Street Railway Journal

Vol. XIV. *NEW YORK AND CHICAGO, APRIL, 1898.* *No. 4.*

THE SYSTEM OF THE BALTIMORE & NORTHERN ELECTRIC RAILWAY COMPANY

In the city of Baltimore, which has recently been noted for its excellent railway systems, there has been developed during the last few years a fine system of suburban electric lines, which for construction and equipment rank among the best in the country. The region to the north of Baltimore, with its transportation systems, is shown in the map on page 178, and of these systems that of the Baltimore & Northern Electric Railway Company is the subject of this article.

The Baltimore & Northern Electric Railway Company is a consolidation of the Falls Road Electric Railway and the Pikesville, Reisterstown & Emory Grove Railroad. The former line was constructed under a charter of the first-named company from Charles Street and Lafayette Avenue, in the city of Baltimore, to Pikesville, where connection was made with the Emory Grove line. The construction of the Pikesville, Reisterstown & Emory Grove Road was begun in 1894, and was finished in 1895. The latter line consists of 10½ miles of single track, with fifteen turnouts, making a total length of about 12 miles of track. The road was laid with 56-lb. T rails on oak and chestnut ties, resting on gravel ballast. Owing to the large excursion business handled on the road, the company anticipated the necessity for a double track, and now owns the right of way for additional track between Pikesville and Emory Grove. The plans for this work have been made, and it is thought that the work will be started at an early date. The Emory Grove line extends from Pikesville, one of the suburbs of Baltimore, and through the villages of Garrison, Owing's Mills, Delight, Reisterstown, Glyndon, to the terminus of the line at Emery Grove Camp Grounds, now occupied by the Methodists of the State of Maryland, and consisting of about eighty acres of beautiful wooded land.

Early in 1897 plans were perfected for an independent line into the city of Baltimore, so that cars could be operated from Emory Grove to the center of the city, a distance of 21 miles, without change. At this time all passengers were transferred at Pikesville, and were brought in from that point by the Baltimore Traction Company, now a part of the Baltimore Consolidated Railway. The new line now leaves Pikesville about 300 yds. north of its old terminus, running over private rights of way nearly its entire length to the city line. The main line of the road passes through the beautiful section of the country between Pikesville and Mount Washington, along which a number of projects for developments have already been started, and from Mount Washington it crosses the

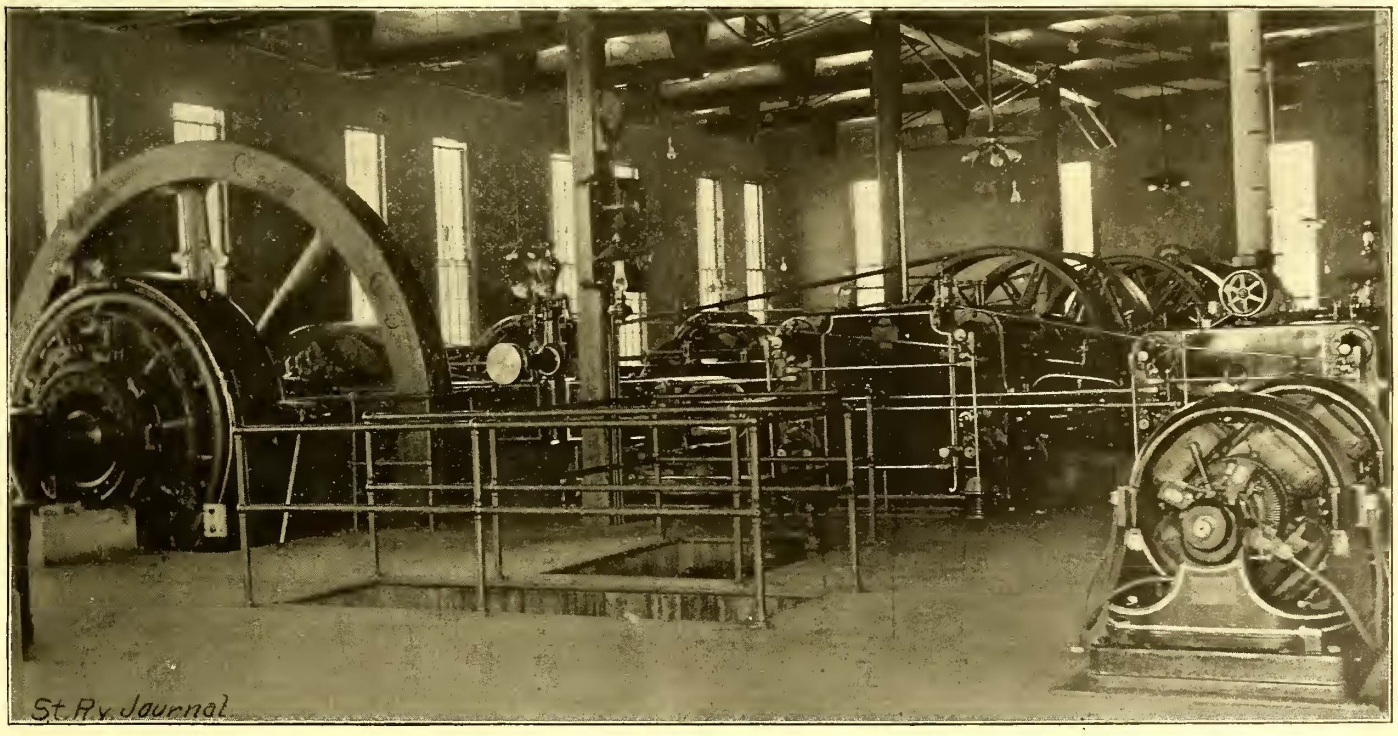


FIG. 1.—POWER STATION OF THE BALTIMORE & NORTHERN ELECTRIC RAILWAY CO.

Northern Central Railway by a steel viaduct, and thence alongside of the Falls Road Turnpike into the city. Its Arlington branch, which leaves the main line about 1700 ft. west of Mount Washington, extends through the new suburb of Aubrey, passing the Gentlemen's Driving Park, Pimlico race course to Electric Park and West Arlington. Its West Woodberry branch extends from Union

FIG. 2.—DOUBLE BRACKET CONSTRUCTION ON CURVE

Avenue and Falls Road through Woodberry, thence skirting the northern boundary of Druid Hill Park, where large building operations, involving the expenditure of $100,000, have now begun. Within the city line it is constructed in the center of the street along the Falls Road to Lafayette Avenue, thence on Lafayette Avenue two blocks to Charles Street, where connection is made with the Baltimore City Passenger Railway Company, over whose line the cars of the Baltimore & Northern

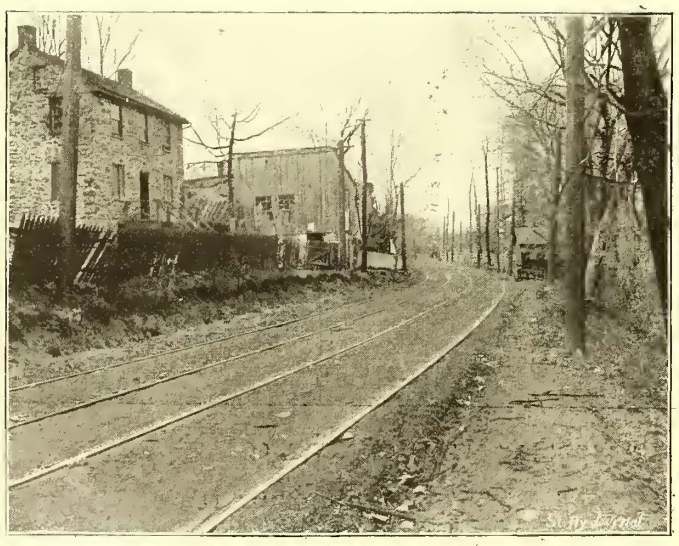


FIG. 3.—SECTION OF TRACK ON HIGHWAY

Electric Railway are operated for 1½ miles further to a point which is considered the business center of the city.

The length of the main line double track to Pikesville is about 9⅜ miles. The length of the Pikesville & Emory Grove division is 10½ miles, making a total distance from Baltimore to the terminus of about 20 miles. In addition to this there is the Arlington Branch, 2 miles of double track, and the West Woodberry Branch, about 1¼ miles double track, not fully completed at present. This makes the total length of the line 23½ miles, there being 11 miles single track, including turnouts, and 12½ miles double track. The total length of track is about 36 miles.

POWER STATION.

Current is supplied from the company's power house at Owing's Mills, and from the plant of the Belt Line Tunnel, which was built to supply power to the tunnel locomotives, but which sells surplus power to several railway companies, among them the Baltimore & Northern.

The company's own power house at Owing's Mills contains three 220-h.p. Ball & Wood compound engines, 225 revolutions, each belted to a No. 4 Westinghouse generator. These, with four 180-h.p. return tubular boilers constituted the original power plant of the Pikesville, Reisterstown & Emory Grove road. During 1897 Thomas C. Basshor & Company installed for the railway company a 500-h.p. compound condensing Rice & Sargent engine and three 200-h.p. return tubular boilers, with the necessary piping, Knowles condenser, feed pumps, etc. The engine is direct connected to a 300-k.w. Westinghouse 10-pole generator. The switchboard was installed by the Westinghouse Company. The stacks, two in number, are 72 ins. and 96 ins. in diameter, respectively, and are 75 ft. in height, built of steel and lined with firebrick to a height of about 15 ft. above the roof.

Coal is brought to the power house on the Western Maryland Railroad, whose tracks are about 15 ft. above the boiler room floor, owing to the natural conformation of the ground. Chutes connect with bins of about 500 tons capacity, and the coal falls directly from the cars into the bins, or on to the boiler room floor, effecting considerable economy in handling.

The water for the boilers is taken from two purifiers, or settling wells, which have been dug about 15 ft. from a creek running through the company's property. Filtration through the soil frees the water from silt and vegetable impurities. The water then is pumped from six wells into

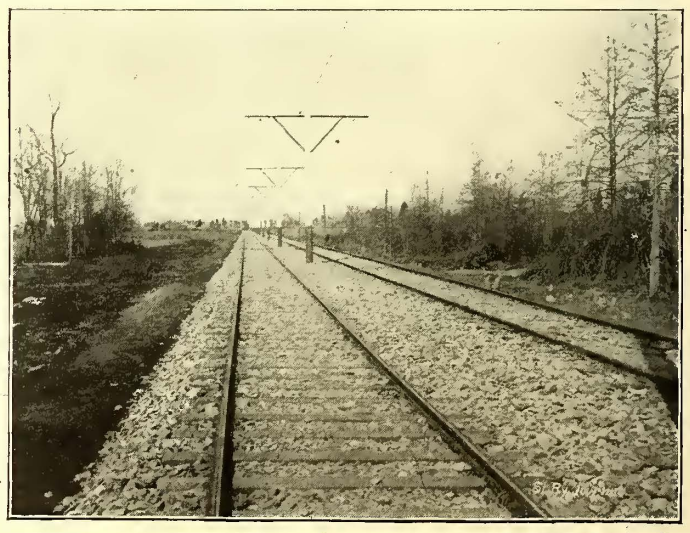


FIG. 4.—STRAIGHT TRACK CONSTRUCTION OVER OWN RIGHT OF WAY

a 30,000-gal. wooden tank, 30 ft. above top of power house. All boiler feed pumps can be connected to a fire system, which has four outlets in car barn and four in power house, with 2¼-in. hose and nozzles. The employees have a fire drill about once a week at irregular intervals, when they are expected to man the pipes and makes necessary arrangements for fighting fire.

At Owing's Mill power house there is also a 50-k.w. motor Westinghouse booster, running at 800 revolutions, wound for 525 volts. The booster feeders are tapped into

the mains at a point midway between Arlington Junction and Pikesville (about 6½ miles from the power house), and feeds this section, 4 miles in length. At the Belt Line power house there has been installed a second Westinghouse motor booster 125 k.w., 550 revolutions per minute, wound for 265 volts. The feeders from this booster tap into the mains at Mount Washington (a distance of 5¾ miles), and feed the section from Arlington back to a point near the car barn. The trolley wire is not cut between the direct feed and the booster feed.

TRACK AND OVERHEAD CONSTRUCTION.

The roadbed inside the city limits consists of 90-lb. girder rails, supported on Georgia pine cross ties, measuring 6 ins. x 8 ins. x 8 feet. These are bedded on a foundation of gravel. As the street through which the road passes had never been paved, the railroad company was required to furnish new cobble or mosaic pavement between tracks and 2 ft. on each side. The general construction of the roadbed on macadamized and paved streets is shown in Figs. 6 and 7, and that on the company's own right of way in Fig. 10.

The greater part of the remaining track was constructed of 60-lb. 4¼-in. T rails, with six-bolt splice bars, supported on ties similar to those used for girder track. The ballast consisted of 6 ins. of clean broken stone, 2½ ins. ring, under the ties and filled level with the tops of the ties, carried to the ends and sloped off. The dummy or space between the tracks was also filled with stone to prevent accumulation of weeds, and to furnish a reserve for filling in any points where the earth in fills, etc., might settle.

Where the road runs on the county highways, the construction consists of 64-lb. T rails 6 ins. high, supported on cross ties similar to those already described. Broken stone was placed under the ties to a depth of 4 ins., and was brought up to within 3 ins. of the top of the rail. Fine stone and stone dust were then filled in to the tops of the rails, and sprinkled and rolled until thoroughly compacted by a steam roller. This forms an excellent driveway, the rails offering but slight obstacle to the wheels of vehicles turning in and out, and the construction is much cheaper than paved girder track. This style of construction has been used to a considerable extent in the vicinity of Baltimore, and has been entirely satisfactory to the public and to the railway companies.

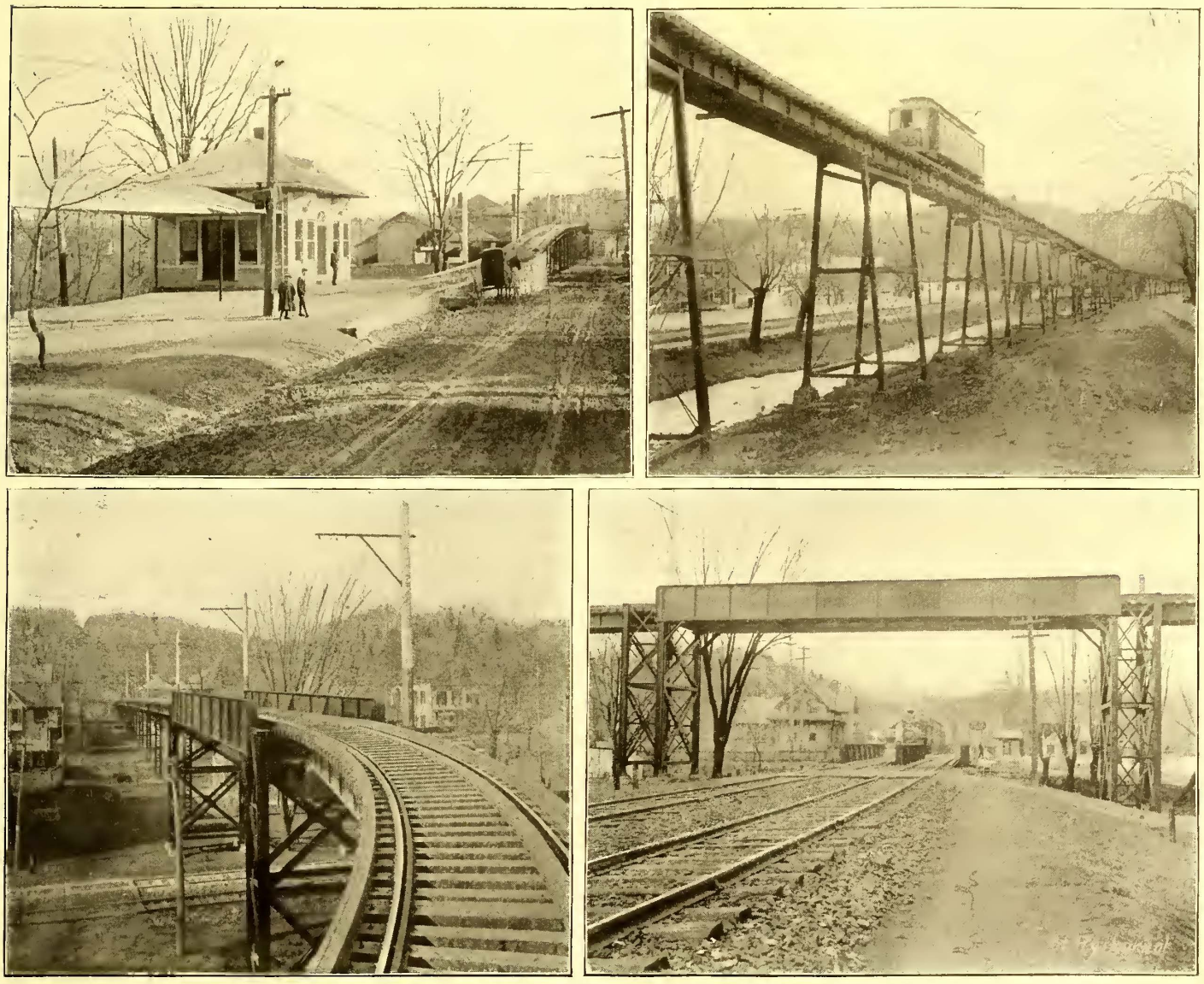
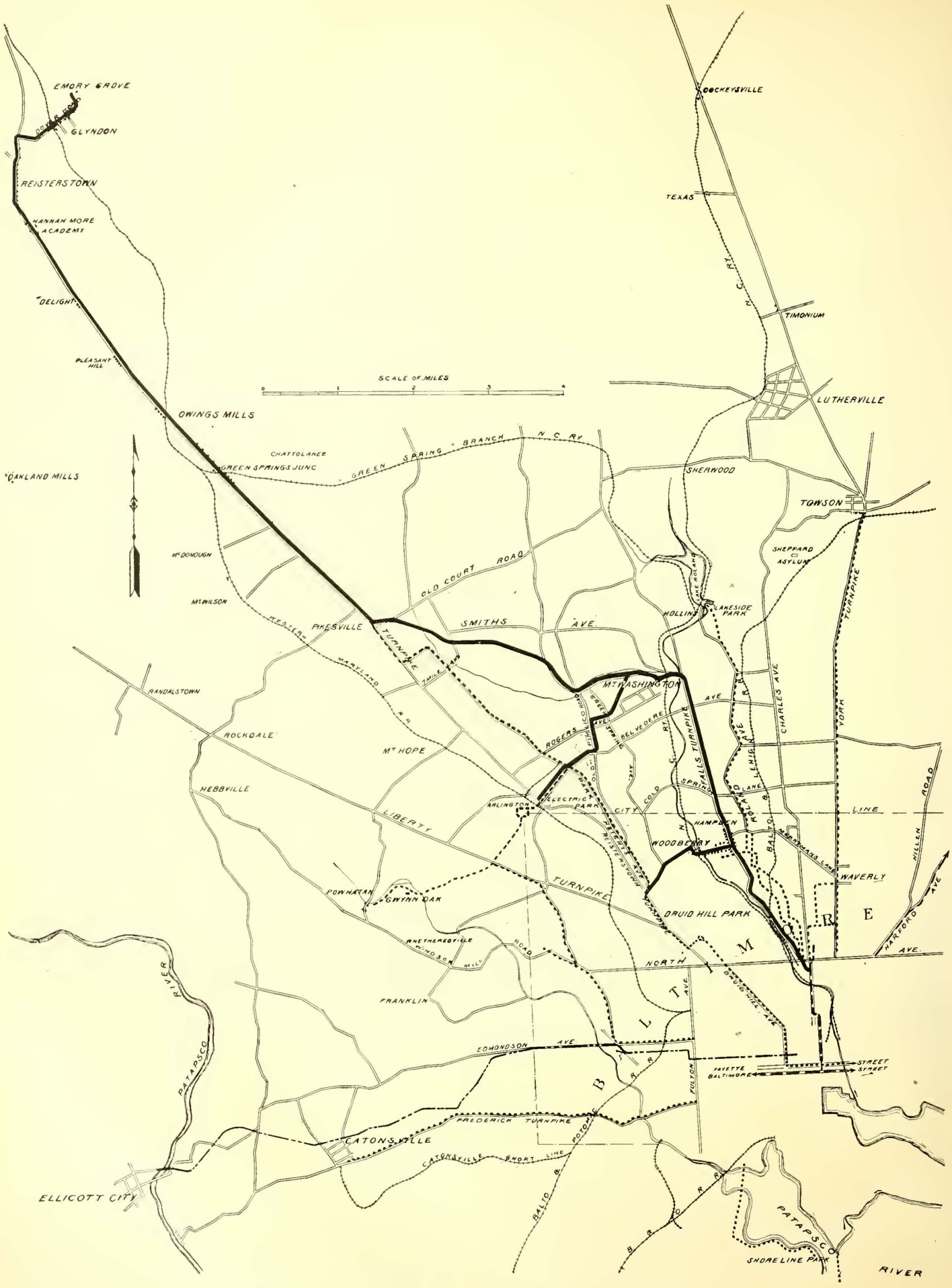


FIG. 5.—VIEWS OF VIADUCT

On private rights of way the tracks were laid 13 ft. center to center, and center pole bracket overhead construction was used. The accompanying views give a good idea of the different characters of roadbed.

All rails were supplied by the Pennsylvania Steel Works. The girder rail was section No. 200; the 6-in. T rail, section No. 206 (Shanghai), and the 4¼-in. T rail, section No. 7.

On highways and other places where the room was not



Baltimore & Northern Electric Railway.
Baltimore City Passenger Railway.
Baltimore Consolidated Railway.
Baltimore, Catonsville & Ellicott City Railway.

MAP SHOWING ELECTRIC RAILWAY LINES IN NORTH AND WEST SUBURBS OF BALTIMORE

available, the tracks were set 10 ft. center to center, and wood pole cross suspension was used. The poles for all the work were long leaf, merchantable quality, Georgia pine, sawed octagonal, 10 ins. in diameter at the top and 12 ins. at the butt. These were set 6 ft. in the ground in cement concrete, which was brought up above the ground and coned up to the pole, and finished with cement mortar, A 3 in. or 4 in. bond was used at each joint in order not to interfere with the bolts. Atkinson "Horse Shoe" bonds and Washburn & Moen "Crown" bonds were employed in about equal proportions. The T rail track was bonded with two No. 000 "Crown" bonds 32 ins. long, outside of the splice bars. The use of copper bonds on the exposed T rail was avoided, as the roads in the neighborhood of

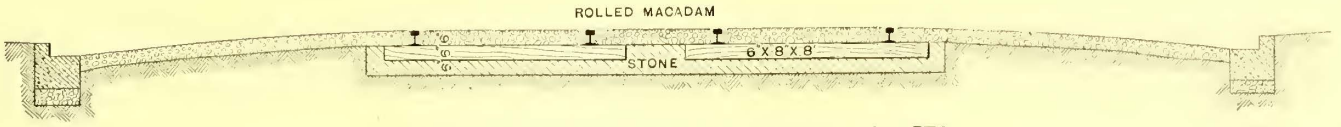


FIG. 6.—SECTION OF TRACK ON MACADAM STREETS

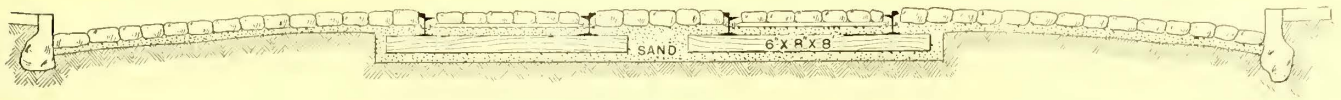


FIG. 7.—SECTION OF TRACK ON PAVED STREETS

designed for a water shed, which it is thought will lengthen the life of the poles materially.

