Robert W. Blackwell & Company, Ltd., was recently formed, with strong personal and banking alliances. New offices are being opened in the principal cities of Great Britain, and others will shortly be located on the Continent. Among the new parties interested in Robert W. Blackwell & Company, Ltd., are Col. Sir Charles Edward Howard Vincent, K. C. M. G., C. B., M. P., and Mr. Francis Henry Barker, chairman of the Associated Share Investment Company.

MR. GRANVILLE C. CUNNINGHAM, M. I. C. E., who has been for some years past managing director of the City of Birmingham Tramways Company, has been appointed general manager of the Central London Railway, one of the most important city transportation undertakings in the world (full description in the STREET RAILWAY JOURNAL for March, 1898, page 141). The cost of construction of this railway has been enormous, particularly in its city terminus at the bank, and as it bisects the great area of traveling London, passing under Bayswater Road and Oxford Street, it can hardly fail to secure an enormous revenue. Whether or not this revenue, gross and net, will be sufficient to earn a fair rate upon the investment, is the real question, but the company is to be congratulated on securing the services of Mr. Cunningham, whose experience in electric railroading during the past ten years has been second to that of few managers on either side of the Atlantic. Mr. Cunningham was for some years general manager and chief engineer of the Montreal Street Railway Company, one of the most successful and conservatively managed properties in North America.

COLONEL GEORGE B. M. HARVEY, president of the Atlantic Coast Electric Railroad Company and head of the Harvey syndicate, which recently purchased the street railway system of Havana, has been elected president of the publishing house of Harper & Brothers. Colonel Harvey is thirty-five years of age and a native of Vermont. After a newspaper experience commencing with the "Springfield Republican" and including the "Chicago Daily News," the "New York World" and the "Newark Journal," Colonel Harvey severed his connection with newspaper work in 1893 to engage in electric railroading, notably in Staten Island and in Eastern New Jersey. Previous to that time he had served on the staff of Governors Green and Abbett, of New Jersey, and had acted as Commissioner of Banking and Insurance of New Jersey. In a number of his railway enterprises he has been associated with Mr. William C. Whitney. In addition to his railway work and his connection with Harper & Brothers, he is vice-president of the Monmouth Trust & Safe Deposit Company, a director of the Lakewood Trust Company, a director of the Audit Company, a director of the Mechanics & Traders' Bank, of New York, vice-president of the National Salt Company and owner and editor of the "North American Review."

MAJOR RUSSELL B. HARRISON, formerly of Terre Haute, who has been a prominent and gallant officer during the recent Spanish war, returned to the United States on sick leave about Nov. 1, and will remain in this country from thirty to sixty days before returning to his post. Major Harrision has made a fine record during the war. He was originally appointed to the staff of General Fitzhugh Lee, in command of the 7th Army Corps, and was first detailed to act as Assistant Inspector General of the corps. A little later he became Chief Ordnance Officer, and had in charge the equipment of the corps with all ordnance necessary for their campaign. Still later he became Provost Marshal, with widely varied and important duties, having in charge the sanitary policing and sanitation of the camps, the regulation of the signal service system, etc. On the occupation of Havana he was placed in command of Morro Castle, being thus the first American officer to enter the castle and assume command. In April and May, 1899, the 7th Army Corps was mustered out of service, but Major Harrison was one of two or three officers retained in the service, and he became Inspector General of the Department of Santiago and Puerto Principe, under General Leonard Wood. In July there came an epidemic of yellow fever in his department, and while inspecting hospitals in the vicinity of Cuba about the middle of August, he succumbed to the fever, and had perhaps the most severe case ending in recovery known in the annals of medicine. On October 18 he was able to leave the hospital, and was put on sick leave and sent to New York. He left on November 5 for Omaha, where his wife has resided during his absence, and will remain there for some time to come.

MR. GARRETT A. HOBART, Vice-President of the United States, who died last month, was for a long time president of the Paterson (N. J.) Railway Company, and took an active interest in its management. It was largely through the personal attention which he gave the property, together with the efficient management of Mr. McAdoo, the company's general manager, that the property was brought to its present efficient state. Mr. Hobart was born June 3, 1844, at Long Branch, and was graduated from Rutger's College in 1863. He entered the legal profession, in which he soon secured success, as well as in business and politics. For eleven years he was chairman of the Republican State Committee of New Jersey, and beginning with 1884, was a member of the Republican National Committee. As presiding officer of the Senate he acted with great efficiency, and was also prominent in party councils, a fact which has not been true of most Vice-Presidents. In addition to his connection with the Paterson Railway Company, he was interested in many other corporations, engaged in transportation, banking and manufacturing.