The cross-suspension work is of the standard type; 5-16-in. span wires being attached to poles by eye-bolts $\frac{5}{8}$ ins. x 16 ins., cap and cone insulation being used, supporting a 15-in. full deep groove ear riveted on to the No. 00 Baltimore have suffered considerably from the theft of copper bonds. The managers, therefore, have used No. 0 extra BB galvanized iron and channel pins, triple laced, i. e., one piece of wire was used to make three bonds.

The section insulators used were manufactured by the contractors and consist of a piece of hickory wood about

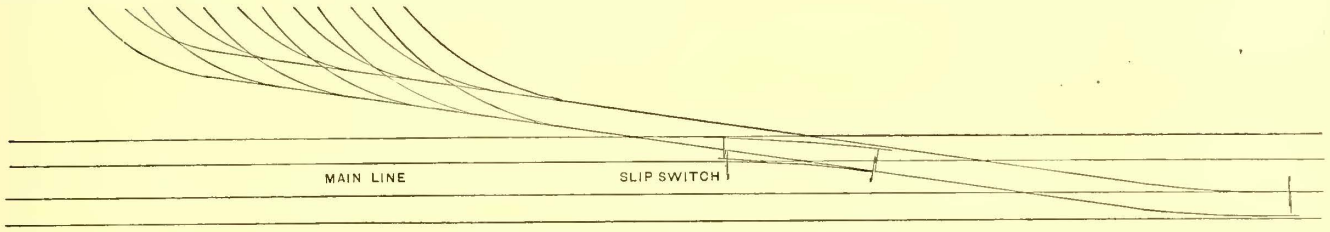


FIG. 8.—ENTRANCE CURVES TO CAR HOUSE

hard drawn trolley wire. No solder was used anywhere on the trolley wire. Brackets are made of $2\frac{1}{2}$-in. horizontal pipe, 14 ft. long, running through the pole and supported by diagonal struts of 2-in. extra heavy pipe, the connections being made by malleable iron castings. Suitable lugs, as shown in the illustration, carry the span wire 2 ft. long with a removable piece on the bottom, which, if burned by an arc, can be replaced. The trolley wire is led through a small brass casting, which takes the burn at the point where the arc is made, thus preventing the burning of the trolley wire. The anchors were of a new type, designed by one of the contractor's engineers, and are fitted

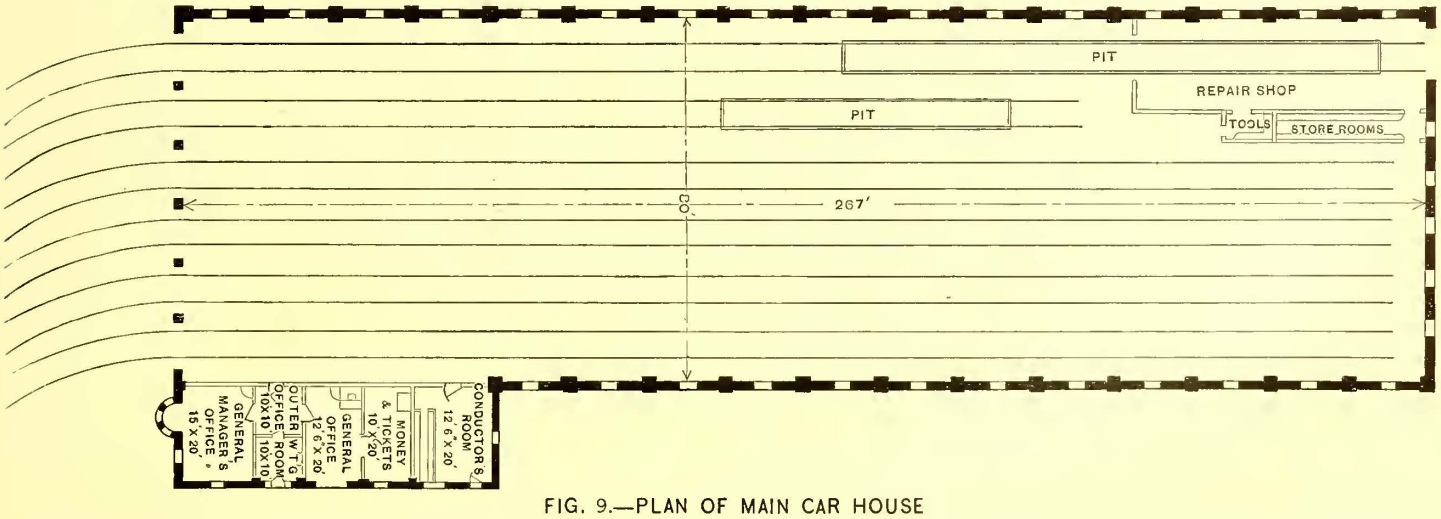


FIG. 9.—PLAN OF MAIN CAR HOUSE

about 2 ft. in length, and to this are attached span-wire hangers of the ordinary type. This has proven to be the most satisfactory form of bracket suspension, as it prevents the breaking of hanger studs, and cushions to some extent the blow of the trolley pole should it ever leave the trolley wire.

The girder rail bonding consisted of two short flexible bonds, of No. 0000 capacity, placed under the splice bars. at their top with a swivel, to which the bridle wires are secured. This prevents the kinking of the trolley wire at point of attachment, a common difficulty with the usual type of anchor ears.

The cost of girder track, including paving, bonding, and overhead work, but exclusive of feeder wire, was approximately $26,000 per mile of double track. The cost of T track, including ballast, bonding and overhead construc-

tion, but exclusive of feeder wire, was about $20,000 per mile of double track. The cost of Shanghai T rail was about $1000 per mile additional. In addition to the above the grading for the line cost about $3000 per mile.

The pike, on which a considerable part of the road was built, was narrow and with many sharp bends. In order to straighten the roadbed and make it safer for vehicles, thus permitting a higher rate of speed to be made, a large

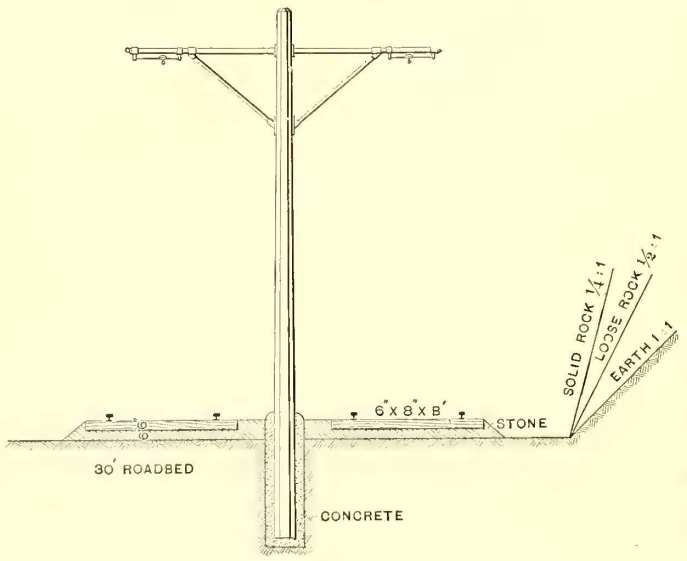


FIG. 10.—SECTION OF TRACK OVER OWN RIGHT OF WAY

amount of excavating, both earth and rock, has been done. Free use was made of drains, large size terra cotta pipe being principally employed with masonry headwalls. Walls of masonry were supplied where embankments might prove dangerous at a later day, owing to the action of the weather.

The road crossings over the T rail track were constructed according to the standard plans of the engineer, and consist of 3-in. oak plank laid on 1-in. oak strips between and outside the rails, filled with broken stone and

FIG. 12.—STANDARD CLOSED CAR

finished with a dressing of fine stone and rammed. These were found to be cheaper and more suitable than plank sidings.

The entire construction has been of the most substantial quality, to permit high speeds with a minimum danger of accident and repair accounts.

In order to avoid a grade crossing with the Northern Central Railroad tracks, and further in order to span a small stream and the streets in Mount Washington,a single track steel viaduct about 1400 ft. long was constructed. This is one of the most interesting features of the line, and is illustrated in the engravings on page 177. The spans over the Northern Central Railroad consist of two plate girders 68 ft. long x 5 ft. deep, placed 14 ft. between centers and supported by steel towers. A clear headway of 22 ft. was required above the top of the steam rails. The remainder of the viaduct consists of plate girder spans varying in length between 34 ft. and 40 ft., supported by towers from 17 ft. to 20 ft. center to center. The foundations of the towers are of two classes, one of masonry resting on concrete footings, and the other being entirely built of concrete with granite cap stones.

The viaduct was furnished by J. G. White & Company, their sub-contractors, the Phœnix Bridge Company, supplying and erecting the steel superstructure.

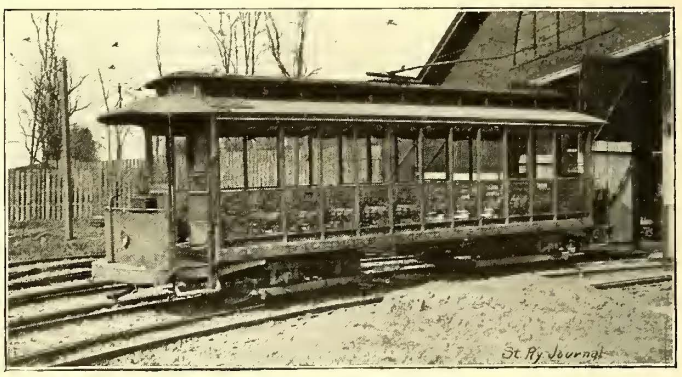


FIG. 11.—STANDARD OPEN CAR

ROLLING STOCK.

The rolling stock includes ten double truck open cars,made by the American Car Company,34-ft. body, 40-ft. bumpers, with Bemis double trucks, each equipped with two 50-h.p. Westinghouse motors. These cars are of the cross seat, center aisle type, with "Walkover" rattan covered spring

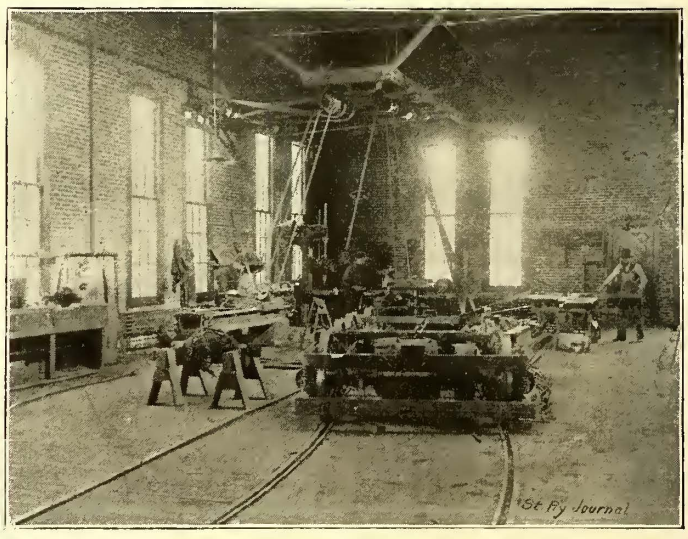


FIG. 13.—VIEW IN REPAIR SHOP

seats. Parcel racks extend the whole length of the cars. There are also five ten-bench single truck open cars, made by Jackson & Sharp, mounted on Bemis single trucks, equipped with two Westinghouse No. 36 motors; fourteen single-truck open cars, made by the Laclede Car Company, with center aisles, rattan covered spring cross seats, mounted on Peckham 9 A trucks, and equipped with two 35-h.p. Westinghouse motors; five single-truck closed Jackson & Sharp cars, mounted on Bemis single trucks and equipped with two 40-h.p. Westinghouse motors, and ten double-truck closed Laclede Car Company cars, vestibuled, 39 ft. over bumpers, 37 ft. over ves-

tibule, divided into passenger compartment, 17 ft. 6 ins., and smoking compartment, 10 ft. long. Two of the latter cars utilize the smoking compartment as baggage room. There are six seats on each side of passenger compartment, and three on each side of smoking compartment. The seats are of Hale & Kilburn "Walkover" type, 34 ins. long, 15 ins. wide, leaving a 21-in. aisle. The seats are placed 30 ins. center to center, and are provided with foot rest rails. Each car is fitted with eight lights in interior, with headlight and rear platform light. The width of car over all is 8 ft. 4 ins.

In addition the company has a parlor car of the same general style and dimensions as the last mentioned, but furnished with velvet carpet, silk window hangings, rattan easy chairs, eight removable side tables, similar to Pullman tables, twenty lights, buffet, etc. This car has proved very popular, being the first of such cars introduced in Baltimore. All closed cars are heated with Whittingham electric heaters.

CAR HOUSES AND REPAIR SHOPS

The main car house is illustrated on page 179, and is 267 ft. by 80 ft. in interior, with general offices and conductors' room in the extension. The building has brick walls, steel columns and steel roof trusses, the roof being covered with corrugated galvanized iron. A small space is reserved for slight repairs, the principal repairs being made at the barn at Owing's Mills. Fire protection is afforded by a 10,000-gal. wooden tank 40 ft. above the ground, fed by electric pumps, and the building is piped and supplied with hose and nozzles at convenient points.

The repair shop is in the Owing's Mills car house, and is equipped with the usual complement of tools, including a lathe, drill press, shaper, emery wheel, buffer, novelty wood worker, wheel grinder and other tools, all driven by motors. A paint shop and carpenter shop are accessory to the main repair shop.

In lifting car bodies from trucks, or in lifting bodies and trucks from wheel axles, a very simple car hoist is used. It consists of four differential pulleys attached to stub posts, and the pulleys are hooked to two rails, which pass under the bodies.

CONTRACTORS AND ENGINEERS.

George R. Webb, vice-president and general manager of the road, conceived the project of this through line five or six years ago, and the resulting railroad system is due very largely to his foresight and energy.

The whole contract for roadbed, overhead wires, feeders, approaches, trestles, etc., was given to J. G. White & Company, of New York and Baltimore.

The surveys and plans were prepared by D. B. Banks, consulting engineer, who supervised the construction of the work.

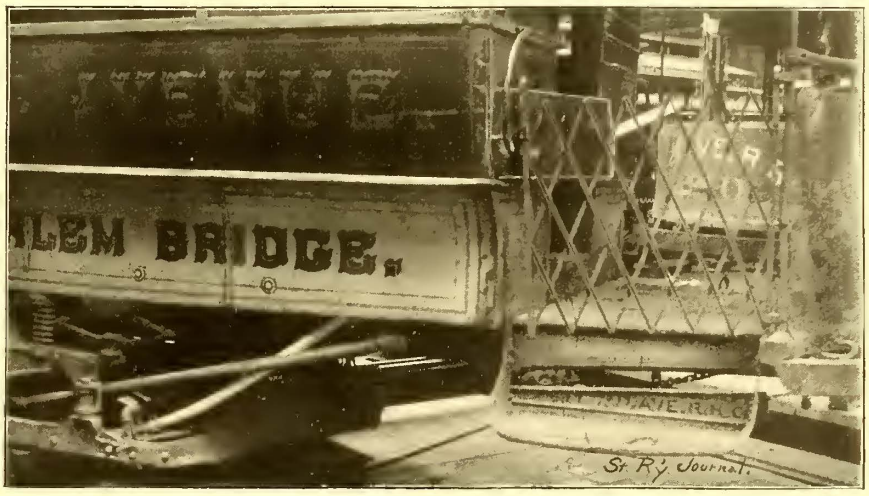
The Post Office authorities at London, England, have put into service an electric motor van for conveying the mails between the General Post Office and the West Central, Western and Paddington district offices. The van was provided by the London Electrical Cab Company, Ltd.

It is stated that the Consolidated Traction Company, of Jersey City, has decided to issue transfers to all its different lines at intersecting points.

A Freak Accident

The maxim that it is the unexpected which always happens is as well exemplified in street railway operation as in any other line of activity. An example of this occurred recently in New York. A 10-ft. length of ¼-in. gas pipe insinuated itself in a peculiar manner into the anatomy of a grip car of the Third Avenue Railway Company, of this city a short time ago, and the location finally reached, is shown in the accompanying illustration.

It seems that some workmen on a neighboring track



PECULIAR ACCIDENT IN NEW YORK

after using the pipe laid it on the paving just outside of the cable track. The gripman did not notice it, but when the car had nearly passed over it, by some means or other the end became raised up and caught in the rear fender, the latter being low and hung just in front of the wheel. The front end of the pipe was held rigidly against the paving, and the other end curved up, passing between the end of the platform sill and the sill of the car, on through the floor, through the end of the seat, and out at the rear end of the car. It took with it the end panel, as shown, and when the car was stopped, was found extending about 18 ins. over the rear platform. Fortunately, no one was standing in its way, and no one was hurt. The gripman did not know of the accident until told of it by the conductor, who was much startled by the appearance of the piping through the floor of the car.

The white color of the pipe in the engraving helps to distinguish it from the extension bars of the truck and other parts of the car.

As has been stated, it usually happens that the choice of fuel is a matter of location, but in cities where several competing grades of coal come to market, it would probably pay to have expert tests made to determine what grade of coal and what mixture is most economical for the work.—From report of committee, St. Louis Convention, 1896.

If I had asked a street railroad man the same question he would have promptly and correctly answered (even if he did not know and had to guess) that the bevel on a car wheel was for the purpose of centering the car on the track, providing a means for a lagging wheel to catch up again, and maintaining the axles of the car at right angles with the rail of track.—From report of committee, St. Louis Convention, 1896.

Shops of the Nassau Electric Railroad Company of Brooklyn

By James F. Hobart, M. E.

The machine, blacksmith and carpenter departments of these shops were almost completely destroyed by fire on the morning of Sept. 3, last. The buildings have been rebuilt, but not quite all the tools have yet been placed in position, and the overhead hoists, and the heating (hot air) conduits are not yet quite in place.

The old shops had iron roofs, the trusses being of architectural steel shapes, and covered with corrugated iron. That this kind of a roof was not desirable for car shops, the Nassau people found to their sorrow, nor could the fire be got at through the iron roof until it fell in, and the work of clearing away the débris was made slow and costly by the tangled steel beams. It was necessary to cut the rivets before a large portion of the truss work could be torn apart, and, taken as a whole, the steel roof has proved a costly investment for the Nassau Company.

It is needless to state that the reconstructed shops do not have steel or iron roofs. The buildings are covered with the regulation timber truss roofs, with spruce ribs, over which matched stuff is placed and covered with sheathing felt in the regular orthodox manner. This roof

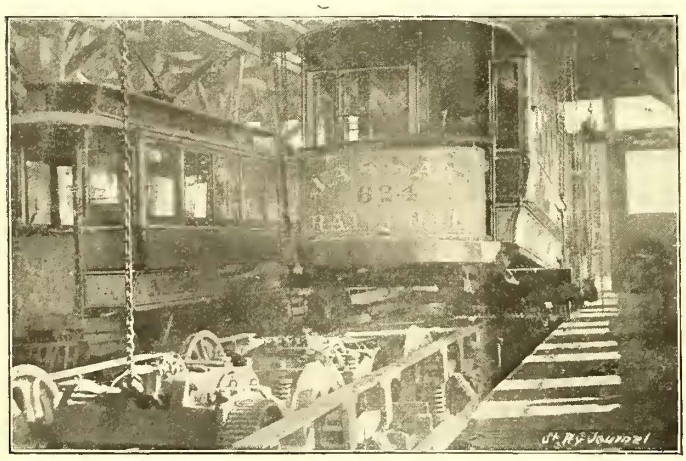


FIG. 1.—PITS AND METHOD OF RAISING CARS

will burn if it gets on fire, but the firemen can at least cut holes in it in order to get at the fire within, something they could not do with the former construction.

The four pits have been enlarged to comfortably handle three cars each. Each pit is lighted by twenty incandescent lamps. A narrow-gage track is laid in the concrete, which forms the floor of each pit, and a car carrying the lifting jack is fitted to the track in such a manner that the jack can be given the necessary lateral motion to enable it to reach the centre of gravity of both front and rear motor axles.

The overhead hoisting apparatus is very simple as well as inexpensive. Three continuous lines of 8-in. steel I beams are placed over each pit, and fitted with trolleys, to which 3000 lb. Harrington hoists are suspended by means of long strap-links of bar-iron. Two of these hoists are placed on each outside I beam, and are attached to the corners of the car. The hoist on the central I beam is used for raising wheels off of the pit, taking out motors, and for all other work that so frequently comes along.

The pits are heated, four 6-in. hot-air pipes being led into each pit from the hot-air heating system of the shop. Instead of the brick tight walls, so usually found at the sides of pits, the entire space under the floor, for a considerable distance on each side, has been cleared out and made available for man and material to handle and be handled in, making it possible for quite a number of men to work in the pits at the same time, and get around and past each other without delaying the work by getting in each other's way.

The several lines of steel I beams overhead, above described, all terminate in an overhead transfer carriage

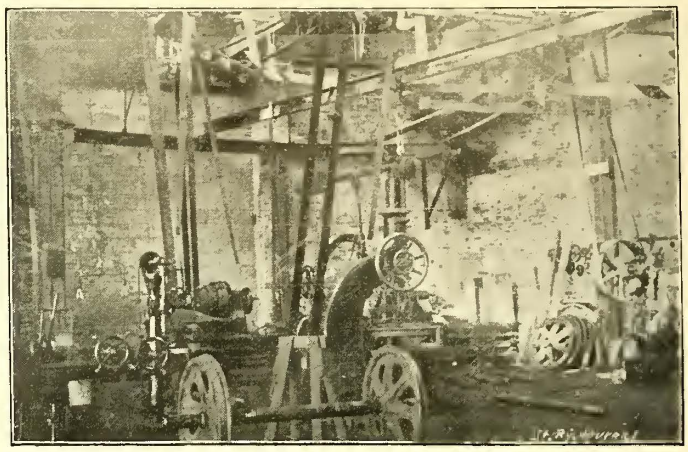


FIG. 2.—A CORNER IN THE MACHINE SHOP

whereby any or each of the several trolleys can be carried while loaded, from one pit to another, or to a great many other parts of the shop which are reached by other lines of single steel overhead I beams and trolleys with hoists attached.

At the 100-ton wheel press, one of the lines leading from the pit transfer has its transfer in the radial length of I beam, which is pivoted on the track end, the other end being mounted on a small trolley made to travel in the arc of a circle upon another I beam placed crosswise overhead, to which the radial beam is directly attached by means of the trolley mentioned. Another circular beam, and another transverse trolley support the I beam in about the middle of its 16-ft. length.

A novel method of supporting the wooden trusses was adopted. Outside of the building, at places where the old walls had fallen, pilasters were built to sustain the ends of the trusses, which were built right into the walls, stones being placed in the wall to receive them. Inside, a timber was set under the truss, and framed into it, also bolted to the brick-work, with large star washers outside. Where the old walls were standing, and the steel posts remained

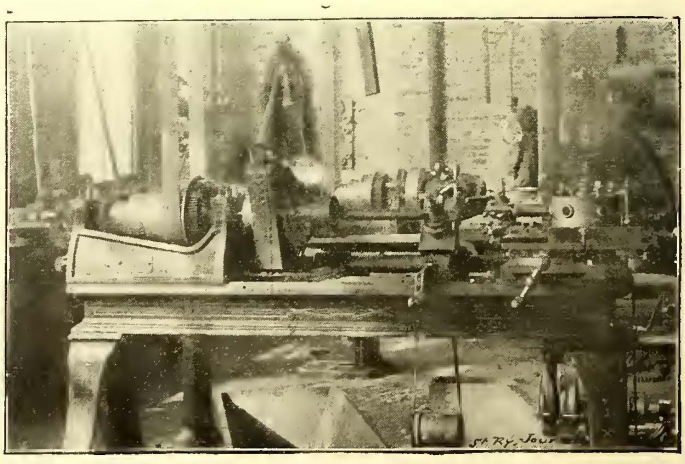


FIG. 3.—LATHE FOR BORING BEARINGS

built into the walls, the end of the truss was placed on top of the steel built-up post, and the wooden post carried down nearly to the ground and bolted through, as described, another section of wood being used on the other side of the wall, instead of the star washers. The en-

tire shop is electrically driven from the railway circuit, a 100-k.w. motor being used for the main drive, and a number of smaller motors are scattered through the shop, which is heated by a hot-air system, a fan and enclosed heating coils being used, the hot air being delivered through frequent openings near the top of the walls of the shop.

The shop is lighted by monitors built in the roofs, the section of roof (there are two sections) furthest from the vertical windows in the walls being furnished with a higher monitor than the section of roof nearest to the side-wall windows. In addition to the above, a great number of circular overhead bright metal reflectors are scattered through the shop, suspended from above, and each reflector carries ten incandescent lamps, which as placed, throw their light directly down upon the work. Several clusters of these lamps may be seen in the picture of the carpenter's shop.

An air-pump is being set up, from which air under 75 lbs. pressure is to be distributed around the shop, and used for blowing out commutators, and for all other work, including the blowing of the shop whistle, that air is now found to so readily lend itself to do.

A Fox lathe has just been set up for the special purpose of boring all the solid bearings used on the cars. A finer hob jaw has been made, to be used for driving the tool, so that the small cuts will be taken through the babbitt. By the use of a two-jawed chuck on the spindle of this lathe, it is expected that a box can be bored very quickly and in good shape. At the time of my visit they were having trouble with the lathe by its boring larger at one end than at the other. Probably after better means for holding the box have been secured, there will be no trouble of any kind, but with a long box held at one end by a pair of light chuck jaws, there will always be more or less trouble in getting a straight box, because the outer end will dodge and spring away from the tool to a certain extent, making the bore smallest at the end furthest from the chuck.

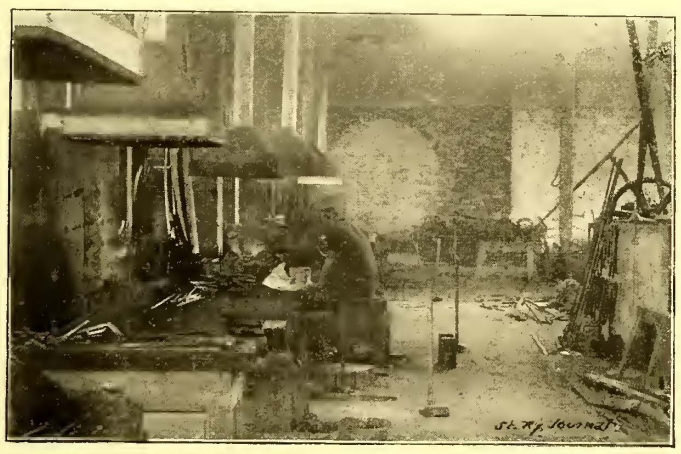


FIG. 4.—THE BLACKSMITH SHOP

The armature room has been rebuilt with heavy brick walls between it and the rest of the shop. These walls are carried up above the roof, which is entirely cut off in that manner from the rest of the building. This action on the part of the company seems to be pretty good proof that they considered the origin of the recent fire to have been in the armature room. About all the work in the armature room is done on the piece-work system. A motor for driving power coil-winders has recently been put in and a couple of these machines are already connected thereto.

I noticed a novel manner of disposing of the old 100-k.w. motor which formerly drove the shop. It was pretty badly used up by the fire—in fact, only three of the larger machine tools were thought worth being kept—and the heavy pieces of the motor were utilized as jumping blocks in the blacksmith shop. The pole-pieces were let into the ground, one close to each anvil, and so placed that the top of the concrete floor came just flush with them. The heavy yoke served another forge, and the base was placed at still another.

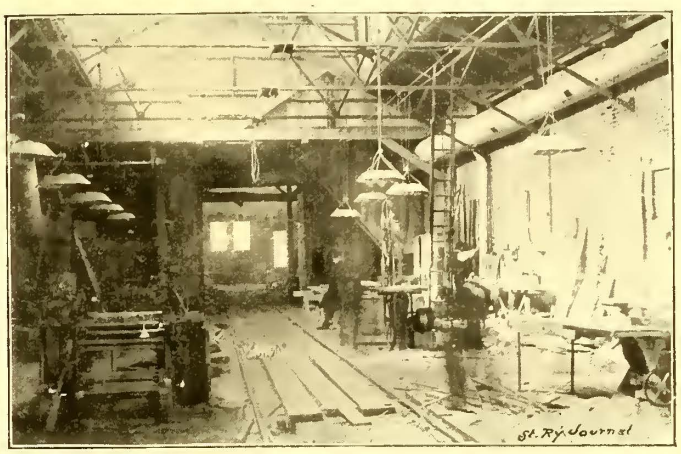


FIG. 5.—THE WOOD-WORKING SHOP

There are six forges in the smithy, all the forges being made of single sections of old steam boiler shells, holes being chipped for the air pipes, the tuyere trap, etc. The smithy is also fitted with a motor which drives the blower, also a Baudry hammer, 1-in. x 5-in. shear, and a drill press, thus making it unnecessary for the smiths to run to the machine shop occasionally. There are two pits near the tools above described, where new cars are set up and old ones overhauled, and the tools come in very handy there for small jobs that are constantly coming up.

Two car sheds were formerly maintained at the shops, but one of the sheds has been converted into a wood-shop, and the space under the floor excavated deep enough to allow all the shafting to be placed under the floor, thus leaving everything clear overhead. A car track runs through this shop, and a small push car is to be made with the bearings inside the wheels, so that there will be no projection beyond the wheels, and the car can pass lumber piled close up to the very edge of the track.

The wood-shop, and, in fact, all parts of the shop, are separated from the main erecting room and from each other by means of heavy fire doors, which are all well mounted on Coburn trucks, and therefore slide very easily. These doors are tinned both sides, and are weighted so as to be self-closing. Each door is also fitted with a box clip, where by moving a thumb-lever, the door may be held open if desired, but each of these levers (one to each door) is fitted with a thermostat, which, whenever the temperature rises on account of a fire, will drop the thumb latch and allow the door to close automatically.

A wheel grinder is being erected in an adjoining building, and after this machine is in position, two men can run a car up to the machine and center one of the axles without removing the truck from the car. The wheels can be ground and the car removed in about two hours, with only the services of the two men mentioned above.

I noted a very simple and effective rig for testing the motors and fields for grounds, short circuits and other railway motor ailments. The assistant master mechanic has built himself an office close to the pits, and a voltmeter and an ampere meter are permanently located in this office. Cables are provided long enough to reach to any part of the pits, and these cables, or flexible wires, are

wound upon drums or spools just outside the office. A set of ring contacts and a pair of brushes to each reel enable connection to be had with the instruments when the wire is either all off or all on or partly on the reels. The volt-meter connection is common flexible lamp cord, while the wires from the ampere-meter are large enough to carry 75 amps.without trouble. In order to properly control the current sent through the test wires above described, a water rheostat is set up on top of the office. A 30-gal. barrel forms the tank, and a pair of old brass bearings serve as electrodes. Salt is used to secure the proper degree of conductivity, and the assistant foreman jokingly alluded to a little experience he had when setting up the rheostat. He first tried rock salt, and put it in by the quart, without obtaining a proper degree of conductivity in the water. He

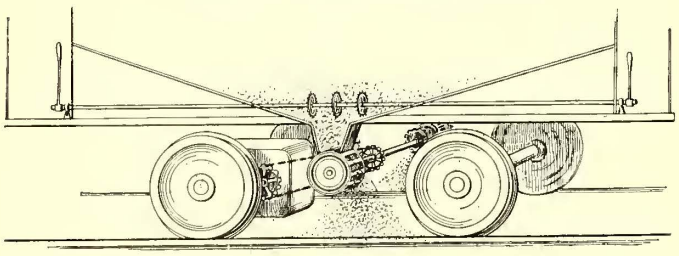


FIG. 6.—SECTION OF SAND CAR

then invested in a nickel's worth of table salt at the nearest grocery, and soon found that he could put this in by the teaspoonful, instead of by the quart, as he did with the rock salt.

A cord runs up through the top of the office and over a pulley, suspending one of the bearings, and enabling them to be brought together or separated at will to pass the desired number of amperes. In testing, the assistant master mechanic sits in his office and watches the ammeter and volt-meter, with his hand on the rheostat cord, while one of the workmen makes the required contacts at the motor which is undergoing the test.

Another neat little electric "kink" is on exhibition in the office. The Nassau road has a telephone exchange of its own, and it is frequently necessary to call up the night watchman in the shop. A time clock has to be registered alternately by the watchmen, every two-and-a-half minutes and therefore the watchmen have not much time to watch the telephone. A gong is set up in the middle of the shop, and by pushing a button the M. M. can summon any head workman he wants by means of a code of signals, as is often necessary when a car comes in for hurried light repairs. When the telephone bell rings, it drops an annunciator, so the watchman can see that he has been called. The annunciator flap, when it falls, closes the circuit of the shop gong (nights only) and that bell rings steadily until the watchman responds and resets the annunciator and answers the telephone.

The equipment of the machine shop includes the following tools, all furnished by the Prentiss Tool & Supply Company: Watson & Stillman 100-ton wheel press; 18-ft. bed lathe, with 46-in. swing, for turning out axles; 6-ft. Pond lathe, with 20-in. swing; 6-ft. lathe, with 21-in. swing; 12-ft. lathe, with 24-in. swing; 3-ft. 6-in. Fox lathe, with 14-in. swing; 10-ft. lathe, with 21-in. swing; 4-ft. lathe; 24-in. drill press; two 20-in. drill presses; 7-in. speed lathe; 36-in. wheel borer; a $\frac{1}{4}$ to $\frac{1}{2}$ in. Brown bolt cutter; 18-in shaper; Frasse hack saw.

The equipment of the armature room includes four field-winding lathes, built by the company's own works, and one band-wire winding lathe.

The equipment of the blacksmith shop comprises one Beaudry 3-ton steam hammer; one Watson & Stillman 100-ton wheel press; one 24-in. drill and one combination shearing and punching machine.

The equipment of the wood-working department comprises one rabbitter, two mortisers, one variety machine; one wood-turning lathe, one peining machine, one four-sided molder, two planers, one rippling saw, one cross-cut saw, one band saw, mostly supplied by H. D. Smith; one Clement ripping saw, witn adjustable table; one Fay hollow tool mortiser.

Fig. 6 shows an ingenious sand car employed by the company for sanding its tracks. The sand is kept agitated by a set of wheels on a horizontal shaft, worked by a platform lever, as shown. The supply of sand deposited on the track is regulated by the revolving bucket wheel, driven by a sprocket chain from the motor axle, as shown. This stops entirely the flow of sand when the car is stationary, and increases it in proportion to the speed of the car.

Electric Railway Motors

By Geo. T. Hanchett.

VIII.—Commutators and Brush Holders.

Even after the advent of the carbon brush the commutator and brush holder remain one of the most difficult parts of railway motor construction. Railway armatures of necessity operate with fixed brushes, for even if means for adjusting their angular position were provided, it would not be possible to manipulate them when the motor was operating, and at such times only is any benefit to be derived therefrom. The rapidly varying load on the railway motor is always shifting the line of sparkless commutation, and even though good design may reduce the shifting to a minimum, the conditions are very conducive to sparking. Dust and grit, which are always in close proximity, do not help matters, and brush holders and commutators must be built to stand this severe service.

Considering first the commutator, it is obvious that under these adverse conditions it should not be handicapped by poor material. Cast, or even tempered, copper is not to be recommended for this purpose. Drawn or drop forged copper are the only suitable materials. Regarding insulated segments, continuous strips of mica are to be recommended. Built up mica segments are not suitable, for they harbor conducting particles and frequently start a bridge between two bars, which results in the destruction of the two coils connected between them. It is surprising how a thin film of copper or carbon dust, scarcely equivalent to a No. 40 wire in circular milage, will suffice to burn out bobbins of No. 10 or even larger wires. The reason for this probably lies in the fact that the spurious conductor is exceedingly short, and being connected at either end with a massive copper commutator bar, the heat which is generated in it is rapidly conducted away,

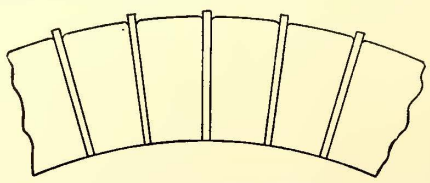


FIG. 1.—COMMUTATOR WITH EXCESSIVELY THICK SEGMENTS

and even should the bridging film be deflagrated, an arc would be established between the bars, which would be sufficient to destroy the coils connected between them.

The mica which is commonly used in commutators is of two kinds, namely, amber and India mica. Of these the India mica is best, electrically considered, but amber

mica has advantages that renders it more suitable. A mechanical consideration enters here. The commutator should wear down evenly,the segment as fast as the copper. The copper is subjected to an electrical gnawing action due to small sparks as well as simple wear. If the mica segments are made too thick, the bar will wear faster than the mica, giving the commutator an appearance like that shown in Fig. 1. This difficulty once started will develop rapidly,for the more the mica segment protrudes,the greater will be the sparking action at the bars. Commutators in which the mica segments are too thick come into the repair shop a grayish black color, and on running the fingers over the surface, the protruding mica segments are readily

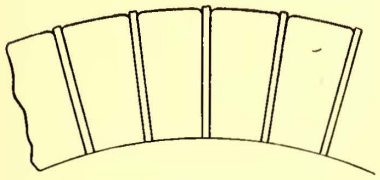


FIG. 2.—HOW THE ACTION BEGINS

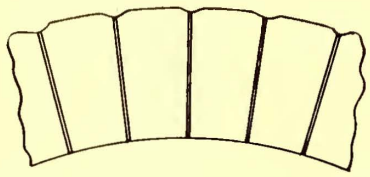


FIG. 3.—SHOWING WEAR WHEN SEGMENTS ARE TOO SOFT OR TOO THIN

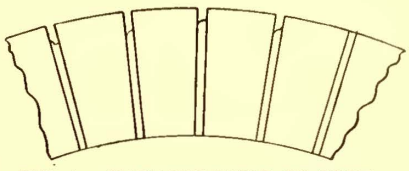


FIG 4.—SHOWING WEAR OF SOFT BUILT-UP SEGMENTS

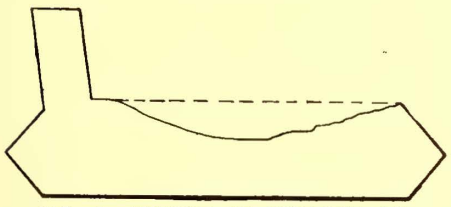


FIG. 5.—EFFECT OF NEGLECT OF THE BRUSHES

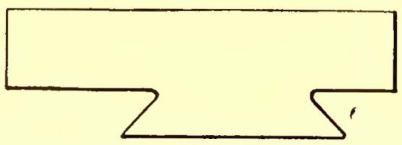


FIG. 6.—MODERN METHOD OF BINDING COMMUTATORS

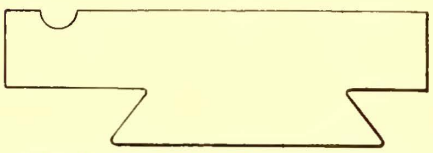


FIG. 10.—UNDER-CUT COMMUTATOR BAR

felt. Often the segments protrude 1-32 in. or more. The gnawing action usually starts at the edge of the bar and works down beside the segment, as shown in Fig. 2. A short time suffices to wear down the intervening copper between, and the damage is done.

Modern railway commutators require a segment at least 1-32 in. thick. If this be made of amber mica, it will wear down with the commutator fairly evenly, but in order to secure equally even wear with India mica the segment must be thinner, about .025 in. or .02 in., and either of these latter widths of segment are too easily bridged by carbon and copper dust. Necessity demands that India mica segments to give best mechanical results must be thinner than is good practice electrically, and therefore railway commutators built with India mica almost invariably have the faults just rehearsed.

The toughness of India mica is fully appreciated by those who have to turn up commutators. A commutator built of amber mica can readily be turned clear across its face with a single sharpening of the turning tool, but in the case of commutators built with India mica, the toughest tools lose their edge at almost the first turn of the lathe.

Built up segments have a converse and equally objectionable fault. They are too soft and wear down faster than the copper, creating depressions in the commutator, which are easily filled with carbon dust, inviting a short circuit. This wear is well depicted in Fig. 3. Built up segments also are liable to break apart with heat, so that a small piece will become brittle and drop out of the space between the bars, as shown in Fig. 4, leaving a hollow, which immediately becomes a receptacle for carbon dust and copper.

The carbon brushes which bear on a railway commutator should be frequently trimmed and squared. Failure to do this results in a bar worn as shown in Fig. 5, and this curve becomes so concave that it is almost impossible to fit a brush to it; moreover, if the commutator wears evenly it will last longer. Commutator segments should be worn down to within about $\frac{1}{8}$ in. of their wearing depth before they are removed. It does not pay to go closer, as one of the bars might become completely worn through, and possibly cause a short circuit, which would call for a new winding as well as a new commutator. It is plain that as the commutator wears away the angular breadth of the bar becomes less, and a brush which at first bridged $1\frac{1}{2}$ segments might easily bridge $2\frac{1}{2}$ or more. In this way the commutated bobbin would be held under the brush too long, and the sparking difficulties, which are severe enough in any case, would be enhanced. As the commutator wears away the width of the brush should be proportionately altered, and especially is this true with deep commutators.

A popular way to build commutator bars is shown in Fig. 5, illustrating the double bevel employed on the W. P. 50 machine. These bars will wear until they break through on the other side, but the pressure on the end

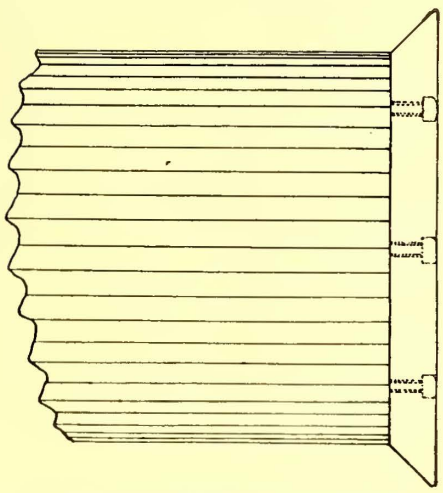


FIG. 7—VULCABESTON COLLAR TO INTERRUPT ARCS

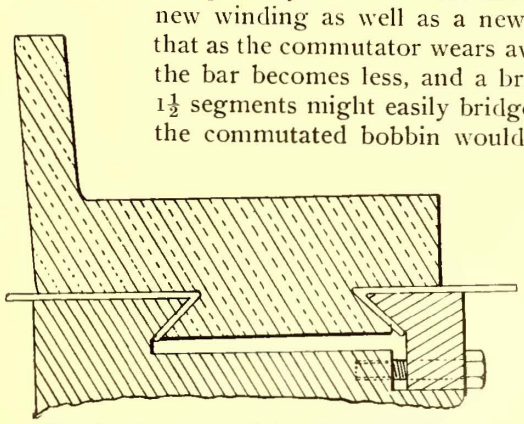


FIG. 8.—EXTENDED MICANITE COLLAR TO INTERRUPT ARCS

FIG. 11.—GAGE FOR MICA SEGMENTS

collar may cause them to buckle or shift before their useful life is ended. The preferred form of bar to-day is shown in Fig. 6, and is now almost universally adopted. The grips hold this bar just as firmly at the end of its life as in the beginning.

A common way to build a commutator sleeve was once to have a large threaded collar, concentric with the shaft, pressing the beveled collar against the bars, but the preferred practice now is to draw the collar into position by means of six or eight cap screws suitably spaced about the end of the commutator. This latter method will prevent one section of the commutator being tightened to the exclusion of the others.

It takes very little to provoke an arc on a railway motor commutator, and consequently extraordinary precautions have to be taken to prevent an arc being established be-

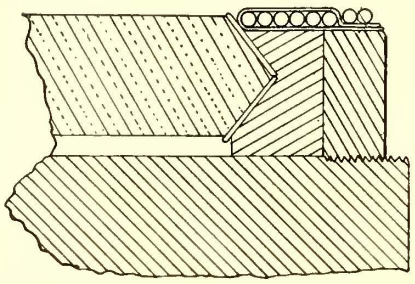


FIG. 9.—PROTECTING CORD INSULATION WITH ASBESTOS

tween the commutator segments and the iron shell supporting them, for the latter is one of the terminals of the motor. A popular method is to screw a vulcabeston collar on to the end of the commutator, as shown in Fig. 7, thus preventing the formation of arcs from the surface of the bar to the iron shell, except by a circuitous path.

Another method is to extend the mica collar, as shown in Fig. 8. This forms an effective fence to prevent the arc from jumping to the iron, but is not mechanically so well adapted to rough handling. With double bevel bars, the surfaces of which come flush with the end collar, it is frequently good practice to wind a shellaced string protected with asbestos over the collar, as shown in Fig. 9. This method is not so effective but it can be applied to many existing motors where other means are not easily applied.

It is customary to line that part of the casing adjacent to the brushes with sheets of insulated material, preferably vulcabeston or asbestos, to prevent damage or grounding from the flaring arcs that sometimes occur at the brushes. These arcs are frequently due to weak fields, and often do a great deal of damage to the adjacent parts, especially to canvas-covered heads. For this reason commutator bars with lugs extending upwardly to the diameter of the armature, as shown in Fig. 8, are to be recommended. It will be readily seen that the surface of the armature adjacent to the brushes is of the same potential, and therefore destructive arcs will not find a circuit in the immediate vicinity.

This practice demands a drop-forged copper commutator bar. Where drawn copper bars are used, it is customary to undercut them, as shown in Fig. 10. This makes a lug for the wire and enables the winder to connect up neatly, but unfortunately it demands a more or less combustible head next to the commutator.