GARRETT A. HOBART

## AMONG THE MANUFACTURERS

A COMPANY has been incorporated in London, with a capital of $15,000, for the purpose of printing and publishing a European edition of the "American Machinist."

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, has recently received a letter from the Seoul Electric Company, of Seoul, Korea, ordering a Cross Special No. 3 filter with a capacity of 30 gals. to 40 gals. per day.

THE GREEN ENGINEERING COMPANY, of Chicago, who are the manufacturers of the Green traveling grate described recently in the STREET RAILWAY JOURNAL, and are also contractors for complete steam plants, having opened an office in St. Louis, in room 642, Century Building.

THE BROWNELL CAR COMPANY, of St. Louis, is very busy on a number of orders, among them one for fifty-five new cars to be used by the Metropolitan Street Railway Company, of Kansas City. The shops are full of work from other orders as well, and the company reports an excellent outlook for the coming year.

THE SEGUINE-AXFORD VENEER COMPANY, of Newark, N. J., is rapidly extending its lines into every field where veneers are used. The company is giving particular attention to street car work, and is supplying, when specified, ceilings and other veneer work made with a guaranteed moisture-proof glue of their own make.

THE WALWORTH MANUFACTURING COMPANY, of Boston, has recently moved its main office from 16 Oliver Street to its new store, 128-136 Federal Street. The company has secured at this latter address fine offices, which have been fitted up in the best manner possible for conducting its large and constantly increasing business.

THE INTERNATIONAL BRAKE SHOE COMPANY, of Chicago, has recently received numerous inquiries regarding the diamond "S" brake shoe from foreign lands, with a view toward adapting it as standard. To care for this growing export trade the company has recently published pamphlets in the various languages for circulation abroad.

GEO. KISSAM & COMPANY, of New York, the well known advertising agents, have recently published a tasteful folder giving particulars of the International Traction Company, of Buffalo and Niagara Falls, the advertising on whose lines is controlled by this firm. The folder also presents a bird's-eye view of the entire system, with the Niagara Falls in the foreground.

THE UNION BOILER TUBE CLEANER COMPANY, of Pittsburgh, Pa., has just completed a contract for cleaning two Hazleton or porcupine-boilers having over 2000 tubes, one end of which is welded tight. These tubes were badly scaled, and the closed end required a special tool of unique design, as well as the use of the Union Boiler Tube Cleaner Company's special design of flexible shaft.

THE CLING-SURFACE MANUFACTURING COMPANY, of Buffalo, N. Y., reports a rapidly increasing demand for Cling-Surface, with recently large shipments to England and Mexico. Of the many testimonial letters sent in by users of this preparation for belts the Union Traction Company, of Philadelphia, says: "We have ordered a second can of Cling-Surface, which is evidence that we consider it satisfactory."

THE STERLING VARNISH COMPANY has just issued a small but interesting pamphlet on the subject of insulating varnish, which contains besides a good deal of valuable information, a number of fac simile letters of recommendation, orders, etc. An edition has been printed in French and German for distribution on the Continent, and all in this or foreign countries who desire to obtain a copy, will do well to address the company.

THE H. C. ROBERTS ELECTRIC SUPPLY COMPANY, of 831 Arch street, Philadelphia, Pa., has recently purchased the good will, stock and fixtures of the Franklin Electric Supply Company, of 506 Cuthbert Street. Mr. Roberts has had long experience and close connection with electric industry, and his company is in an excellent position to advise purchasers as to apparatus, as well as to supply them with various kinds of electrical goods.

THE CLEVELAND CRANE & CAR COMPANY, of Cleveland, Ohio, has recently published a tasteful catalogue descriptive of the electric cranes built by it for railway power stations and factories. These cranes have had a most successful record where they have been installed, especially in power stations where electric power is so easily available and most convenient. The cranes are built in all types, including traveling cranes, jib cranes, locomotive cranes, etc.