In assembling commutators a good method is to take the prepared bars and stack them along the bench together with the segments which are to go between them. These segments consist of slips of mica, which are gaged by means of a tool shown in Fig. 11. A sufficient number of slips are selected from a pile and inserted in a slot in a gage until a certain predetermined tightness is attained. This forms a segment.

All railway brush holders are almost identical in principle. They consist of a brass casting provided with suitable lugs for the connecting wires and a rectangular tube, which is radial to the commutator and in which a single block of carbon rests. A spring-impelled finger presses the carbon against the commutator, and the holder is so designed that the pressure shall be practically constant throughout the life of the brush.

There are two methods which have been employed for supporting brushes. One is to employ a protruding stick or rod of insulating material, on which the brush holder is mounted. With the W. P. motors these were small sticks of wood let into mortises in the lower half of the case at diametrically opposite position on the commutator. In the Westinghouse armatures the insulating support is secured by the upper half of the case.

A method which is now finding favor is to fasten the brush holder to a vulcabeston board, which is concentric to the commutator, and serves to separate the brushes from the armature head. This board is fastened to lugs cast in the upper half of the motor casing. Wood is sometimes used instead of vulcabeston for this purpose.

Methods of Determining the Resistance of the Railway Feeder Circuits and the Ground Return Losses

Albert B. Herrick.

I notice in the March issue of the Street Railway Journal an article by S. F. Jeter on a method of determining the resistance of the railway feeder circuits and the ground return losses, but the method described requires a pressure wire. In determining these losses and resistances for railroads, I have of necessity devised a number of methods for making these determinations without a pressure wire, and they may be of interest to others in making these tests.

The method separates the resistance of the line return from that of the ground return, or determines the resist-

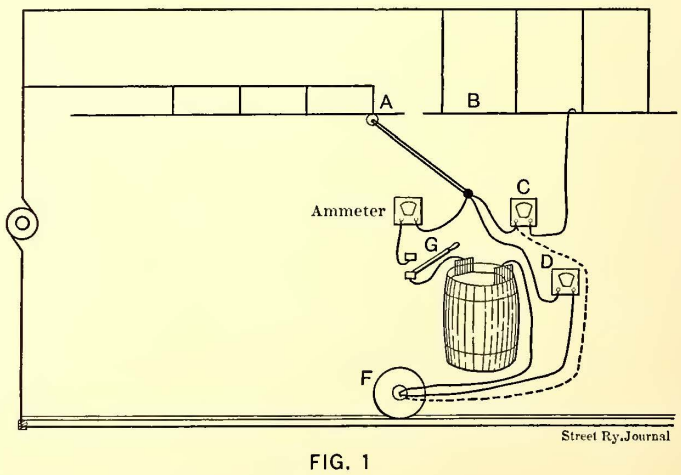


FIG. 1

ance of these two circuits together; the former method is applicable where there are line circuit breakers on the line and no cars operating on either section terminating at these breakers. The water rheostat referred to can be readily made out of an oil barrel with the head knocked out, and with slats placed across to prevent the two iron plates, which are $\frac{1}{8}$ in. thick, 16 ins. across and 24 ins. long, from touching. The barrel is then filled about three-

quarters full with water. This rheostat can be carried on the front platform of the car and the instruments arranged conveniently inside, and connections made as shown in Fig. 1.

There are several little wrinkles the knowledge of which will assist in obtaining good results from water rheostats; one is the use of bi-carbonate of soda to reduce the resistance of the rheostat. This gives better results as to the constancy of current flowing through the resistance than salt or sulphuric acid. The current should flow through the rheostat till the water is well warmed up and near the boiling point, when the current will become nearly constant. When the rheostat is constructed as above, it will pass approximately 200 amps. at 500 volts.

In order to make these determinations without any pressure wire, the car can be stopped within a car's length of a line circuit breaker, and a hook placed over the trolley *B*, as shown in Fig. 1. This circuit is then carried through a voltmeter to the trolley connection of the car; in most car wiring the fuse box will be the easiest place to tap this circuit. This trolley connection is then carried through the rheostat and there connected to the ground terminal on the motors. It can be readily seen that when the current flows from the trolley to the ground, the difference of potential between the trolley wheel *A* and the idle

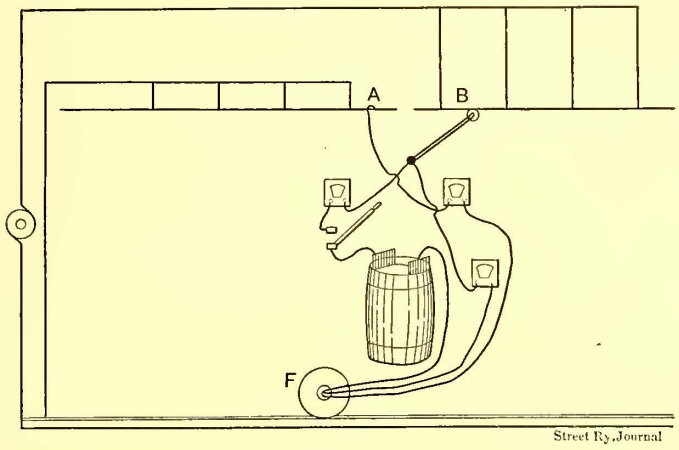


FIG. 2

trolley wire *B*, Fig. 1, is the loss of potential due to the resistance of the feeder and the trolley wire through which the water rheostat is fed, the idle trolley wire *B* acting as a pressure wire, and the lost volts in the copper system will be read on voltmeter *C*. Voltmeter *D* will read the drop on the rheostat, and the instantaneous reading of *C* plus *D* subtracted from the station voltage, will give the ground return drop in volts. Now, if voltmeter *C* is connected from *B* to *F*, as shown by dotted lines, and the switch *G* is opened, then the station pressure is read. It is well to have only one unit operating on this test, and the station pressure with no load and full load, can be maintained at a constant pressure by the switchboard attendants. The voltmeter *C* should be left connected long enough from *B* to *F* to get the maximum rise of voltage and the actual station pressure.

The trolley pole can now be swung around, the pressure wire brought to the idle trolley wire, and the resistance of the circuit *B*, terminating at this point, can be determined in the same way.

If the station pressure cannot be maintained constant for the change of load, when the water rheostat is thrown in, the ground return drop can be read directly in this way: Open the feeder switches supplying that section used as a pressure wire and ground one of the feeder terminals of the switch to the ground bus terminal in the station. This can be done with a fuse wire or with a light link in series with the ground wire, so that it will blow without any damage if any misconnection is made on the line.

In Fig. 2 the above connections will be seen, and if the load is thrown on again by means of the water rheostat, the pressure between *F* and *A* will be the ground return loss in volts, which will in this way be measured, independent of the station pressure. By prearranging a regular programme between the switchboard attendant and yourself, these tests can be easily carried out, and by making and breaking the circuit at the rheostat by means of switch *G*, signals can be sent to the station which can be read from the movement of the ammeter hand.

A test sheet which will help to show the application of these determinations, three circuit breakers on the line, is given below:

TEST SHEET.

	A	*B*	*C*	*D*		*E*	
Test	Station Volts	Amperes	Drop on Rheostat	Drop on Line	$\frac{D}{B} = R$	Drop on Ground Return by Difference.	$\frac{E}{B} = R$
1st	562	180	528	22	.122	12	.066
2nd	561	182	514	28	.153	19	.104
3rd	563	186	489	31	.166	43	.231
4th	562	190	460	38	.200	64	.337
5th	561	193	441	46	.238	74	.383
6th	560	201	430	58	.288	82	.408

The ground return circuit where the earth is used as a partial return is affected by many conditions. The moisture in the earth, the character of sub-soil, the character of earth in which the rail is laid and the volume of current flow, all affect the resistance of this return circuit. Dry clay is the poorest conductor, sand next, and loam the best. If water underlies the soil, the resistance of the earth return falls fast as the current volume increases. In dry weather the rails and the soil immediately surrounding the rails will be found moist where water underlies the track bed. A roadway through salt marsh meadows has the lowest ground return resistance that I have measured. This resistance was not changed on breaking the electrical connection of the rails between the test car and the station, and as there were no adjacent water mains to act as an auxiliary, the low resistance must have been due to the character of the soil and the presence of the salt water. The worst ground return that I have found is where a thin layer of clay on which the road was built had bed-rock underneath. Under these conditions where the track was dead, it required several minutes for the electromotive force to be applied to this ground until sufficient current flowed to break down the normal ground resistance. It will be noticed when the ammeter is read, and the volts divided by the ampere reading gives also the electrical resistance of the circuit under measurement.

It is sometimes important to discover the line and ground return losses at the end of the line where the above method cannot be used, such as at the end of the road where data is required for road extensions.

With a double trolley road I have used the method shown in Fig. 3. Open all cross connections between the two trolleys *A* and *B* to a point back of the first line circuit breaker *C*, and in this way obtain a pressure wire from the station; the measurements are carried

out in the same way as indicated in Fig. 1, using the isolated trolley *B* as a pressure wire.

Another determination, and a very important one, can be made when the question of electrolysis is at issue, and a railway manager wishes to determine how much current is carried through a parallel water pipe system, how much is carried through the rails of the railway back to the station, and also to discover whether the bonding is poor in track sections.

A number of methods have been described in the past to make these determinations on individual bonds, or

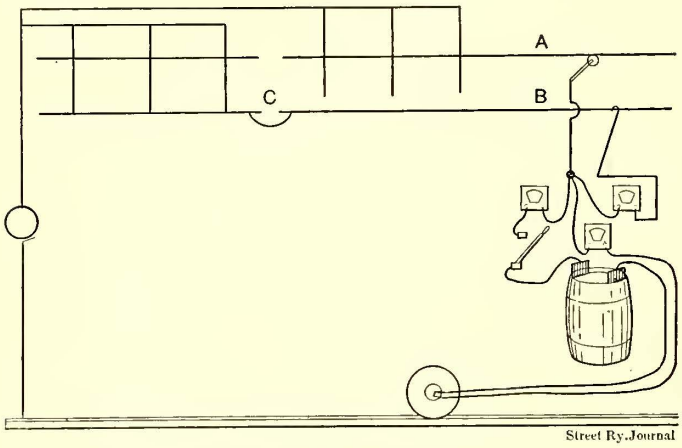


FIG. 3

where several adjacent bonds are under test. One method is to run a car with specially designed contact brushes over the rail joints, but the very presence of the car at this point will cause the splice plate to form a connection bridging the bad bond, though the joint will open after the car has passed.

A great many figures have been published on the resistance of individual bonds, and these have been carried to six places of decimals; in some, the current of 1000 amps. has been passed through these joints, and again the elevation of temperature has been designated as "warm" and "very warm." Such information does not convey to

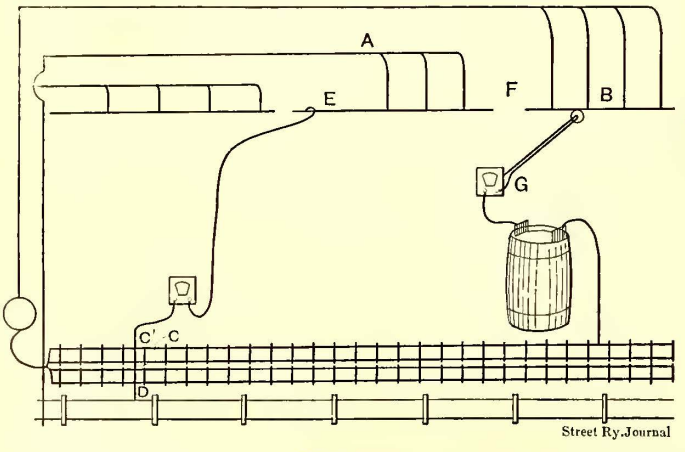


FIG. 4

the practical man any ideas which can be applied to his track conditions, and the only determinations of any value are those made on the track and water pipe returns themselves under the actual conditions of operation.

In Fig. 4 the rheostat is left in the same connection at the point *B*, and feeder *A* should be grounded with a heavy fuse. If at the point *C* on the rail, we connect an ammeter between the rail and the trolley *E*, a metallic return will have been substituted for the ground return. The drop between the points *F* and *B* will then be due to the current passing from the car to the end of the section through the rails, and this measurement will give the rail return loss over this section of track. If the conductor still connecting the rails be continued to a water plug, extending to the water main to be measured, and a good connection made at this point, the current readings in the ammeter will increase and the first readings of the ammeter is to the second reading of the ammeter as the resistance of the water pipe is to the rail return over this section, and the current in returning to the station will distribute itself between the two conductors in the same relation as these two readings are to each other. The contact resistance will vary these relations slightly, but not enough to be considered.

If an ammeter *G* is kept on the circuit of *B* while these readings are being made at the end of the section, then the sum of the first reading on the ammeter at *C* and the second reading on this ammeter, subtracted from the readings of the ammeter *G* will be that current which sneaks through the earth without traversing the rail or the water pipe system, or that which is due to the low resistance of the circuit from the points *C* to *D* to the power station. This circuit will be in the proportion of the total as the reading on ampere meter at *C* is to the reading of ampere meter at *G*.

Of course all the current can be returned through the ammeter at *C* by opening the ground switches in the station and using *A* as the only ground return. This is sometimes necessary when the fault lies between *B* and *C* on the track.

It is well in making connections at point *C* on the rails and water pipe *D*, to amalgamate the iron by some of the well-known methods, in order to eliminate the contact resistance at these points. By moving the points *D* and *C* along the track, and noticing the drop between *F* and *B*, and the current flowing through ammeter at *C*, this drop should decrease approximately proportionately to the length of track between *C* and the connection with *G*, but there will be a sudden change in the resistance when broken bonds have been passed. An individual test on each bond will then be required in order to put this railway conductor in good electrical condition.

Overhead Trolley Construction on New Draw Bridge in New York

The overhead construction to be installed across the new draw bridge now being built over the Harlem River at Third Avenue, New York, has been designed with the particular aim in view of giving a complete metallic contact the entire length of the bridge when the draw is closed. It has usually been the custom when installing work of this kind to leave a considerable break in the overhead construction at the points where the draw connects with the approaches, compelling the car to drift past these places, often for a considerable distance. This method also makes the trolley wheel jump a gap several inches wide, which is not only annoying to the occupants of the car on account of the noise and jar, but is also very wearing on the trolley wheel and pole.

The new Third Avenue bridge is built in a very substantial manner, the materials used being stone and steel throughout. The draw is 300 ft. in length, and 87 ft. 6 ins. in width. Three roadways are provided, one for street railway tracks and two for teams. In addition to this there are two footways for passengers. The draw is 24 ft. above high water. The north approach of the bridge is

about 895 ft. in length, it having been found necessary to go back this far in order to avoid a too rapid ascent. The grade of this approach is 3 per cent. The main south approach divides into two branches, one going east about a block and the other west about the same distance. The grade on these approaches varies from 3 per cent to 3.6 per cent. All the electric cars of the Union Railway Company will use this bridge for reaching the company's terminal at 129th Street and Third Avenue.

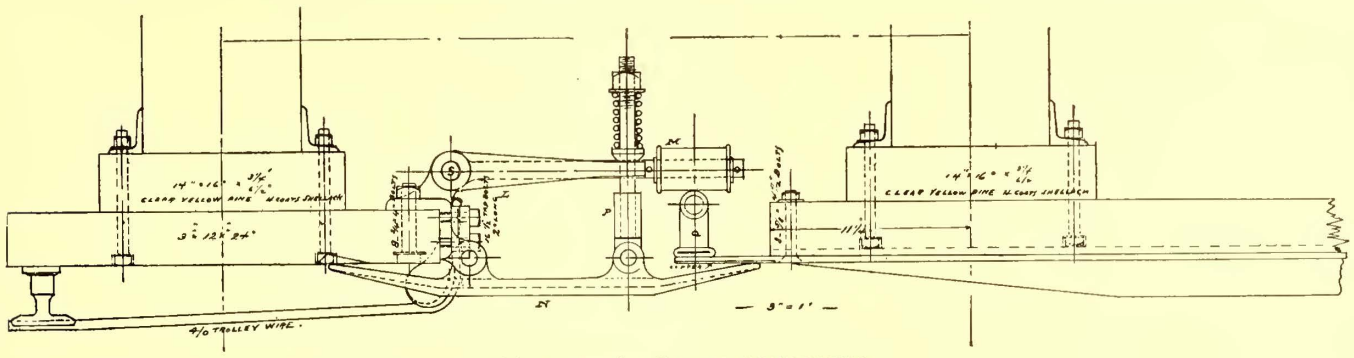


FIG 3.—SIDE VIEW OF CONNECTOR

The accompanying illustrations show the overhead trolley switches and connectors, with method of attaching them. Fig. 2 shows a side view of the mechanism for making a complete connection of the overhead wire on the approaches, with the overhead conductor on the draw, and Figs. 3 and 4 show this device in detail. No. 0000 hard-drawn copper trolley wire is used, except on the draw, and the ends of the wire are anchored in the manner shown at the end of each approach. When a car is about to enter the draw, the trolley wheel passes along the overhead wire until the flange of the wheel strikes the metal connector, which is shown in the cut. As is shown by Fig. 4. this connector is furnished with flaring ends, so as to catch and guide the trolley wheel. The wheel rides on its flange over the connector until the car is on the draw,

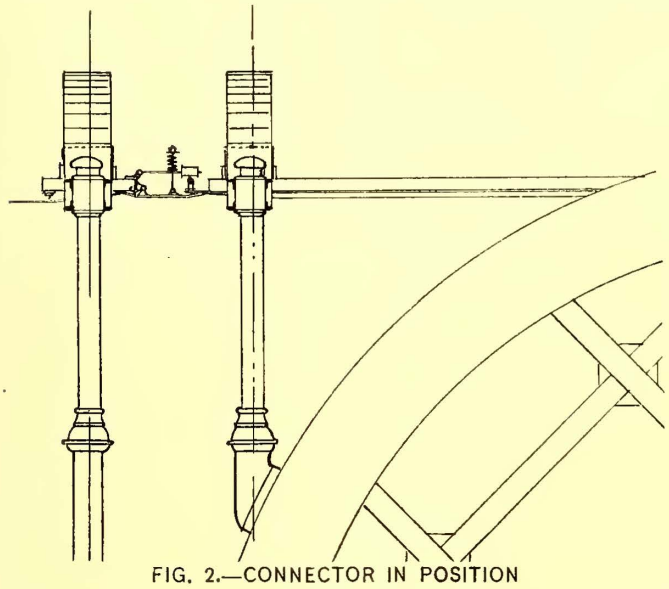


FIG. 2.—CONNECTOR IN POSITION

when the trolley wheel passes to a T iron, which runs the entire length of the draw. This T iron is 3 ins. x 3 ins., and weighs 7.4 lbs. per foot. It is furnished in 30-ft. lengths, and the sections are carefully bonded together by copper bonds. This T-rail is mounted on well-seasoned yellow pine timbers 3 ins. x 12 ins., with four coats of shellac, and is shown in Fig. 1. Wooden backing is used in order to prevent the trolley wheel, if it should happen to leave the T iron, from coming in contact with any of the metal portions, and so charging the bridge. A good connection between the trolley wire on the approaches and the T iron on the draw is guaranteed at all times by means of rollers on copper tubes, and a spring which keeps the connector firmly pressed upward. This feature is clearly shown in Figs. 2 and 3.

The poles for supporting the overhead construction on the approaches are of an extra heavy pattern, weighing approximately 960 lbs. each. The poles vary from 5 ins. to 6 ins. and 7 ins. in diameter. They are set in the ground

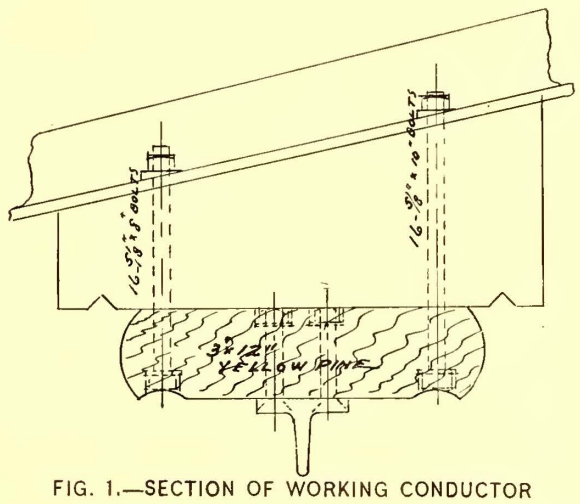


FIG. 1.—SECTION OF WORKING CONDUCTOR

with Portland cement, and are supported along the stone walls of the approaches by iron brackets and braces. On the iron-work they are set in pockets on column base stones. The poles were furnished by the National Tube

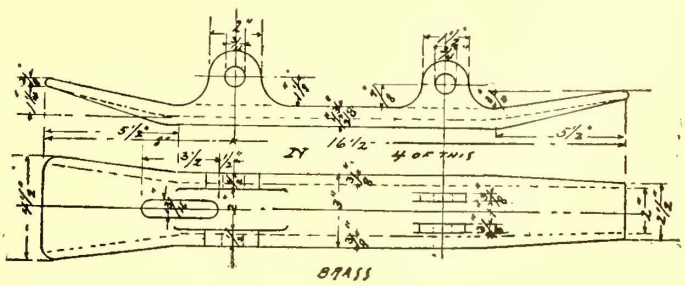


FIG. 4.—CONNECTOR

Works. No. 0 "Phono" electric wire is used for the span wire, and on curves. This wire has a tensile strength of 80,000 lbs. per sq. in., and is made by the Bridgeport Brass Company. The entire trolley construction was designed by S. H. Harrington. The line was built by Smethurst & Allen. The president of the Union Railway Company gave orders that nothing but the very best of materials and workmanship, regardless of cost, were to be employed in the trolley construction on the bridge.

LETTERS AND HINTS FROM PRACTICAL MEN

Pressing Wheels on Axles

Brooklyn, N. Y., Feb. 12, 1898.

Editors Street Railway Journal:

Recently there was occasion to investigate the problem of the proper proportioning of the diameter of certain steel car-wheel hubs and axles to secure the maximum possible grip between the two, and yet have the compression of axle and the extension of bore within the elastic limits of the materials in the axle and wheel. The following was the treatment of the problem:

Let the diameter of the axle be d and that of the wheel bore, which is of less diameter, be $d\,x$. Then the normal circumference of outer surface of axle $= \pi\, d$, and of inner surface of bore $= \pi\, d\, x$.

When the wheel is forced on the axle, d will be lessened and $d\ x$ increased, so that, putting $d\ y$ for the common diameter, the compression of outer surface of axle will be $\pi\ d\ (1 - y)$ and the extension of inner surface of bore will be $\pi\ d\ (y - x)$ and per unit of length, $1 - y$ and $y - x$, respectively.

For per unit of length per maximum safe compression of axle material put a and per maximum safe extension of wheel material put b. Then $1 - y = a$ and $y - x = b$. $\therefore$ $y = 1 - a$ and $x = 1 - a - b$, and the normal diameter of axle $= d$ and the normal diameter of bore $= d\ (1 - a - b.)$. What are the values to be given to a and b is to be determined.

It may be said that so far, this discussion has dealt with the outer surface of the axle and the inner surface of the bore, which are to be brought into contact. Whether consideration of the reinforcement of the inner surface of the bore by adjacent and surrounding layers, and similarly of the axle inward, the other being outward, would affect differently the ultimate query—namely, what safe stress may be put upon the materials in the contact surface, is doubtful.

An empiric solution, probably, is a correct practical one.

Nine steel bars—g. s. m.'s tests.—ranging in per cent of carbon from 0.09 to 0.559; in elastic limit of tension per sq. in. from 32,540 to 43,310 pounds, and at that stress, in extension per inch from 0.00119 to 0.00161, show an average extension of 0.00129. These bars, each under 30,000 lbs. stress per sq. in. extended per inch varying from 0.00095 to 0.00108, and averaging 0.00104. Rejecting the ninth bar, having carbon 0.559 per cent., the eight remaining bars ranged in carbon from 0.09 to 0.222 per cent. in elastic limits per sq. in., from 32,540 to 37,330 pounds, and at that stress in extension from 0.00119 to 0.00132, with an average of 0.00124. Similarly these bars under 30,000 lbs. tensional stress extended per sq. in from 0.00095 to 0.00108 with an average of 0.00103.

It may be safe to take the maximum allowable extension per unit of length at .00111 $= b$ and compression per unit of length at one-half this or .00055 $= a$.

$$\text{Then } d\ (1 - a - b) = .99834\ d,$$

which is the diameter of bore of the wheel hub, d being that of the axle; or, diameter of bore : diam. axle :: 599 : 600; that is for steel forged wheels and axles, the diameter of the bore of the wheel, should be one six-hundredth less than the diameter of the axle.

G. Leverich.

Repair Shop Practice in Salt Lake City

Salt Lake City Railroad Company.

Salt Lake City, Utah, Feb. 25, 1898.

Editors Street Railway Journal:

The electric railway here was one of the first to be put in operation west of the Mississippi, and at that time, of course, we were new at the business. Burned-out armatures, fields and open circuits seemed enormous troubles to us, and we were in trouble most of the time. We looked for trouble, and expected trouble, and if trouble did not come we were disappointed. It is an old saying that it is an ill wind that blows no one any good, and we confess that the troubles which we experienced first made us realize that if we were to be successful we must prepare ourselves for every emergency, and to do this must have a shop with good tools and appliances for turning out everything necessary for the repair of our motors, trucks and cars. With a shop thus equipped, we realized that it must be run on strictly business principles and that we must know whether we were manufacturing different articles as cheap and as good in quality as they could be bought in the open market. We therefore instituted a careful system of accounts, and when it is necessary to build any new article for a motor, truck or car, a special order is issued to the shop foreman by the storekeeper for the article in question. The cost of labor on this is computed in the shop from time cards which are furnished the workmen every morning, and with the cost of materials give absolutely the total expense on any order. So far as possible each workman is assigned a particular line of work. Thus, we have one man whose business it is to look after the putting on of gears and pinions and looking after bearings; another who has charge of the controllers and resistance boxes, and so all through the different departments. The man who runs a lathe does not do much else, so that in this way a man soon becomes proficient in his special line of work. Our experience in shop practice has been very satisfactory, not only as regards the first cost of supplies, but in the fact that we were able to make some improvements in the different parts used. To illustrate, I might cite the case of axle bearings and armatures. With a new motor equipment it is not difficult to order bearings to fit the axles, but an equipment in time becomes old and the bearings probably worn out of true, so that it is necessary to true them up. By this time the standard has been lost for that bearing. It is true that another standard could be established by making the bearings one-sixteenth or one-eighth inch smaller than the original size, but after a while there will be three or four different sizes and general confusion. But where a company turns its own bearings, the bearing can be bored to fit. On the other hand, if standard size bearings have been ordered, and the armature or axle has run for some time, the new bearing becomes practically old before it leaves the car shed on account of its fitting the journal too loosely. We have adopted babbitt in all our bearings, finding it cheaper and better than bronze. We have brass or iron shells which we fill with babbitt, and when they become worn melt the babbitt out and refill the shell again, using the old metal by adding new metal each time to keep up the life of the metal.

Our first equipment consisted of Sprague No. 6 motors, Stephenson car bodies and wooden trucks. The latter have been replaced with iron or steel trucks, of which we have quite a variety, including the Brill No. 21, the McGuire F No. 19, McGuire "Columbia," Bemis and Peckham. All our trucks are single trucks, with 30-in. wheels.

The first trucks had a 6-ft. wheel base; later we put on some with 6 ft. 6 in. bases, increasing later to 7 ft., and last of all to 7 ft. 6 ins., which we have adopted as a standard. We are fast doing away with the old Sprague controllers, replacing them with K 2 controllers. We have not discarded any of our motor equipments, but have been adding to the first equipment many of the different types of motors which have come out from time to time, including the Westinghouse No. 1 double reduction, the T.-H. S. R. G. motor, the Westinghouse No. 3, W. P. 50 and finally the Westinghouse No. 12 A, which we class among the best. We have made many improvements in our early equipments. With the Sprague No. 6, open circuits seem to be the chief difficulty, but by persistent efforts, and by trying every scheme possible to conceive, we finally found a cure, or better, a preventive, for open circuits in the Sprague No. 6 armatures. This was accomplished by discarding the old commutator shell and substituting a new shell similar to the old, but having the collar cast on the back end of the commutator shell next to the winding. This shell was 5 ins. in diameter and ⅜ in. wide. When the motor is put in place on the armature shaft, this collar is well insulated by wrapping three or four layers of tape round it. The leads are then brought down upon the collar and then set up close to the commutator shell of the commutator, then bent at right angles in the slot of the bars and soldered in place. All leads are thus connected. Then the hood is put in place, and after winding a few layers of tape on it and just over where the leads come down on the ring on the back end of the commutator shell, a band of No. 19 band wire, about 3 ins. wide, is wound around the leads of the armature firmly down upon the collar. This prevents all vibration of the leads, which was the principal cause of the open circuits when connected by the old method. Since we adopted this plan we have scarcely ever had an open circuit in our Sprague armatures. We do not, however, attribute our success with the Sprague machines wholly to this method of connecting the armature, for if the winding is not properly done, it matters little what method of connecting the leads is employed. We have discarded the metal brush holders and adopted a wooden brush holder of our own design, also an armature bearing of our own, doing away with the ball bearings of the old style.

One of the most satisfactory results secured in our shop is the construction of our own commutators. It is thought by some that the construction of commutators is a simple mechanical problem, and that any first-class mechanic can construct one without any experience. In starting to build our commutators we mark each with the date it was first put into use. We then record in a book the data concerning it, giving a description of its construction, the kind of material used in the parts, the kind of mica, the blackness of the mica, and as minute a description as we can make. We then watch carefully to see how the commutator runs. At any time when inspection is necessary, the history of the commutator can be taken from the book, and we are thus able to learn what forms of construction are good and what are defective or give the best results with certain kinds of motors, for a proper thickness of mica for one commutator will not give satisfactory results on one for any kind of motor. What is true in commutator construction is also true in the making of trolley wheels, pinions and other parts of a car equipment.

It might be well to say a few words in regard to our night crew. We have abandoned the idea that most of the repairs on motors, trucks and cars have to be done at night. Our day inspectors have been done away with entirely, and it is the duty of the night inspector to inspect all cars and mark in a book the numbers of the cars with the repairs necessary. This record is then left with the day men to make the repairs, unless it is some small repair, such as the cleaning of controllers, contacts, soldering of wire, etc., which is done by the night inspector. The latter man also oils all the bearings and notes what condition they are in. This plan requires a greater number of cars, but nearly every road owns a few extra cars for special occasions, so there is really no extra equipment required, and anyone knows that a man cannot do a day's work in one night.

W. H. Patterson.

Casting an Engine Cylinder

Philadelphia, March 12, 1898.

Editors Street Railway Journal:

A cylinder belonging to a power station engine broke recently, and the attached drawings explain how we made a new one. We prepared the seat of the mold with the design of sweep in Fig. 1. In this the spindle A is supported in a wooden frame, on a plan which differs somewhat from the usual arrangement. This will be understood by the sketch.

After sweeping up, the sweep and spindle connections were taken off, and the segment *B*, Fig. 2, put on. This

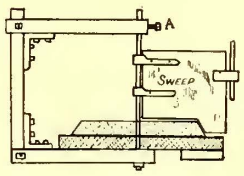


FIG. 1.—MOLD SEAT

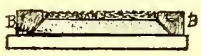


FIG. 2—BOTTOM OF FLANGE

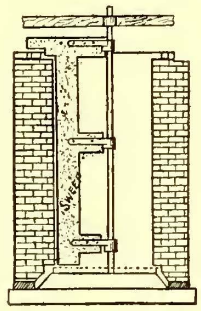


FIG. 3—COPE SWEEP

was made of wood, the same thickness as the cylinder flange, and rammed with molding sand, as shown, thereby forming the bottom flange of the cylinder.

The cope was made now with the cope sweep in Fig. 3. The outside of the mold was built up with brick, and the

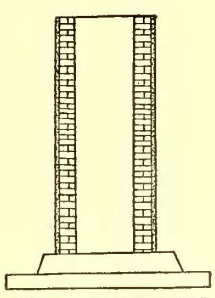


FIG. 4.—MAIN CORE

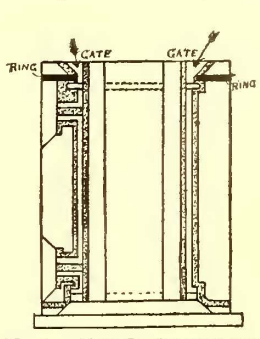


FIG. 5.—MOLD COMPLETE

patterns for the nozzles lined up in their proper places during the operation. This completed the cope to the top flange of the cylinder. The sweep was taken out and the newly-formed cope or exterior wall lifted from the seat, and steps taken to build the core.

This core was built up 14 ins. above the top flange of the cylinder to provide space for the usual "head." This main core is shown in Fig. 4.

After having completed the sweeping of this core, it was permitted to stand in the seat until thoroughly dry, when

an iron cope plate or ring was swept with loam on one side and placed so as to form the outer wall head, as shown in Fig. 5.

Fig. 5 shows the mold complete with the pouring gates and nozzle cores. An 8-ft. high cylinder was cast.

Engineer.

Making Aluminum Gears

Boston, March 3, 1898.

Editors Street Railway Journal:

Car builders are using aluminum bronze gears to some extent in electric motor service, and the accompanying explanation as to the processes of making and testing such gears may be useful. If any systematic study has been made of casting aluminum gears, the results have been very carefully kept private. Aluminum is being used regularly by some of the largest gear companies in small percentage. It is added to the gear metal in proportions of from ½ lb. to several pounds of aluminum to the ton of steel, the purpose of the addition being largely to prevent the retention of the occluded gases in the steel, and give thereby the production of solid ingots.

Due to its non-tarnishing qualities and its lightness, aluminum is particularly adaptable for electric motor gears, and a considerable use for the metal in this direction bids fair to grow rapidly within the next few years. The writer does not propose to attempt to instruct in the art of casting gears from aluminum, as every foundryman has his own way of doing work of a special nature, and I will therefore merely narrate the particulars of my recent experience.

I purchased aluminum alloyed 12 per cent bronze. I used manganese alloy in combination with copper and nickel to get rigidity and hardness.

The furnace I used in melting the aluminum mixture was a small type of the Siemens-Martin furnace, with oil as a fuel. The furnace had a capacity of about 500 lbs., and was equipped with oil burners. About two hours and a half were required to melt the mixture. After the charge was melted, it was frequently rabbled and the surface skimmed clean after the first good rabbling. Two tests were made before tapping, the first to see if the metal was "high enough." The determination for a charge was made by dipping out a little of the metal and pouring a bar about 6 ins. long and 1 in. in diameter, and after it had set, cooling it carefully in water. Then the usual tests were applied to it. The ½ per cent aluminum bronzes have a specific gravity of about 7.50, and are of a light yellow color. The 5 to 7½ per cent have a specific gravity of 8 to 8.30. They are of a yellow color and give tensile strength of 70,000 to 80,000 lbs. per sq. in., with an elastic limit of 40,000 lbs. per sq. in., and an elongation of 30 per cent in 8 ins.

In order to cast the gears and get satisfactory results, I erected the pouring gate over the mold, as shown in Fig. 1. I filled the pouring gate at the top with the necessary quantity of metal. The plug was withdrawn and the metal would go down the gate-hold to the flask through the mold, carrying the confined air and gases before it, and thus insuring a clean casting. I encased the pouring gate in an iron pocket (A), and to this set up the bracket (B) for a bearing for the stopper shaft (C), operating the latter with a lever (D). No blow-holes or sponginess can be allowed, because this destroys the high conducting power of the metal by interposing air spaces between the inner and outer surface of the metal.

The castings made were a perfect success, and I think the way of making them original.

The stuffing boxes were dry sand cores, hung in the cope and just short enough so that they would not touch the green sand when closing. I poured by a runner the whole length of the flask, and gated with a gear between each stuffing-box on top of core, as shown, each gear being of different size.

The temper required may be obtained after hardening by reheating sufficiently only to relieve shrinkage strains, and will be indicated by the color. The peripheral and the rotative speed of the gear must be considered, and the former should not be so great as to cause heating of the teeth. If the teeth are cut, it is important that the form remain intact, as the least change from that origi-

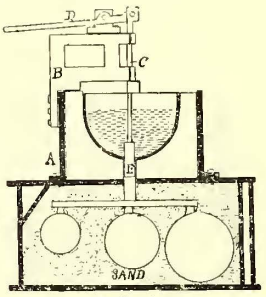


FIG. 1

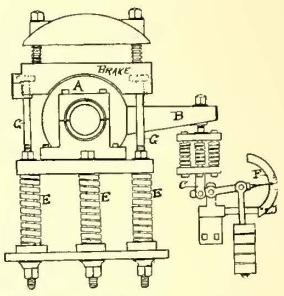


FIG. 2

nally given them will utterly destroy the accuracy of the carefully calculated curves and faces of gear-teeth necessary to insure their proper working. Standard cutters for all pitches and diameters of gears, of both involute and epicycloidal forms of teeth, are made in this manner, and have become almost universally considered a necessity. For milling any considerable width of surface, composed of a combination of a number of curves, flats and angles, it is best to have a "gang" of cutters, comprising one for each shape in the combination.

In the tests of aluminum gears, both molded and cut gears were employed. The device used in testing is shown in detail in Fig. 2. It had to be specially built.

The central shaft upon which the gear to be tested is keyed is provided with a solid wheel (A), upon which is applied the brakeshoe by means of drawing up on the rods (G G) and the spring (E). Power was delivered to the main shaft of the testing machine by two 3-in. belts, and was absorbed by a rope dynamometer. By applying the brake a resistance was introduced to oppose the motion of the driven shaft, and this was maintained constant for a sufficient period to allow observations to be made. The continuous pressure was regulated by the tension of the springs, which in these experiments was about 2000 lbs. The lever (B) was free to run a little way with the shaft, when a spring balance (C) at the side would indicate on the dial (F) the pull due to the friction. The gear under test would be meshed with a gear set up on a connecting shaft, and the main shaft of the testing machine would be turned by a pulley and belt on opposite side until one gear or the other was stripped or broken. The experiments were continued with some aluminum gears 12 ins. diameter, and corresponding cogs where pressures up to 2000 lbs. per sq. in. were recorded.

It is held by some that aluminum gearing has turned crystalline in service. If we take a fracture of the gear, plane and polish a portion of it transversely and longitudinally, and examine it under the microscope, then a rational explanation is obtained. If the metal which, under a nicking test, shows amorphous fracture and breaks granular in a mysterious way, then it is more likely that the gear has been cast incorrectly. Overheating has perhaps weakened the metal in certain portions, and fracture will naturally occur unexpectedly in those portions. All this should be allowed for.

The arrangements set up for purposes of comparison of aluminum gears with other kinds, were those in the next sketches. In Fig. 3 an aluminum and iron gear of the same dimensions were tested together, with the result that some teeth were stripped from the iron one first. In the set-up in Fig. 4, the small aluminum gear turned the

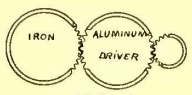


FIG. 3

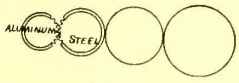


FIG. 4

three steel gears, each under frictional power test, for six hours, and with the result of the giving out of the iron gear No. 3 first. In Fig. 5 is shown a speed test, the driver being cast iron and revolved at 350 r.p.m. for 60 minutes, without injury to the cogs of the smaller aluminum gear, which, of course, was turned at a high

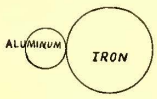


FIG. 5

FIG 6

rate. Fig 6 shows an aluminum gear surrounded by five brass gears, the object being to ascertain the wear of the teeth in the former. After four hours' run at 180 r.p.m. and under friction brake, no perceptible wear was evinced on the teeth of the aluminum gear. I believe that there is a future for aluminum gearing for all kinds of machinery and power drives. B. F. Fells.

Tramway Matters in Sydney, N. S. W.

Sydney, Feb. 14, 1898.

Editors Street Railway Journal:

In your October number, recently received, I noticed a lengthy article on the proposed electric tramways and conversion of the present steam tramways of Sydney, New South Wales, to electric power.

Having been resident and actively engaged in the electrical industry for several years, I carefully perused same, and was struck with the fact that no mention was made of those persons who have pioneered, designed and engineered the various schemes throughout, and to whom the kudos of the work ought rightly to belong. Perhaps a few words on electric traction matters in New South Wales may be of interest to readers of your paper, and may also place on record the inauguration of electric traction in this territory. When the late chief commissioner, Mr. Eddy, was appointed, in conjunction with his two colleagues, Mr. Oliver and Mr. Fehon, the post of electrical engineer to the railways was created and eventually filled by P. B. Elwell, of "Elwell-Parker" fame. On the date of his appointment one electric line was in operation, installed about the year 1890, at Randwick, but it was decidedly unsuccessful, both from a financial and working point of view. This plant consisted of about two miles of single line, equipped by the Thomson-Houston Company, and operating three cars fitted with double reduction motors. Power was obtained from a bipolar 90-k.w., 600-volt generator, belt connected to a 100-h.p. Armington & Sims high speed engine. Eventually this same plant was transferred in 1893 to North Sydney and successfully reinstalled under the personal superintendence of the engineer to the railway and his assistant, Mr. G. F. Clements, since deceased.

From the care and attention given by those officers, together with the active co-operation of the Commissioners, the system of electric traction, contrary to their previous experience proved itself to be a most pronounced success. The first line was laid along the Military Road, about two miles and 26 chains long and in March, 1897, it was extended to Mossman's Bay, making a total length of 3 miles, and 62 chains. A further extension is now nearly completed toward Willoughby in a different direction and replacing a portion of the Cable Road—this line having a total length of 3 miles and 20 chains. At the same time a further addition to the lines, driven by electric traction, was undertaken, and the present Rose Bay line, now under erection, having a total length of 1 mile and 25 chains, will shortly be inaugurated.

The Commissioners, from their previous experience, and after most careful consideration, next gave their support and used their influence for carrying the George Street electric line into effect, and, under the guidance of their electrical engineer, formulated a scheme for the final conversion of the present existing steam tramways, as generally explained in the article in question. We electrical men recognize Mr. Elwell's splendid efforts in this direction, and, I think, I am venting the opinions of the majority when I say that it was an injustice not to couple with the article the name of one who has taken all the responsibility in the past, and upon whom it rests in the future.

Another important work now nearing completion, under the direction of the same officer, is the electrical portion of the system of sewage pumping, which is being successfully engineered by him. The first installment of this plant consists of two 25 h.p. motors driven by current taken from the Commissioners' trolley mains, and driving by means of spur wheels and pinions, two double acting twin air compressors which are fitted with automatic controlling apparatus. This apparatus supplies the compressed air necessary to work air rejectors, ejecting the sewage matter from the lower levels to the higher level main sewer. This system is to be widely extended in the future, further particulars being in course of preparation in the various departments concerned at the present moment. Veritas.

The experiment of state ownership of railroads has been tried longer in France than in Brazil, and under more favorable conditions. The model road there runs through well-populated districts with large cities as terminals, but the results in France are discouraging. Eighteen years ago a railroad system was constructed, which was to furnish cheap rates for passengers, cheap freight for shippers, and abundant profits for the state. It has done none of these things. At first the advocates of the enterprise insisted that only time was required to prove the wisdom of the project. Eighteen years have passed and the results may be briefly summarized. Theoretic methods have been abandoned, and the railroad is now managed substantially as are those in the hands of private capitalists, except that its tariff of rates is a little higher, and its cost of operation is considerably larger. The last report shows that the net return on the whole capital is 1.35 per cent. The Government has every year a considerable deficiency to settle, and the people who use the line pay somewhat more than they would have done if the enterprise had been left to private capital.—From report of committee on "Municipal Ownership of Street Railways," Niagara Falls Convention, 1897.

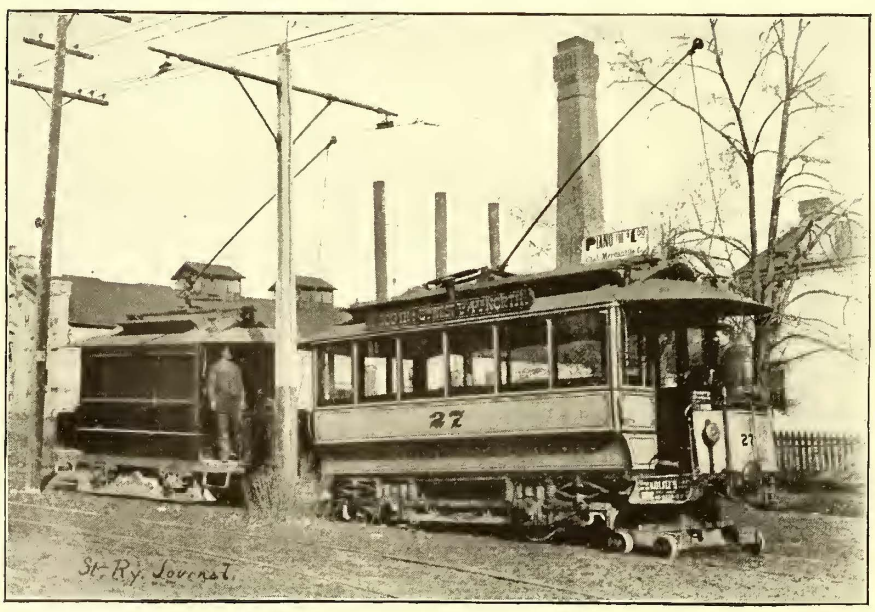
A bill has been introduced at Albany which if passed will make it illegal for the elevated railroads of Greater New York to let any part of their buildings or cars for advertising purposes.

Notes on Current Practice

SALT LAKE CITY.