THE DE WITT SAND BOX COMPANY, of Lansingburg, N. Y., has recently closed a contract with the Third Avenue Railroad Company, of New York, for 840 sand boxes. The De Witt Sand Box Company is a recent organization which will manufacture the De Witt sand box, formerly made by E. F. De Witt & Company. The change has been made to increase the manufacturing facilities of the firm, which has recently been taxed, owing to the large number of orders received.

THE BERLIN IRON BRIDGE COMPANY shipped from its plant at East Berlin, Nov. 15, a train load, comprising about twenty-seven cars of structural material consigned to the United States Commission at Paris, France. This material will constitute a very important element in the American exhibit at the Paris Exposition, and is for the steel framework of a machine shop to be used exclusively by the American exhibitors of iron and wood-working machinery at the exposition.

THE EIGHTEENTH EDITION of the Electrician Electrical Trades' Directory and Hand Book for 1900 is now in preparation, and is to be ready in January, 1900. This well-known British publication is a carefully compiled list of British, colonial and foreign engineers, manufacturers, lighting and tramways companies, and, in fact, all engaged in electrical pursuits throughout the world. Correspondence should be addressed to the "Electician" office, Salisbury Court, Fleet Street, London, E. C.

THE SOUTHERN PACIFIC COMPANY has issued a trio of pamphlets entitled "Shasta Route," "California South of Tehachapi" and "Wayside Notes Along the Sunset Route." The pamphlets are well gotten up and contain an industrial, geographical and scenic description of the interesting features along the company's route. The illustrations are especially clear and attractive. A map of California, with a brief description of its resources, attractions, topography, climate, etc., is also published by this company.

THE GOLD CAR HEATING COMPANY, of New York, has recently published a large circular descriptive on one side of its system of electric heaters, and on the other side giving the salient points of the recent suit between the Consolidated Car Heating Company and the Palmer & Monson Street Railway Company, in which it was decided that the Gold system was not an infringement of the patents of the former company. Mention of this decision was given in the last issue of the STREET RAILWAY JOURNAL, and a reproduction of this circular is published elsewhere in this issue.

J. G. BRILL COMPANY, of Philadelphia, has just secured an order from the Union Traction Company for 150 cars. One hundred and ten of these cars are to be of the twelve-bench open type, with an aisle through the center; the other forty are fourteen-bench open cars, also with center aisle. Both are to have the Union Traction Company's standard finish, and to be of the same style and finish as furnished the Union Traction Company by the Brill Company during the past summer. Westinghouse No. 38 motors will be used on the twelve-bench cars and four Westinghouse No. 3 motors on the fourteen-bench cars.

GEORGE W. LORD, of Philadelphia, manufacturer of Lord's Boiler Compound, after twenty-three years at his former location, moved on Dec. 1, to his new plant, 2238 to 2250 North Ninth Street, Philadelphia. The new plant covers a ground space of 150 ft. x 175 ft., and consists of a three-story and basement brick building, with foundation and walls sufficiently strong to allow the addition of three more stories, should that space be required any time in the future. The equipment will include the latest apparatus for manufacturing the chemicals used in the preparation of the many formulas of Lord's Boiler Compounds.

THE FRANK M. PIERCE ENGINEERING COMPANY, of New York, reports a very active business, largely as a result of Mr. Pierce's extensive foreign travel within the last few years. During the last month the company reports contracts closed as follows: Four 500-kw. direct-connected, cross-compound, heavy duty, St. Louis Corliss railway engines; one 500-kw. direct-connected, simple, heavy duty, St. Louis Corliss railway engine; twenty-two engines on order to supply the company's English trade, and one electric lighting power plant for equipping a central station in one of Uncle Sam's new island possessions.

THE HAM SAND BOX COMPANY, of Troy, N. Y., reports a large number of recent orders. These boxes are used extensively abroad, as well as in this country, as shown by the following list of foreign railways on which the boxes have recently been applied: Bolton Corporation, Lancashire; Blackpool & Fleetwood Tramroad Company, Potteries Electric Traction Company, Corporation of Liverpool, Dublin United Tramways Company, Waterloo & City Railway, London; Corporation of Sheffield, Liverpool Overhead Railway Company, Carlisle Tramways Company, Corporation of Sunderland, Corporation of Dundee, Corporation of Southport, and Great Grimsby Street Tramways Company.

THE CLONBROCK STEAM BOILER COMPANY, of Brooklyn, manufacturers of the Morrin "Climax" steam boiler, reports that the Climax boilers, which the company had on exhibition at the Trans-Mississippi and International Exposition, Omaha, Neb., 1898, and the Greater American Exposition, Omaha, Neb., 1899, have all been sold to the following parties: The Council Bluffs Street Railroad Company, Council Bluffs, Ia., one 500-h.p. and one 250-h.p. boiler; the Madison Street Railroad & Electric Light Company, Madison, Ia., one 250-h.p. boiler, and the International Packing Company, Omaha, Neb., for its new plant at Sioux City, Ia., three 500-h.p. and one 200-h.p. boilers.

EXPERIENCED HELP, at a time when required, is an important matter with railway companies. Good men are required, and an emergency creates a demand that must be promptly filled. E. G. Johnson, who has been for several years Superintendent and General Manager of the Philadelphia & Bryantine Railroad and the Bryantine Transportation Company, has opened an office in the St. James' Building, Broadway, New York, and is in touch with the railways and with the best class of labor, which can be vouched for and recommended. Application to Mr. Johnson will be regarded as confidential and immediate response given. No

charges are made for the service rendered and personal attention is given by Mr. Johnson to all business intrusted to his office.

ANNOUNCEMENT is made of the organization of the New York Air Compressor Company under the laws of the State of New Jersey. The capital stock of the company is $100,000, and a complete foundry and machine shop plant has been purchased on the line of the New York & Greenwood Lake Railroad at Arlington, N. J. Contracts have already been let for a full modern equipment of tools. It is intended to manufacture a complete line of air compressing machinery at the new plant. The officers of the company are: J. W. Duntley, president; Alexander MacKay, vice-president; W. P. Pressinger, secretary and treasurer. The directors are: J. W. Duntley, Alexander MacKay, W. P. Pressinger, William B. Albright, W. O. Duntley, Thomas Aldcorn and Austin E. Pressinger. The New York offices of the company are at 120 Liberty Street.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, reports fifty-five orders for the month of October, the machine ranging in size from the smallest to 300 kw. capacity. A repeat order was received from the Maryland Steel Company, of Sparrows Point, Md., this making the fifth order, and being for a 300-kw. generator and several motors. Orders were received from the London, England. "Star," and the St. Petersburg, Russia, "Novia Wremia," two of the most important papers of the respective cities, for the Bullock "teaser" equipment for operating newspaper presses. Two 300-kw. alternating current generators were shipped to the Wilson Aluminum Company, of Holcombs Rock, W. Va., to be used in the manufacture of ferro-chrome, an electro-chemical product used in the manufacture of chrome steel.

THE NEW CAR HOUSE at Port Chester, N. Y., for the Port Chester Street Railway Company, will be furnished by the Berlin Iron Bridge Company, of East Berlin, Conn. This building will be one of the largest of its kind in the country. The Berlin Iron Bridge Company also reports a large number of other orders. Among them are a new pier shed and dock, 40 ft. x 600 ft., at Providence, R. I., for the Clyde Steamship Company, and some new work for William Cramp & Sons, Ship & Engine Building Company. The work for this company will include a new machine shop 142 ft. wide and 350 ft. long, three stories in height. All the floors, including the gallery floors, to be controlled by electric traveling cranes. The building will be of steel frame-work, the outside walls of brick, and will be one of the largest and most complete machine shops in the world.

THE AMERICAN STEEL & WIRE COMPANY, of Chicago, has issued a circular to its customers explaining that the partial destruction on Nov. 4 of one of its plants at Waukegan by fire will not seriously delay the filling of orders. The circular says: "The fire affected particularly the finishing end of the plant, the rolling mill not being damaged in any respect. Our warehouse, with a fair stock of goods, was also saved. We have already made arrangements for the execution by our other plants of unfilled orders at Waukegan, and desire to assure you that all orders now placed with us which have been lodged at Waukegan for shipment, will be taken care of by shipment from other plants with very little, if any, delay; and all future orders will receive our prompt and careful attention as heretofore. We therefore solicit a continuance of your future favors, and are in position to respond promptly."