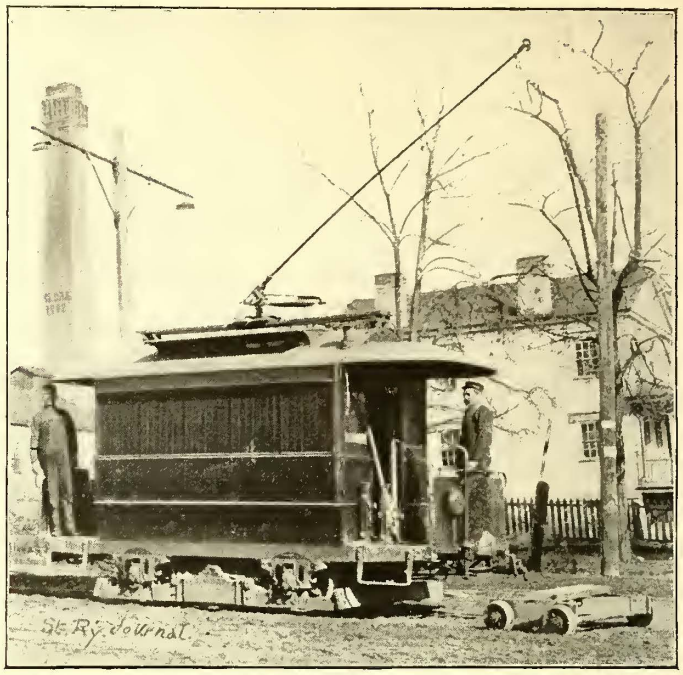
The current used on the lines of the Salt Lake City Railroad Company is supplied by the Utah Power Company, which generates its power at a waterfall some 13 miles distant from the city. The railroad company has hence abandoned its old steam plant. In the old station rope transmission was used, and the managers of the company state that they considered this method of driving better than belts. The ropes did not slip, and in case of a break they could be easily thrown off and put to one side without delay. The company has often run its line shaft with fifteen or sixteen ropes instead of the full number of eighteen for which the pulleys were designed. The drive was not one with a continuous rope, as each loop was separate.

In track construction, the experience of the company is very interesting. The road was built early in the history of electric railroading, and the bulk of its track was laid in 1889 and 1890. At that time it was thought that a 30-lb. or 35-lb. steel rail would be heavy enough for the service. Time,however, has shown the incorrectness of this position, and the superintendent of the company, W. P. Read, now states that in his opinion anything less than a 72-lb. rail with 36-in. angle bars is inadvisable. The company has three miles of this kind of track, which was laid in 1893, and has not needed one dollar's worth of repairing since. The Shanghai rail, made by the Illinois Steel Works, is used. The company also tried the experiment of employing boys as conductors. It was found they were like men in many respects, some of them were good and some of them bad, but as a general rule they have not been found satisfactory, as they do not seem to feel the responsibility of the position in which they are placed. The company has now changed its rule in relation to them, and will henceforth employ none but men with families.



EMERGENCY CAR AND JURY TRUCK—SALT LAKE CITY

During the past year the company has adopted a wrecking car, in which is kept all necessary tools for bringing disabled cars to the barn, replacing derailed cars on the track, and picking up cars that have been disabled by reason of broken axles. It formerly took from three to four hours to replace these cars with new wheels when on the line. The company is now able to move a car from the track in 20 minutes after the wrecking car arrives. The car carries a small jury truck, made of four cast wheels, with a wooden frame and a pivot bolster, which is placed under the disabled end of the car, and allows



EMERGENCY CAR—SALT LAKE CITY

the latter to be brought back to the car-house. A view of one of these cars with this jury truck is shown in the accompanying illustration. Certain other improvements made by the company and described in a letter from W. H. Patterson, master mechanic of the line, appear in another column in this issue.

CHARLESTON, S. C.

Previous to the electrical equipment of the Charleston system, which occurred last summer, there were in that city two horse road companies, each operating about 14 miles of track. The old City Railway, having by far the best territory, was enabled to pay good dividends, and never missed paying from 6 per cent to 8 per cent on its capital stock of $100,000, and interest on its bond issue of like amount,besides setting aside a surplus which amounted to about $20,000 at the time its franchises and equipments were purchased by the present operating company, the Charleston City Railway Company. The old Enterprise Railroad Company, the other company in that city, not having as desirable territory, and being obliged to operate practically the same number of cars, was unable to pay any stock dividends for the last few years, but paid fixed charges on a bond issue of $50,000. Under the reorganization, franchises for additional streets were obtained, some of the old territory given up, the bond issue increased to $850,000 and stock issued to same amount. The results from operation for the past seven months have clearly demonstrated that the company will always look after its fixed charges and pay from 2 to 3 per cent on its stock, besides setting aside each year a sinking fund equal to 1 per cent of its bond issue. The

present equipment consists of forty motor cars and fifteen trailers, and the mileage, including a line to an amusement park recently built by the company, foots up nearly thirty miles.

During the past seven months, during which the electric equipment has been in operation, the traffic has shown an average increase of 39 per cent over the corresponding seven months of last year, when the system was operated by horses. Some months have shown as high an increase as 47 per cent over the old system. The traffic in Charleston is always greater in the spring months, and as the company has not as yet enjoyed the best time of the year for traffic, it is thought that at least the average per cent increase mentioned, if not a little more, will be maintained to round out the year's operation.

The colored people form a considerable percentage of the population of the city, and are good patrons of the railway company, whose experience shows that a colored man, when he has money, is a liberal spender. The company does not run special cars for this class of patrons, except in one instance, on a suburban line, where the employees are principally colored, and work in phosphate and fertilizer mills. A special car is run for white employees at certain hours in the morning and evening, and the company gives the colored employees exactly the same accommodation, and caters to their patronage in every way possible.

Thus far the company has operated on the basis of 56 per cent of its gross receipts, which average will undoubtedly be maintained for the remaining five months of its first year's operation. Its gross receipts will run about $175,000, on which amount, if the present percentage of operation is maintained, the system will have been operated for about $10,000 less than the old horse roads, with increased passenger receipts of 39 per cent.

SIOUX CITY, IA.

There are five independent lines of street railway in Sioux City. One, the Riverside Park Railway Company, is primarily a summer line, running only from the center of the city to a large park some four or five miles out. This line operates its own power plant. Second, the Central Traction Company, whose line has been changed from cable to electricity. This line operates four cars on one of the principal residence streets of the city. It has no power plant, and buys its power from the Sioux City Traction Company. The third line is the Sioux City & Leeds Electric Railway Company, which operates several cars between the center of the city and Leeds, a small suburb about four miles distant. This line buys power from the Riverside Company.

The fourth line is the Sioux City Rapid Transit Company (the old elevated railway), which is now operating three cars from the center of the city to Morning Side, another suburb about three miles out. This line also buys its power from the Sioux City Traction Company. The fifth line is the Sioux City Traction Company, which operates eighteen cars, and has six through or cross town lines in its system. Owing to the local conditions it is impossible to give a frequent service on this system and pay operating expenses with conductors, and this company's cars are therefore equipped with fare boxes.

This road was originally equipped with Sprague motors, but now, with the exception of sweeper equipments and five summer cars which still have the Sprague equipments, all the motors are modern ones. These include four Westinghouse No. 3 equipments, ten G. E. 800 equipments and eight Westinghouse 12 A equipments. None of the No. 3 equipments is sent on the hill lines. The G. E. 800 motors are used with B. A. controllers, and the Westinghouse 12 A are used with B-3 controllers, both combinations being wired up to convert the motors into generators on the brake points of the controllers. This is found to be a very satisfactory method for braking, as it requires little effort on the part of the motorman to keep his car under control even on the steepest grade and on the most slippery rail, for the instant that the car is braked too strongly, so that the wheels begin to skid, the driving power is lost to the motors, their output as generators is at once diminished and the wheels begin to turn again. The motors, still excited, begin once more to build as generators, and while with this method a car could not be brought to a complete standstill on a hill, it can be so controlled as to barely move. On level track a car can be brought to a full stop in a very short distance. Although the grades are as high as 12 per cent this braking through the motors has no perceptibly injurious effect upon them.

The company furnishes live steam at low pressure from its power plant for heating several warehouses in the vicinity of the station. It is also installing some new condensers of the siphon type, manufactured by the Knowles Steam Pump Works. During the past season about 3 miles of equivalent single track have been laid in pavements with concrete foundation. The item of repairs in such expensive pavements necessitated a high class construction, and the company therefore used a 60-ft. 6-in. T-rail, with steel ties and concrete beam under the rail.

AUGUSTA, GA.

This company has made a number of important changes in its equipment since the last extended description of the line appeared in the Street Railway Journal for March, 1894. Double reduction motors have been discarded for single reduction motors, and for gears the company is using exclusively solid steel axle gears forced on the axle. These have been found entirely satisfactory, and as yet none has had to be replaced. "Harveyized" steel pinions are employed in connection with the steel axle gears. These pinions run with practically no wear,and the teeth keep their proper shape, so that the motors run very much more smoothly than with the old-style soft steel pinions.

The company station is still run by water power, using water from the city canal. For governing, an electric water wheel governor, invented by W. E. Moore, the company's superintendent, is in use, and has been giving satisfactory service for more than four years. These governors have now been adapted to work mechanically, and are said to be as sensitive as an electric governor and more simple in construction. The charge of the city for water power is $5.50 per h.p. per annum.

For track construction the company uses a T-rail with ties and hard burned brick paving between the rails. This pavement, where properly laid, has been satisfactory and seems to wear very little, even under heavy traffic. In fact, it has been found that the repairs on this hard brick pavement laid on concrete are considerably less than with asphalt paving.

An experiment was made several years ago of employing boys as conductors, but this practice has been discontinued, as they were very unsatisfactory both to the company and the public generally.

SPOKANE, WASH.

The Spokane Street Railway Company is now employing G. E. 800 motors exclusively on its rolling stock.

A change has been made in the standard size of axles from $3\frac{3}{8}$ to $3\frac{3}{4}$ ins., and the company's engineers state that they believe that a further advance to 4 ins. not undesirable. The weight of the wheels has been increased from 300 lbs. to 350 lbs. The cable line has been abandoned, and the lines are now operated exclusively by electricity. The company's present receipts are averaging about 30 per cent. above 1897, which show an increase of about 30 per cent over 1896. The water power plant, so far as the street railway apparatus is concerned, remains much as it was in 1892. The only dynamos direct connected to water wheels which have been installed in the plant are upon the company's lighting and power system, and with this Replogle governors are being used. The success of these installations will dictate the same arrangement in any further increase of the plant of street railway generators of similar nature.

The company still connects the positive pole of the generators to the ground, and believes that this arrangement has certain advantages over the opposite connection. Combination cars have been adopted as standard, and the company is rebuilding several of its old rolling stock to conform to this style, which has been found for the variable climate of Spokane the most successful. For transfers the company is using a ticket manufactured by the Globe Ticket Company.

SAN FRANCISCO.

As is well known, the Market Street Railway Company has installed on some of its heavy grades an auxiliary cable system, for the use of electric cars mounting and descending the grades. In one case these grades are as high as $25\frac{1}{2}$ per cent. The system is working with entire satisfaction. The cars continue their trips on these blocks with only a few seconds' delay and at about half the regular speed, with scarcely any additional expense. Some of the other cable lines have been transformed from cable to electricity, but no further changes of the hilly cable lines to electric power is contemplated at present. For use on some of its cable roads the company is using the Lang lay of cable, and on others the ordinary lay. The choice is governed by the particular conditions existing on each of the lines.

The climate of San Francisco makes the use of combination cars particularly desirable, and the same class of cars as formerly used is still employed. The fender question has been agitated to some extent by the local authorities, and the Board of Supervisors has just approved a type of fender which the company has attached to its electric cars. It consists of a scoop attached to the truck, and so adjusted that the front end will drop to the pavement whenever the trigger in front is struck by an obstacle, or whenever the motorman steps on a foot-plate. The company does not use or favor projecting fenders, believing that they add greatly to the number of accidents, serious and fatal, as well as trivial. The style of fender being used is one designed in the company's shops.

In its power stations the company is increasing the use of condensers by the extension of salt water pipe lines. The Bryant Street electric power station is now running condensing from salt water taken in pipes from the harbor, and condensing machinery will be installed at the station at Market and Valencia Streets, as soon as the salt water pipe can be extended to that point from the Bryant Street station. The Omnibus power station, which is some distance from salt water, is run condensing by the use of surface coolers on the roof of the station.

A large variety of styles of rail are employed. It has been the company's policy to employ as much as possible old rail in preference to purchasing new. Thus quite an amount of 8-in. slot rail, formerly used on cable lines, has been employed for electric track rail, and by cast-welding the joints good results have been secured up to the present time. A large amount of old cable track rail has also been used in electric construction, and as the ball of the rail was too low to permit of its use with the standard flange of the electric car wheels, the projecting tram of the rail was sheared off. The standard track construction of the company in new work is, however, a 75-lb. girder rail on broken stone foundation.

The company's car employees are paid 22 cents an hour, and those who desire are allowed to lay off one day in the week. All employees having regular runs are required to lay off at least one day in two weeks. All men are required to give a bond for $250, and in addition a cash deposit of $25.

Great attention is given to the prevention of accidents. All claims on account of accidents are attended to by a special official, who has the title of claim attorney. Every effort is made to determine the cause of any accident that may occur, and as soon as this is learned, to make such changes that similar accidents will not occur in the future. From the growing familiarity of the men with their work and closer attention to discipline, the number and severity of accidents have been greatly reduced in past years, so that notwithstanding the increase in business the average expense for accidents has been reduced to less than one-half of the annual expense several years ago. The traffic of the company shows a satisfactory increase from year to year.

Systematic Car Cleaning

Now that boards of health, representing both State and municipal authorities, are giving special attention to the cleanliness of steam and street railway cars, to prevent the spreading of disease germs through a community, and for sanitary reasons in general, it is important that street railway managers give the matter special attention in order that they may be prepared to deal intelligently with these officials, and provide such means as will enable them to meet the requirements as fully and as inexpensively as possible. A manager may not believe that there is much danger from the spreading of disease germs, as alleged on public conveyances, still he has to meet the requirements for public safety, so that as a matter of cleanliness and taste the subject is important. Other things being equal, especially where there is close competition for traffic between different lines and systems, the one that provides the cleanest and best ventilated cars will secure the largest patronage.

The chief demand for better sanitation of public conveyances comes from a growing taste or refinement of life incident to this progressive age, and it cannot be ignored. There is nothing so conductive to the peace of mind and content of heart of the average traveler as the knowledge that the railway officials regard his physical wants and cater to them; or, in other words, that they cater to the public taste. In the matter of scientific and systematic car-cleaning, some of the principal steam roads of the country have of late been giving special attention to this subject and their practice—which in some respects is a copy of the practice of the United States Marine Hospital service in the cleaning and disinfecting of emigrant ships—can well serve as a basis for street railway practice. In some cases a specially trained force is employed at terminal points on many large steam roads, whose duty it is

to thoroughly clean and disinfect the interior of the coaches, especially those employed in suburban service.

Frequently compressed air is employed to remove the dust from the cushions, carpets and interior trimmings, and is generally regarded as the cheapest and most satisfactory means for cleaning a car. The seats and backs, whether of plush or rattan, are removed from the car when the dust is blown out, from both the top and the bottom sides of the seats. Stationary backs are cleaned by beating and by the air blast, and the air is also employed for blowing the dust out from the corners and from behind the heater pipes. To prevent the dust from settling back in the car, the doors and windows are all opened, so that the greater part of the dust is carried away by the strong current generated by the blast. Where compressed air has been used in cleaning seats and backs by street car companies, it has not proved as satisfactory as it seems to be in steam practice. When a blast is employed it seems to drive the dust into the plush, and when a suction device is employed it is said to consume an enormous amount of air, making the cost considerable. In any case, it is found better to remove both seats and backs from the car, and clean them either by hand or with a mechanical beater.

After the dusting process, the woodwork is carefully washed with a solution of Modoc pulverized soap. The use of strong soaps, pumice stone or ammonia is not recommended, because these injure the paint and varnish. The floors are swept and mopped every day, and occasionally are mopped with a solution of carbolic acid.

The disinfection on steam roads is accomplished by the use of formaldehyde gas, which is introduced to the interior of the car under a pressure of 451 lbs. by means of a rubber pipe inserted through the key-hole of the outside door. Previous to introducing the gas, all doors and windows are closed tightly, and all closets and berths (if it be a sleeping car) are opened, which gives the gas the opportunity of permeating all parts of the car. The time alloted for disinfecting each car is usually from 4½ to 5 hours, after which they are opened and thoroughly ventilated. It is said that the odor of the gas quickly disappears, and that the gas does not injure the finest finish of any upholstered or polished car. The wood and metal work of the interior is then wiped off with a weak solution of Modoc pulverized soap—1 lb. of soap to 6 gals. of water. In some cases dustless floor dressing is applied every thirty days. Dustless floor dressing is a chemical preparation, practically odorless, but containing antiseptic properties, and it is claimed for it that it prevents dust from rising during the process of sweeping. It is applied with an ordinary cotton-string mop, and dries immediately.

After the cleaning and disinfecting the car is then sprayed with formaldehyde, with an ordinary rose sprinkler, or, better, with an air sprayer, which drives it into every corner and crevice. For spraying, 1 lb. of 40 per cent formaldehyde is first dissolved in 5 gals. of water, which takes a 1 per cent solution. This quantity is sufficient for twelve cars, and costs about 5 cents per gallon. Formaldehyde leaves no objectionable odor, and is not injurious to the employees, although it irritates the eyes and air passages to some extent, but this is readily thrown off. It does not affect insect or animal life, except when used in large quantities and after long exposure, but the germs or infectious matter which comes of disease are destroyed, and all forms of bacilli are very susceptible to its action.

The following will be found a good formula for formaldehyde gas: 8 ounces of calcium chloride; 1 pint water; 2½ pints formaldehyde. Dissolve the chloride in water, filter and mix with the formaldehyde. The above quantity is required to fill an empty generator to its capacity. One and three-eighths pints should be in the generator at all times when the generator is in use, in order to insure safety. A regular charge, the quantity of which can be entirely used without refilling, amounts to 2½ pints of the solution. The formaldehyde gas is made by boiling the above formula in a high C formaldehyde generator No. 1, with Primus No. 1 apparatus. To obtain the necessary amount of vapor to fumigate a car, the liquid is boiled about twenty minutes to obtain a pressure of 45 lbs. when it is applied to the car.

Below are given some special features in the cleaning and disinfecting of cars practised on some of the leading steam railroads of this country:

ILLINOIS CENTRAL RAILROAD.

W. Renshaw, superintendent of machinery, writes:

"The interiors of our cars are first cleaned by giving them a careful washing from ceiling to floor with a good linseed soap and water, if the car is not to be revarnished. If the car is to be revarnished we use pulverized pumice in connection with the soap and water. The pumice cuts the dirt more rapidly, as well as making a smooth surface of the old varnish. Rattan seats we scrub with soap and water, and if badly worn give them a coat of varnish. Plush cushions and backs are first scrubbed with a solution of ammonia water and afterward dyed. Cushions and backs should first be thoroughly dusted, either by beating or compressed air, the latter being the best and most economical. Before creating any dust in a car the doors and windows should be opened, thereby causing a draught, which will remove most of the dust."

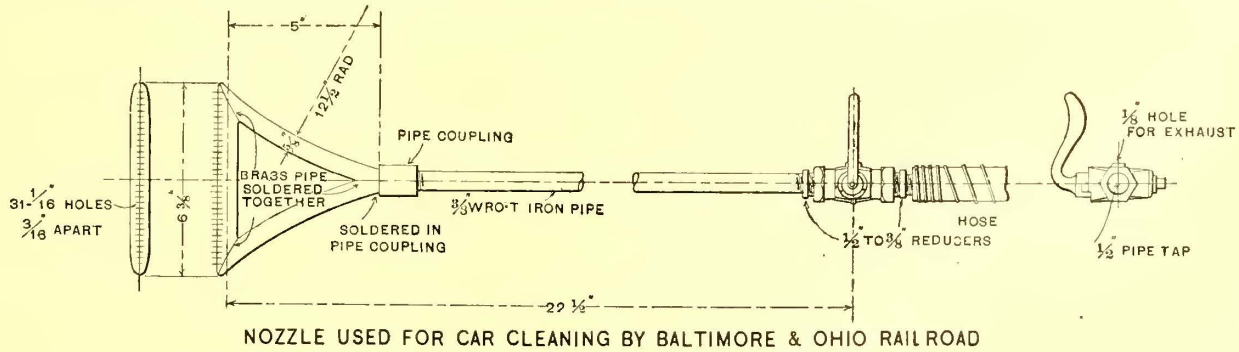
BALTIMORE & OHIO RAILROAD.

J. N. Kalbaugh, superintendent of motive power, writes:

"The inside woodwork of the car is first dusted with a dust brush and washed down with a neutral soap and water whenever necessary. For this purpose white castile soap is preferable, but any good soap containing a minimum amount of alkali will answer.

"The cushions, window shades and parts of car difficult of access are cleaned with compressed air, the dust being blown out, a flattened nozzle being used for this purpose. The form of nozzle used is shown herewith. The floors are mopped and sprinkled with disinfectant.

"The outsides are wiped with dry waste to remove dust, and whenever there is an accumulation of smoke and dirt on the surface they are wiped down with Modoc soap. The Modoc being



NOZZLE USED FOR CAR CLEANING BY BALTIMORE & OHIO RAILROAD

of an oily nature, cannot be used in rainy weather unless the equipment is under cover. The window glass is cleaned with finely pulverized pumice stone or Tripoli and water.

"I can see no reason why this method of cleaning would not be acceptable for cleaning street cars."

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

J. N. Barr, superintendent of motive power, states:

"This company has found that the best method of cleaning plush seats is to remove them from the cars, place them on a rack which rests on 'horses,' and use air for cleaning. A flat nozzle from 2 to 3 ins. wide with a pressure of about 70 lbs. of air is considered the best. This, of course, can only be done during the summer months with us, as the cars are equipped with storm sash, as it would be too inconvenient to carry the cushions out of the end doors in the winter, whereas during the summer the windows are opened and one man passes the cushions out to another, who places them on the rack, and the third man uses the blower. The dust removed from the seat back in the car escapes by means of open doors and windows. Of course, some of it will lodge on the edges of the woodwork, but this cannot be avoided.

"During the winter time, when cars have storm sashes on, the cushions and backs are not treated as often, there not being the same necessity for it as during the summer. When, however, it is necessary, they are cleaned inside of the car, leaving the two end doors open, and most of the dust escapes in this way."

CHICAGO, BURLINGTON & QUINCY RAILROAD.

The cleaning of passenger equipment is a matter that has received a great deal of attention by this road, being considered of so much importance that a few years ago a committee was appointed from the company's mechanical department to look into the subject. The following is the routine followed each day in cleaning the passenger equipment:

Open all windows and doors.
Remove seats.
Clean cushions and seat backs.
Care for stoves and take out ashes.
Fill fuel boxes.
Jar dust down from sash and dust off.
Sweep and mop the floor.
Clean saloon and wash stand.
Clean and fill water tank.
Lamps trimmed, filled and cleaned.
Close windows and wash car on the outside.
Washers to be followed by window wipers and truck wipers.
Sweep platforms and wipe hand railings.
Inside to be dusted and woodwork wiped.

It will be seen that each day the seats, whether they are of rattan or of plush, are removed from the car and the dust is thoroughly blown out of not only the top, but the bottom side of the seat by compressed air. The backs, which are a fixture of the seat frame, are thoroughly cleaned by beating and with compressed air, the air being used also to blow the dirt out from corners and from behind the heater pipes. The floors of all cars are swept and mopped once a day, and in addition to this disinfectants are used for sprinkling the smoking cars.

The frequency of washing the inside of cars and the rattan covering to the seats and backs of seats depends entirely on the service of the company, but the company aims to wash not only the seats, but the whole inside of the car, at least once in thirty days; cars in regular suburban service treated in this way keep looking bright and clean.

DELAWARE, LACKAWANNA & WESTERN RAILROAD.

Robert McKenna, master car builder, states:

"When we clean the seats and backs in our cars we take them out of the cars and beat them until the dust is out of them, and when the plush becomes faded we dye it. We do not use rattan seats and backs in our cars except in our drawing-room and sleepers, and they are rattan chairs which we paint."

BOSTON & MAINE RAILROAD.

Chas. E. Copp, general foreman painter, writes:

"While steam car cleaning differs from electric car cleaning on account of the smoke, etc., some particulars of our practice may be of interest.

"For the interior cleaning in the shops of our passenger equipment that is in good enough order to go into service again without varnish, we use a mild soap solution applied with a brush by one man working up the dirt. Another man with sponge and water follows the first, washing off the parts and wiping them dry. In the case of an interior that is to be varnished, the only difference is that the work is scrubbed or rubbed with pumice stone (powdered or ground pumice stone). For the interior renovation of woodwork of a car in service I should recommend the use of Brooks' car renovator, which is a kind of an oily substance, of a sweet smelling odor, that is applied with cotton waste or rags, and wiped dry with the same. This material can also be used with good results on a car in the shop that is in good enough condition inside to go without varnishing.

"To clean rattan, such as is used in steam and street cars, first remove all dust by blowing it out with compressed air with nozzle and hose connected with the compressed air plant in use for testing air-brakes, which is in use in all steam car shops that are up to date. Then scrub with a good stiff brush, using a solution of 'Soapine' or 'Savogran' and a little ammonia. Apply hot. If the dirt is not removed easily add fine pumice stone and scrub the work and rinse off with clean water and let dry. If desired, a light coat of white shellac or varnish will improve it. If the rattan has become dark and spotted by long use, after washing, paint with a rattan-colored paint and then varnish. If the work is detached and out of car this paint may be successfully applied by the compressed air spray process with a pneumatic painting machine.

"To clean carpeting of any kind, such as would be used in all steam and street cars, the process is about the same as in cleaning rattan. First remove the dust by compressed air, then apply the solution of Soapine and water, which should be *hot* and kept hot all the time, with a flat stiff brush, with a liberal supply of 'elbow grease,' so-called. The solution is a good thing and goes a good way toward the cleaning, but 'elbow grease' does the larger half of the work in the hand of one who tries to do good work.

"In cleaning plush, such as used in steam and street cars, if the plush is not very much soiled, but looks dingy, all that is needed is a light wash with a weak solution of Soapine and water(after the dust has been removed by the compressed air) applied hot with the brush and sponged dry. If the plush is very much soiled and faded, a die must be used to restore the color. This should be added to the solution of Soapine and water (the strength of dye added depends upon the condition and requirements of the plush). The work is then done with one application, applied hot with the brush and sponged dry. The dyeing mixture is prepared beforehand, and a supply should be kept on hand to be always ready. It is made of wool mordant, Glaubers salts and aniline dye, of whatever color of dye is required; it makes no difference what shade is used, but 'fast crimson' and the combination colors that make 'old gold' are the most common colors now in use in cars. This mixture should be boiled for about one-half hour, then set away to settle, then turn off. In doing this none of the sediment that will settle in the bottom should be allowed to go with it. Cover the whole up and set away to be ready when needed.

"Other kinds of soap than Soapine can be used, but Soapine is just as good, and has all of the necessary materials in its make-up, and is cheap. After twenty-five years' experience I have come to the conclusion that the simplest and the cheapest method of cleaning plush used in railroad car service is the best one. The cost of material to wash a common passenger car with just a light wash, without color, either rattan, carpet or plush, would not exceed the price of a pound of Soapine or 'Savogran' (which we are now using in place of it) at 4 or 5 cents per pound. The cost of material to wash and color a common car of plush lining would be from 25 to 75 cents per car, as it depends altogether upon the condition of the plush to be cleaned. The above facts, relating to renovating rattan, carpet and plush, I have gleaned from J. H. Gilman, our foreman upholsterer here.

"Regarding the question, 'How do you dispose of the dust to prevent its settling in the cars?' will say that all plush, etc., is removed from the car in shop practice and cleaned afterward. But the dust in the car can be all blown out with the compressed air, the hose being taken into the car for that purpose. For cleaning the plush in the car I understand that a compressed air suction device is employed by the B. & O. R. R. in its Pittsburgh shops. It is made of tin, of a kind of tea or coffee pot design, with the compressed air attached at the back end under the handle, and a tin snout to which a hose is attached at the forward end, and is passed out of the window of the car. In operation the operator turns on his air and passes the instrument over the plush as though he was ironing it with a tailor's goose, with the speedy result that the dust is sucked up in the operation and speedily passes out of the window."

The Marlboro Street Railway Company, of Marlboro, Mass., expects to install two 250 h.p. engines, with equipment to correspond, in its station the coming summer.

Relative Steam Producing Value of Three Qualities of Coal

A. Baldasano, M. E., and W. J. Beach, M. E., lately made a test at the Duane Street station of the Edison Electric Illuminating Company, New York, to determine the effect of relative steam producing values of two qualities of coal and the efficiency of a boiler. The boiler in which the test was made was of the Babcock & Wilcox deck water tube type, built in 1896, of 370 h.p.

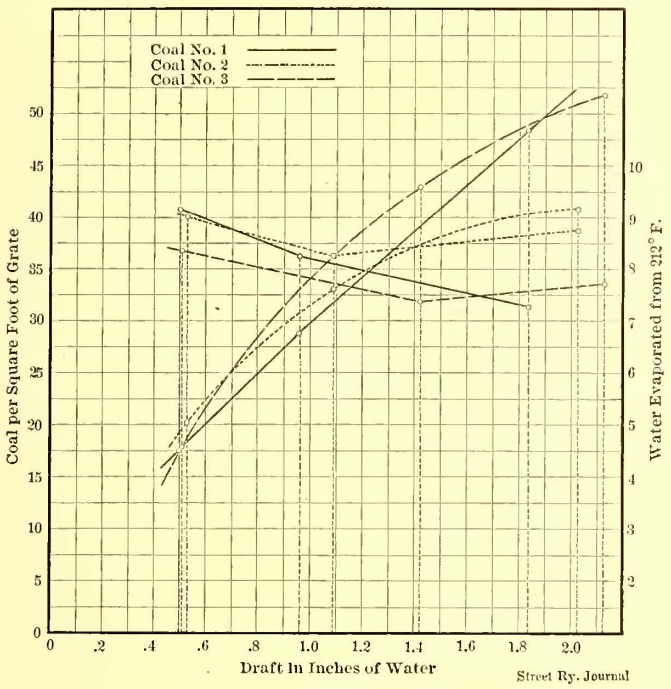


FIG 1

rated capacity, containing 196 tubes of 4-in. diameter and 18 ft. in length. The boiler was built to carry 225 lbs. pressure.

Three samples of coal were tested under three conditions of draught—natural (ashpit doors open), half forced (revolution of blower 400) and full forced (revolution of blower 610). The draught and steam pressure were as uniform as possible in each case. The accompanying table gives a digest of the test.

The results are interesting as showing the adaptability of steam boiler to an enormous overload, though under desirable efficiency, a circumstance which often occurs in central stations, where an accident may temporarily throw a higher duty upon a lower rated boiler. An illustration of this occurred recently at the Edison station at Paterson, N. J. The entire boiler plant was submerged in tons of coal, which fell with the bunkers upon the boilers. As soon as a sufficient amount of the débris could be cleared away the entire plant was operated by one boiler running at 113 per cent overload, which was even greater, except in one case, than that obtained in the above tests. A temporary installation of the forced draught might at some emergency prove the salvation of a crippled station and a worried superintendent.

In Fig. 1 the abscissas give the difference in pressure between the ash-pit and the up-take, and the ordinate the pounds of coal burned per square foot of grate and the evaporation from and at 212 deg. per pound of coal. The second set of curves on Fig. 1, giving the evaporation per pound of coal for different pressures, show that the evaporation per pound of coal does not decrease as rapidly as the draught increases, and in two of the samples reaches a minimum. Fig. 2 shows the water evaporated from and at

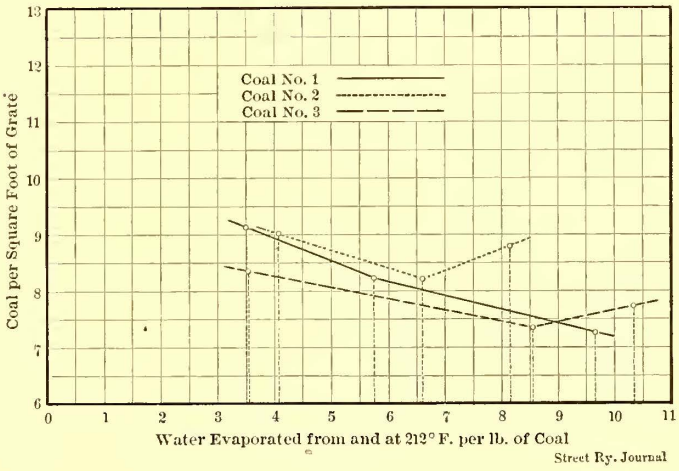


FIG. 2

212 deg. per pound of coal, referred to the coal burned per square foot of grate.

In all three tests the evaporation is greatest with the lowest rate of combustion. An increase in the rate of combustion shows a diminution in the rate of evaporation, and in the case of coal Nos. 2 and 3, a still higher rate of combustion increases the rate of evaporation. Coal No. 1 does not show any increase within the limits of the test.

The "free-burning" coal, which need not be coaxed with air to yield its heat units, is still in the lead for conditions of boiler efficiency, and it may be regarded as axiomated that the more work put in a coal to burn the less of real value obtained from it.

TABLE OF DATA AND RESULTS.

	Coal No. 1.			Coal No. 2.			Coal No. 3.		
	Test No. 1.	Test No. 2.	Test No. 3.	Test No. 4.	Test No. 5.	Test No. 6.	Test No. 7.	Test No. 8.	Test No. 9.
1. Fuel in use.	Lackawanna coal (stored 4 mos.)			Lackawanna coal (from mines.)					
2. Duration of test, in hours	6	4	4	8	4	4	8	3½	3½
3. Condition of draught	Natural	Forced	Forced	Natural	Forced	Forced	Natural	Forced	Forced
4. Draught, in ins. of water. uptake.	.50	.53	.43	.54	.56	.70	.51	.66	.76
4. Draught, in ins. of water. ash pit.	0	.43	1.41	0	.53	1.33	0	.82	1.37
5. Temperature of feed water.	83°	86°	84°	87°	86°	84°	85°	88°.5	89°
6. Total fuel used, in pounds.	7,143	7,800	13,200	11,100	9,000	11,100	9,661	10,200	12,300
7. Ash, in pounds	1,379	1,505	2,547	1,667	1,287	1,587	1,578	1,797	2,167
8. Combustible, in pounds	5,764	6,295	10,653	9,433	7,713	9 513	8,083	8,403	10,133
9. Coal used per hour, pounds	1,190	1,950	3,300	1,388	2,250	2,775	1,208	2,914	3,514
10. Water evaporated by boiler, pounds	55,012	54,275	77,658	84,548	62,466	83,880	68,286	63,750	80,738
11. Equivalent evaporation from and at 212°	65,244	64,287	92,136	100,048	73,983	99,501	80,939	75,325	95,389
12. Water evaporated per hour.	9,069	13,569	19,415	10,568	15,616	20,970	8,536	18,214	23,068
13. Water evaporated per pound of combustible.	9.54	8.62	7 29	8.96	8.09	8.81	8.45	7.59	7.96
14. Equivalent evaporation per pound of combustible from and at 212°	11.32	10.21	8.65	10.60	9.59	10.46	10.01	8.97	9.41
15. Coal burned per square foot of grate surface per hour.	17.5	28.7	48.5	20.41	33.09	40.81	17.76	42.85	51.68
16. Water evaporated from and at 212° per sq. ft. of grate surface per hour	159.9	236.4	338.7	183.9	271.9	365.8	148.8	316.5	400 8
17. Commercial h.p. of boiler	315	466	667	362	536	721	293	624	790
18. Rated h.p. of boiler.	370	370	370	370	370	370	370	370	370
19. Per cent. above or below rated h.p.	15% below	26% above	85% above	2% below	45% above	95% above	21% below	69% above	114% above
20. Efficiency of boiler	76%	68%	58%	71%	64%	70%	67%	60%	63%
Per cent. ash	19.3	19.3	19.2	15.0	14.3	14.3	16.3	17.6	17.6

STREET RAILWAY JOURNAL

APRIL, 1898.

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

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

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

TERMS OF SUBSCRIPTION.

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

EDITORIAL NOTICE.

Papers and correspondence on all subjects of practical interest to our readers are cordially invited. Our columns are always open for the discussion of problems of operation, construction, engineering, finance and invention.

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.

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

It is interesting to note that snow plows and sweepers operated by storage batteries have been introduced on the lines of what was formerly the Englewood & Chicago Electric Street Railway Company, now known as the Chicago Electric Traction Company. The snow plows and sweepers are similar to those usually employed on roads operated by the over-head system, except, of course, that storage batteries supply the propelling power. The Chicago Electric Traction Company has also recently added to its equipment a special car which is chartered for parties and also for funerals.

The new construction in Dublin, Ireland, has been carried forward rapidly during the past six months, and the system there is now practically completed. As will be seen from the description which appears elsewhere in these columns, the work has been carried forward upon a high plane, and the new station of the company will rank in completeness among the best stations of the same capacity in this country. In certain features the system will have a particular interest, especially for our foreign readers, on account of the provisions made for keeping the voltage on the return circuit within the limits required by the local Board of Trade. The copper installation is exceptionally heavy, being over one ton per car operated, while, in addition, boosters are used on both the outgoing and return circuits.

If car wheels be pressed on their axles too loosely they will work off under the severe conditions of electric traction; on the other hand if too much power be used in forcing them on their seats there is danger that the elastic limits of either the wheel, hub or axle will be exceeded, and, consequently, that it will break under any abnormal blow or strain. The proper proportioning of the strains, therefore, that the maximum grip shall be secured within the elastic limits of the materials employed is an important one, and is discussed elsewhere in a communication from Mr. Leverich, of the engineering department of the Brooklyn Bridge. The treatment is a theoretical one, and shows that under the conditions assumed, the ratio of the diameter of the bore of the wheel hub to that of the axle should be as 599 to 600 to secure the best results. It seems as if this principle should have wide application in all railway work, and should settle the question as to what pressure to use in pressing on wheels.

Street railway employees sometimes think that they must rush to their State legislatures to secure a remedy for all of their supposed ills, when in nine cases out of ten, if they would present their case in a proper manner to the officials of their roads their requests would be readily granted. A case to the point occurred not long ago in one of the State legislatures, in which a vestibule law had been introduced. It became necessary for the president of a street railway company to visit the capital and protest against some of the provisions of certain other street railway laws, when he was able to show to the railroad committee that his company was not opposed to the introduction of vestibules, and that had the employees made any request to the company to have vestibules added to the cars, he would have gladly complied with their request. Railway managers are constantly devoting more attention to the welfare of their employees, and now generally recognize the proposition that every step taken or encouraged by them to promote the welfare and comfort of their employees attracts a better and higher class of men to their service.

It is gratifying, indeed, to the observer, no matter from what special standpoint he views the situation, to be able to perceive that street railway accounting, which is really the vital element of all forms of business, is making steady progress, not only in methods and adaptations, but also in the manner of stating results. Investors and the managers of street railway enterprises as well have of late come to look upon the fine skill of the accountant with the same

respect as that which is extended to the ability of the engineer who plans construction work, and that of the expert electrician who secures a maximum of efficiency and economy. There is the same kind of distinction between the well-arranged, well-organized and thoroughly administered accounting system of a representative street railway company of the period and the manner in which the bookkeeping of street car lines was formerly performed, as there is between the model power house and the ill-smelling, out-of-repair stable and its complement of broken-down horses, so commonly offending the sensibilities a decade or a decade and a half ago. The modern street railway is something that is very new, comparatively. The usurpation of the old horse car lines by electric traction is a chapter in the history of mechanical development and progress that is without a parallel. Much of the accounting which has made this transformation possible, with safety to investors, is as new as certain parts of the electrical equipment which has made modern street cars useful to the public. It is not new in principle, for in accounting as well as in mechanics principles are eternal, but it is new in application and in specific methods which it has been necessary to work in order to meet stated requirements. That progress in street railway accounting which is most in evidence at the present time is, of course, that which is revealed by the work of the Street Railway Accountants' Association. So far, however, this organization has limited its effort to classification of the accounts of costs of operations and expenses in general. Its work, however, will scarcely stop at this point—no more than is the general progress that is being made likely to stop with any one division of the work. Nor is the whole development in street railway accounting bound up in this organization, although it may be regarded as the official exponent of that progress. In every auditor's department, from one end of the land to the other, there is some one at work who is constantly weighing the different problems that arise in street railway administration, who is studiously inquiring into conditions that prevail, and who is working with painstaking detail upon plans and methods for reaching required results. Uniformity in treatment of expenses and operating costs in general would seem to be practically secured at the present time. The approaching convention, we may safely assume, will approve of the final report of the committee in this regard and relieve it from further responsibility. But as surely as this is done, which would be simply ending the first chapter of a considerable volume, various new fields to be explored and the methods of work therein properly standardized will be brought to the attention of the association by some of its members. The work of the organization comprises far more than that which is at present in hand, and its years of existence, judging by what it is possible for it to accomplish in the line it has espoused, should be very many indeed. Individual effort, now being put forth everywhere, will accomplish many good results, but even the best of these can only be given the appropriate seal of approval and recommended for general adoption through the offices of such an association as that of the street railway accountants. Progress in street railway accounting is a patent fact, and the Street Railway Accountants' Association of America is the natural gage and exponent of that progress.

The Street Railway Journal recently asked several prominent railway managers who have had a long experience in the business, whether, in their opinions, the duties of a general manager of a large system are any less onerous than they were several years ago, and whether they noticed any change in the relations between street railway companies on the one hand and the municipal authorities and the public in general on the other. In regard to the first, it would appear, on first thought, as if the growing tendency toward standardizing electric railway apparatus and systematizing the work into different departments would lighten the burdens which formerly rested on general managers. It seems to be the general opinion, however, of those with whom we have come in contact, that the aggregate number of trying conditions which surround the office of a general manager are as great now as formerly. The questions, of course, are different, and many which now arise can be treated with a set formula born of experience, but in a business so important as that of conducting a large city system, new questions are constantly arising, or those questions which seemed of little importance in the past now demand an attention which was then postponed, so that as a whole but little difference can be seen between the sum total of demands which are made upon the time of the general manager. Again, the business of a railway company, especially in a large city, is one of almost boundless possibilities. No sooner has one set of conditions been straightened out than a host of problems arise in different directions which suggest improvements of the system and equipment, so that a man of no matter how much energy and resources can always find plenty of opportunity for engaging his attention. While this is true, it is also true that the more a manager can relieve himself from work which others can as well perform, the more time he has to take up these new problems which are constantly on the horizon of his daily occupation. The principle of correct management, we believe, is summed up in the following statement, recently made to us by a man whose reputation as a successful railway manager and president is recognized on both sides of the Atlantic and whose opinion on street railway matters is eagerly sought. He says: "I believe that the principle of making each chief of a department responsible for the acts of his entire department, and paying him in proportion to his efficiency, is conductive to the most gratifying results that can be obtained. We pay our barn foremen, division superintendents and chief engineers upon this plan, gaging them by an efficiency which includes service, material and labor expended."

While in many respects the street railway business has thus changed, there seems to be but little difference in the attitude taken toward the railway companies by municipal authorities and the public. In spite of the improvements, longer rides and better service which have been provided during the last ten years in transportation facilities, there is still in many localities a lack of sympathy between the traveling public and municipal authorities on the one hand and the aims of the railway companies on the other, and in some cities a display of a more or less hostile attitude toward the transportation systems. Undoubtedly much of this antipathy on the part of the public has been fos-

tered by the misrepresentations of the companies' purposes by a sensational daily press, which finds a profit in maligning all large corporations, and unfortunately these efforts have been aided in some cases by a small body of self-styled "reformers," who, by their advocacy of municipal control and confiscation, have encouraged socialistic attacks on capital. The best possible way to overcome this opposition is in the better education of the general public as to the intentions and acts of the railway companies, as well as about the conditions which surround their business. We firmly believe that fair-minded citizens constitute a very large majority in every American community, and that could they realize the injustice of many of the demands on railway companies to which some of them in the past have given a tacit acquiescence, and which amount in reality to sequestration of private capital, they would be favorably disposed toward meeting the propositions of the transportation corporations in a fair and equitable spirit.

The recent report to the Massachusetts Legislature of the special committee appointed by the Governor some nine months ago to investigate the subject of the relations between street railways and municipal corporations promises to mark an epoch in street railway management in that State. The conditions there are similar in a general way to those elsewhere. On the one hand,there is no coherent system of granting franchises, but almost every one is on a different basis; on the other hand, many of the railway companies feel the need of a more fixed and definite tenure of their franchises. Notwithstanding that in most cases these are, in terms, perpetual, they are said to be, in fact, legally revocable at the discretion of the local boards. While in theory such a condition is most illogical, in Massachusetts it has worked on the whole satisfactorily, but the growing importance from an investment standpoint of the street railway properties in that State has imposed the necessity of adopting some more systematic method of dealing with the situation. The committee which was appointed to undertake a solution of this problem was representative of the intelligence and broad-mindedness for which the commonwealth is noted. Upon undertaking its labors the committee soon found that so much popular misinformation existed as to the results secured by different methods of control in other places, especially in certain European cities, that it was decided to accept nothing unless verified by examination on the spot. For this reason a careful examination was made of street railway conditions and franchises of all large cities in this country and abroad, particularly of those in which it is often claimed that low fares are charged or large returns are made by the railway companies to the municipalities, and, as a result, the members of the committee state that "if such a street railway Utopia anywhere exists, they have, in the course of their investigation, failed to find it." Most of the franchises abroad were found to be for fixed terms of years, but this arrangement, the committee considered, is open to serious objections, as it acts practically as a check on enterprise and a bar to any development involving the investment of fresh capital. On the other hand, a perpetual franchise, revocable at will, as at present, without provision for compensation to the company, exposes the latter to hardships through the caprice of the authorities, or the enticement of a higher bid from would-be competitors. The committee deems advisable, however, a restrictive power of revocation on the part of the municipalities as an inducement to good railway service. The municipal operation of street railways is carefully considered, but an attempt to carry this out in Massachusetts would be followed, the committee thinks, with grave difficulties of a practical as well as theoretical character, and does not recommend it. It approves of the ownership of the tracks by the municipality and their lease to the companies, of the regular corporation tax upon a basis of the market value of the capital stock, as at present, and also a tax equal to the dividends paid in excess of 8 per cent, provided, however, that no company shall be liable to pay such additional tax which has not from the date of its organization paid dividends equivalent in the aggregate to at least 6 per cent per year. A graded tax on gross receipts, payable to municipalities, is also recommended. It is the plan of the committee that all money paid to municipalities under these two latter provisions shall be devoted to the repair and maintenance of public highways, and that it should be in lieu of any maintenance of streets, roads or bridges by the railway company. There are other provisions in the proposed act to which it is unnecessary to refer here, but which are in line with the general policy of the committee as outlined above.