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY and the Westinghouse Air Brake Company, of Pittsburgh, have published during the last month two very tasteful catalogues, one relating to the new electric railway motors of the former company, the other to the electro-pneumatic system for controlling trains, of the Air Brake Company. The new motors described include the 68, 69, 56, 70 and 50-C., all of which were described in the October issue of the Street Railway Journal. The catalogue includes as well a number of attractive views of some typical Westinghouse power stations, and is very handsomely printed and illustrated. A description of the Westinghouse electro-pneumatic system of control, which is the subject of the second pamphlet, was also published in the October issue. The catalogue, however, gives a large number of new engravings, and will be found of interest to all electric railway engineers.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, has recently taken the exclusive territorial agency for the Multiplex Reflector Company. These corrugated reflectors and head-lights are claimed to be an entirely new departure and the latest and best thing in the reflector line yet produced. They are said to produce 300 per cent more light, both in intensity and volume, than any other plain or parabolic reflector on the market, and the company invites comparison to substantiate this claim. They are especially adapted for street railway work and certainly deserve the consideration of anyone on the market for a first-class and strictly up-to-date head-light. The Multiplex Reflector Company makes an electric arc head-light with automatic regulation, and claimit to be the only self-regulating arc head-light made. These head-lights are so constructed that no amount of jarring or vibration will disturb their adjustment or affect the light in the least. The manufacturers are always glad to send these head-lights out on trial, or for competitive tests.

THE JACKSON & SHARP COMPANY, of Wilmington, Del., has recently shipped to the Perth Tramways Company, Ltd., Perth, Western Australia, five 18 ft. closed car bodies, and to the Buenos-Aires & Belgrano Tramway Company, Buenos-Aires, Argentina, twenty convertible car bodies, and five ten-bench open cars of the standard type used in this country. Its domestic orders have also been considerable. Among other work the company has just completed six 30 ft. cross seat cars for the Bridgeport Traction Company, Bridgeport, Conn. These cars are very fine in every respect. The interior finish is of mahogany. The seats are upholstered in crimson plush, and have bronze handles on the corners in place of the overhead hand straps. They have upper and lower sash, the top sash being permanent, and glazed with embossed glass. The lower sash when down gives a very large opening, which makes the car very desirable for summer as well as winter service. These cars have a seating capacity of forty persons each. They are equipped with twelve heaters. The platforms are vestibuled, and have double side folding doors. The cars are mounted on short wheel base trucks, and have four motors. They are equipped with Sterling safety brakes. The Brunswick Traction Company, New Brunswick, N. J., has also recently received six 28-ft. closed cars from the Jackson & Sharp Company.

## New Publications

Verbatim Report of the Third Regular Annual Meeting of the Street Railway Accountants' Association of America. Published by the Street Railway Accountants' Association of America.

The verbatim report of the Chicago convention of the Street Railway Accountants' Association of America is just at hand, and Secretary Brockway certainly deserves great credit for the promptness with which this report has appeared so soon after the annual convention. The report contains 160 pages, and has as a frontispiece an excellent likeness of President Calderwood.

Report of the Eighteenth Annual Convention of the American Street Railway Association. Published by the Association. 219 pages.

The official report of the Chicago Convention has been published with the usual promptitude, and members of the association can have the satisfaction of having the printed report before them within less than a month from the close of the convention. It is needless to say that this adds very much to the value of the report and the secretary should have due credit therefor. Some of the diagrams and the banquet menu are reproduced in different colors, and the frontispiece, a portrait of ex-President Sergeant, is an excellent one.

## Trade Catalogues

Insulating Varnish. Published by the Sterling Varnish Company, of Pittsburgh, Pa. Illustrated.

Interior Conduit Catalogue No. 75. 148 pages. Illustrated. Published by the Sprague Electric Company, of New York.

Cranes and Electric Hoists. 20 pages. Illustrated. Published by the Cleveland Crane & Car Company, Cleveland, Ohio.

Westinghouse Railway Motors. 34 pages. Illustrated. Published by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Catalogue No. 64. Lundell Generators, Direct Connected and Belted Types. 36 pages. Illustrated. Published by the Sprague Electric Company.

Westinghouse Electro-Pneumatic System for Controlling Railway and Other Motors. 38 pages. Illustrated. Published by the Westinghouse Air Brake Company, Pittsburgh, Pa.

Application of Storage Batteries in Railway and Power Plants. Circular No. 55. 12 pages. Illustrated. Published by the Electric Storage Battery Company, of Philadelphia.