The report has not yet been acted upon by the Legislature, and the hearings upon it before the legislative committee have not yet been completed, so that it is impossible to state whether it will be adopted in its present form or will be greatly modified if adopted at all. The franchise conditions under which the different Massachusetts roads operate are so varied that it is also impossible to state,without an extended investigation of each case, whether the total taxation as proposed will be greater under the new plan than under the old. The ownership of the tracks by the municipality, we believe, presents grave objections, and may give rise to serious troubles in the future, but if the railway companies are permitted a practically perpetual franchise over these tracks,the difference between the ownership of them and the lease of them by the railway company is not considerable. In many respects, however, the report of the committee is to be highly commended. It recognizes, first, the advantage to the public of the private operation of the railway lines; and second, the necessity of removing these properties from hostile legislation, regardless of the financial ability of the companies to comply with the laws passed or the ultimate effect of such legislation, and based usually upon wrong premises and prejudice. Such immunity would do much to reassure capitalists of the safety of their investments in properties of this kind, would reduce street railway operation to a more business basis, and would of itself compensate the street railway companies for a considerable amount of extra taxation.

In the hearing of this bill, which commenced March 24, the counsel for the railway companies introduced a substitute for the bill recommended by the committee, embodying many of the provisions of the latter, but with certain modifications to better protect the transportation interests. These lay principally in the methods of revoking franchises and compensating the company therefor, and in the graded taxation clause.

New Construction in Dublin, Ireland

The electric system of the city of Dublin, Ireland, is now nearing completion, and when finished will be an installation of which any city could be proud. The equipment is modern, is being installed with great care, and it is thought that its completion will exercise a great stimulus upon the electric railway construction in the British Isles.

The Dublin United Tramways Company has now in operation two electric lines, which have already been described in the STREET RAILWAY JOURNAL. These are the Dublin Southern District line, purchased some time ago from the Dublin Southern Tramways Company, and the Clontarf line to the north. Both of these lines have been in operation for some time from their own power stations, the southern line being the older. The work upon which the company has been recently engaged has been to connect these two sections by an extensive system within the city. This work has just been completed, and the many novel features of construction will make a discussion of the system of interest on both sides of the Atlantic.

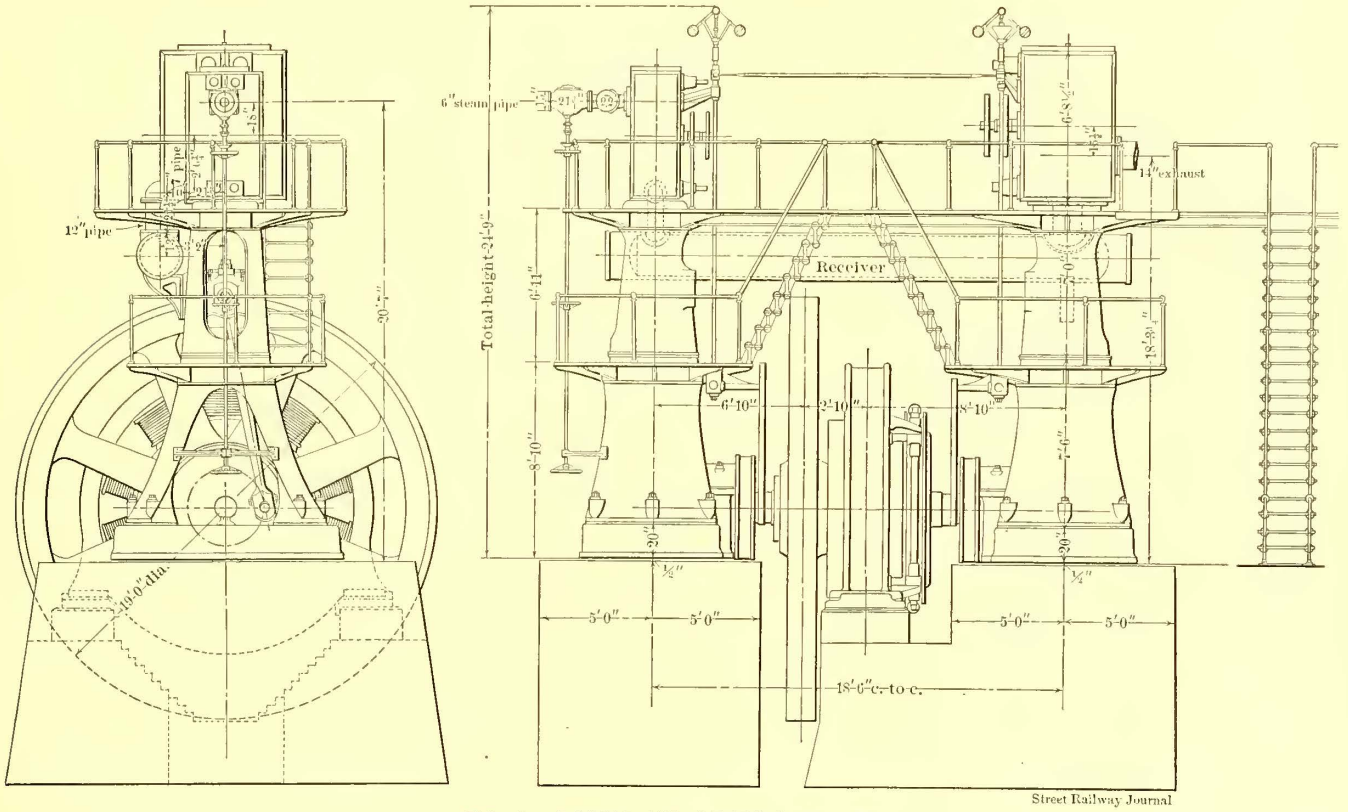


FIG. 1.—ENGINE AND GENERATOR UNIT

POWER HOUSE.

The Dublin United Tramways Company is erecting a main power station on a valuable plot of ground owned by it, some 500 ft. long x 325 ft. deep, fronting on the Grand Canal Dock on the south side of the River Liffey, and toward the east end of the city. The buildings at present being erected occupy only a portion of this ground, and it is intended to erect a spacious car building and repairing shop and car barn on the remainder.

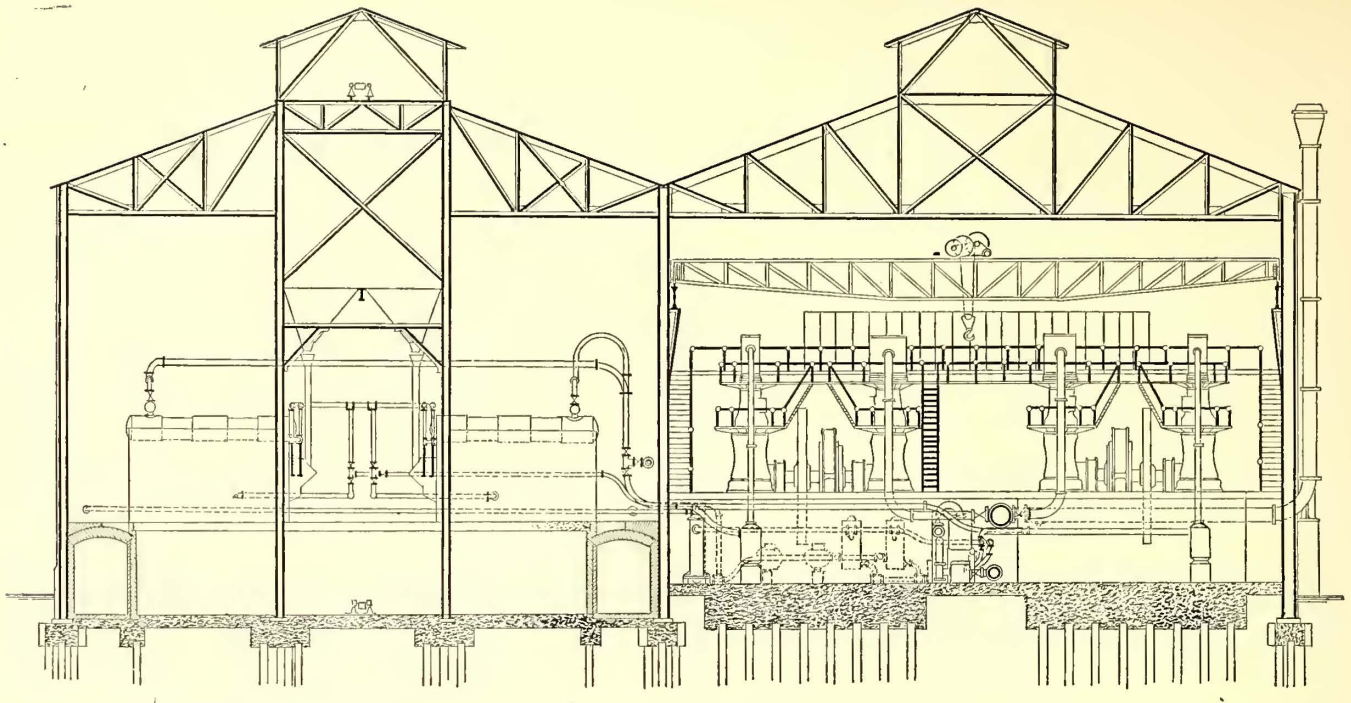
The general plan of the power house will be seen from Fig. 2. It is a steel framed brick building with concrete and steel floors, and consists of two long rooms separated by a center wall, one of which forms the engine and the other the boiler house. A portion of the engine house building is walled off and forms the offices for the chief engineer and his assistants. In this portion also are situated the fitting shop, stores, men's room, etc. A separate coal store, with a capacity for 3000 tons, is placed at the dock end of the boiler house. The whole of the constructional steel work for the power house, including the chimney shafts, was supplied by Riter & Conley.

The boiler house is 131 ft. x 76 ft., and is arranged for twenty Babcock & Wilcox boilers, placed in batteries of two, five batteries on each side of the stoking floor, which is 18 ft. 6 ins. wide. These boilers, of which six pairs are being erected, have each a heating surface of 2530 sq. ft. The tubes are 16 ft. long, and are expanded into forged and welded mild steel headers. In addition to the ordinary steam and water drums, which are 36 ins. in diameter and 21 ft. 4 ins. long, each boiler is provided with a separate steam drum, 20 ins. in diameter, connected to the back end of the steam and water drums by wrought steam neck pieces, 5 ins. in diameter. The thickness of the plates used in the construction of drums is 16-32 in. The whole of the steel used in the manufacture of these boilers was subjected to rigid tests by the government inspector before being passed. The following chemical analysis was specified.

Carbon, between	0.15 and 0.25
Phosphorous, not to exceed	0.05
Manganese, not to exceed	0.45
Silicon, not to exceed	0.03
Sulphur, not to exceed	0.05

The ultimate tensile stress of the plates is between 55,000 and 65,000 lbs. per sq. in., with an elongation of from 24 to 32 per cent in 8 ins. The hydraulic test pressure for the drums was 250 lbs. per sq. in., and that for the sections and mud drums 300 lbs. per sq. in. The working pressure is 160 lbs. per sq. in.

The main flues, which are of brick, are arranged below and at the back of the boilers, one on each side of the boiler house basement, and access is provided to them by doors in each cross alleyway between the boiler foundations. The bottom of the flues has been kept level with the floor to facilitate cleaning. The soot is removed by the



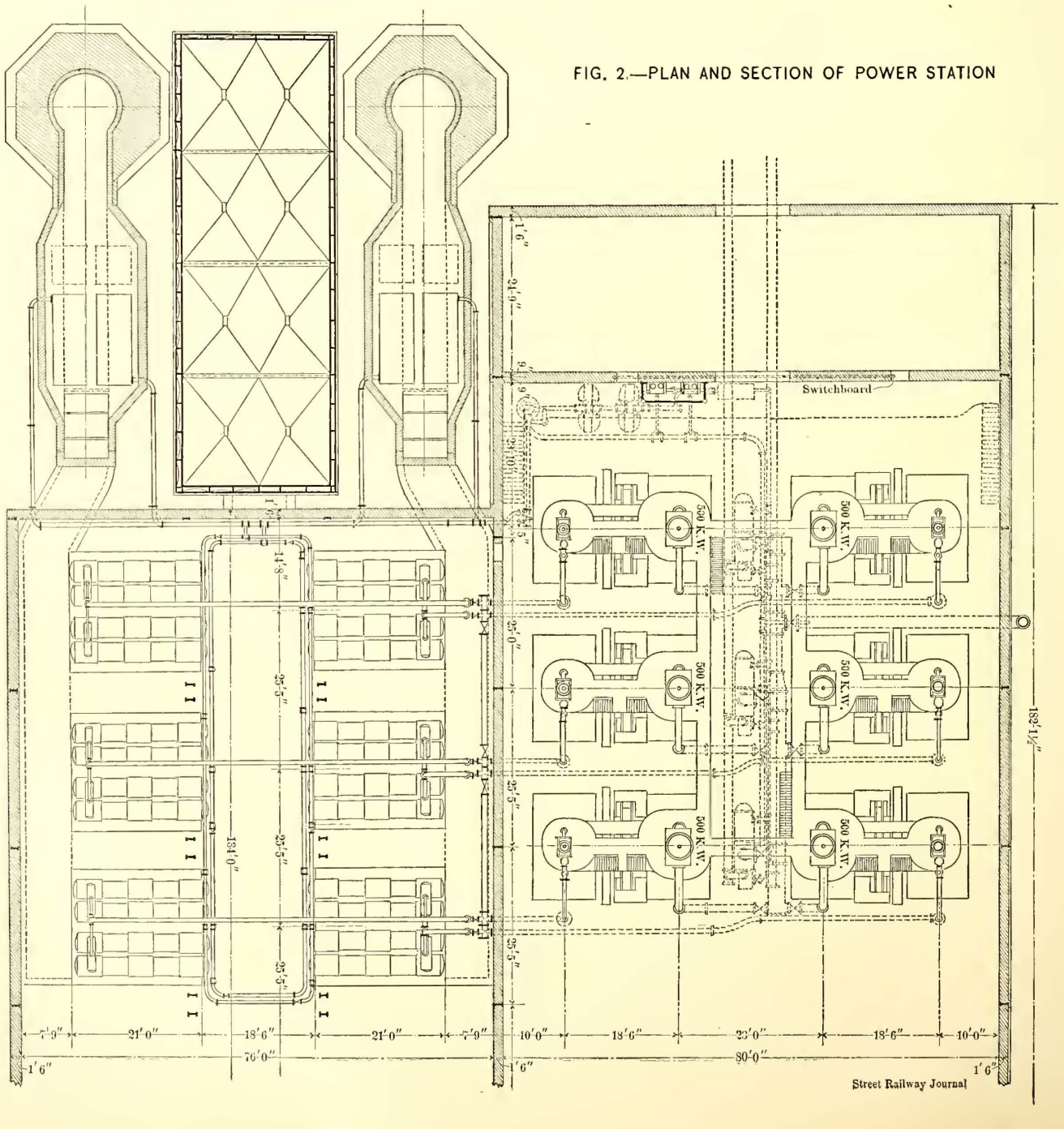


FIG. 2.—PLAN AND SECTION OF POWER STATION

conveyor to the ash bunker for barging away. Each main flue is complete in itself, a separate economizer and chimney shaft being provided for both. A cross-flue is arranged between the boilers and economizers in addition to the ordinary economizer by-pass flues, to enable each flue to work into either economizer or chimney, as may be desired. The two economizers, each composed of 384 tubes, are of the Green type.

The chimney shafts are of steel, lined with firebrick, and are 10 ft. in diameter and 200 ft. high, standing on a brickwork base 26 ft. high from flue level, making the total height of the shaft 226 ft.

The system of piping is at once very simple and convenient, as will be seen from the general lay-out of the station. Any engine can be fed from any boiler, while the length of steel pipe is kept as short as possible. The arrangement minimizes the risk of breakdown, and provides the maximum of interchangeability with the minimum of loss through condensation. The feed pipes are on the ring system. Two rings are used, one for the hot and the other for cold feed. The whole of the live steam and high pressure feed piping is heavy lap-welded steel pipe, the test pressure being 800 lbs. per sq. in. The low pressure piping is the Crane Company's "standard" pipe. The main exhaust pipe is in two sizes, the 20-in. diameter being lap-welded wrought iron, and the 30-in. diameter cast iron pipe. An atmospheric exhaust pipe is also provided, opening into the main exhaust pipe through an automatic relief valve. The whole of the pipe work and the valves and fittings for the same have been supplied by the Crane Company. Stratton separators and C. W. Hunt coal conveyors are used.

The engines are vertical cross-compound Reynolds-Corliss (Allis) condensing engines, with cylinders 20 ins. and 40 ins. x 42 ins. stroke, running at 90 r.p.m., an indicated 800 h.p. at full rated load. The cylinders are not jacketed, but are lagged and covered with planished sheet steel. The valves are arranged in the cylinder heads to reduce clearance, and are double ported. A multitubular reheater receiver is arranged between the cylinders. The pistons are of cast iron, strongly ribbed with junk rings and bull and spring packing rings.

The governor is arranged to control both the high and low pressure cylinder valve gears, which are also arranged so as to be capable of being worked by hand, and in addition there is a second or safety governor acting automatically to close a stop valve should the engine from any cause speed up to 95 r.p.m. The shaft is of selected hammered scrap iron 19 ins. in diameter, where the flywheel and armature are located, and reduced to 17 ins. in diameter in the journals, which are lined with babbitt metal and are 33 ins. long. The flywheel is of semi-steel and is built in segments. It is 19 ft. in diameter and weighs 70,000 lbs., and is so designed that it can be run up to 120 r.p.m. without receiving support from the arms, and up to 150 r.p.m. without exceeding the elastic limit of the material in any member. The condensing plant and boiler feed pumps are of the Wheeler make, well known in Europe and America, and with the feed water filters have been furnished by the Wheeler Condenser & Engineering Company. Three Admiralty type surface condensers are installed, one to each pair of main engines. The condensers are placed in the engine room basement between the engine foundations. The air and circulating pumps are arranged under the condenser and compound steam cylinders are used, piped so as to exhaust into the receivers of the main engines or into the condensers, as may be desired. In addition a Wheeler auxiliary feed water heater is provided to enable the exhaust from the whole of the auxiliary engines to be used for heating the feed. The feed water filters are of the Edmiston pattern, and are arranged on the twin system.

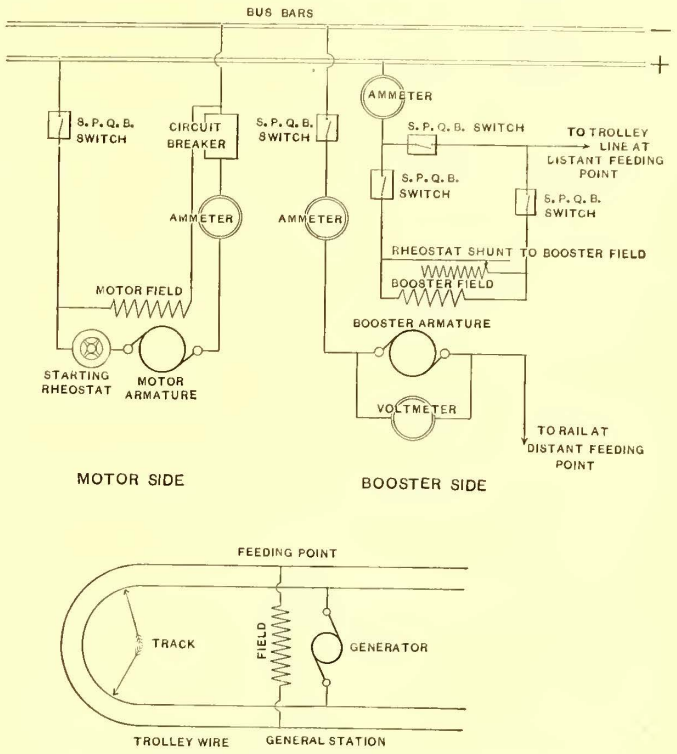


FIG. 4.—DIAGRAMS SHOWING SWITCHBOARD AND BOOSTER CONNECTIONS

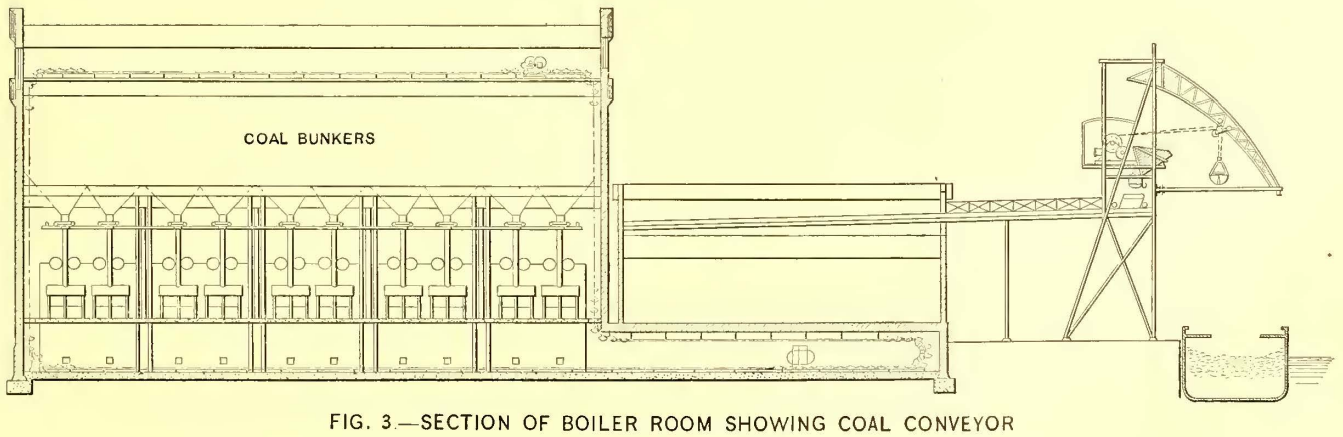


FIG. 3.—SECTION OF BOILER ROOM SHOWING COAL CONVEYOR

The generators are standard General Electric railway machines of 500 k.w. capacity. The switchboard is placed at the office end of the engine room on a gallery 14 ft. high,

and contains some interesting features. The equalizing switches are placed direct on the generator panels, and recording watt meters are connected in the circuit of each generator; no watt meter is used on the station panel, which only carries a main ammeter and two volt meters, one of which is connected permanently across the bus-bars, the other being used when putting a machine in circuit, being connected through a plug switch on each generator panel.

The engine house is 80 ft. x 153 ft., and is traversed the whole length by a 25-ton three-motor electric crane.

SYSTEM OF DISTRIBUTION.

The system is designed for the operation of 200 cars, and is shown on the accompanying map. The system in which some 240 tons of copper (over one ton per car) will be used, is divided into eighteen sections, each supplied by a separate feeder. The feeding points of the different sections are shown on the map. From the feeding point distributors are laid along the streets of each section, and connection is made to the trolley wire at intervals of approximately a quarter of a mile, the connection being made through an automatic circuit breaker.

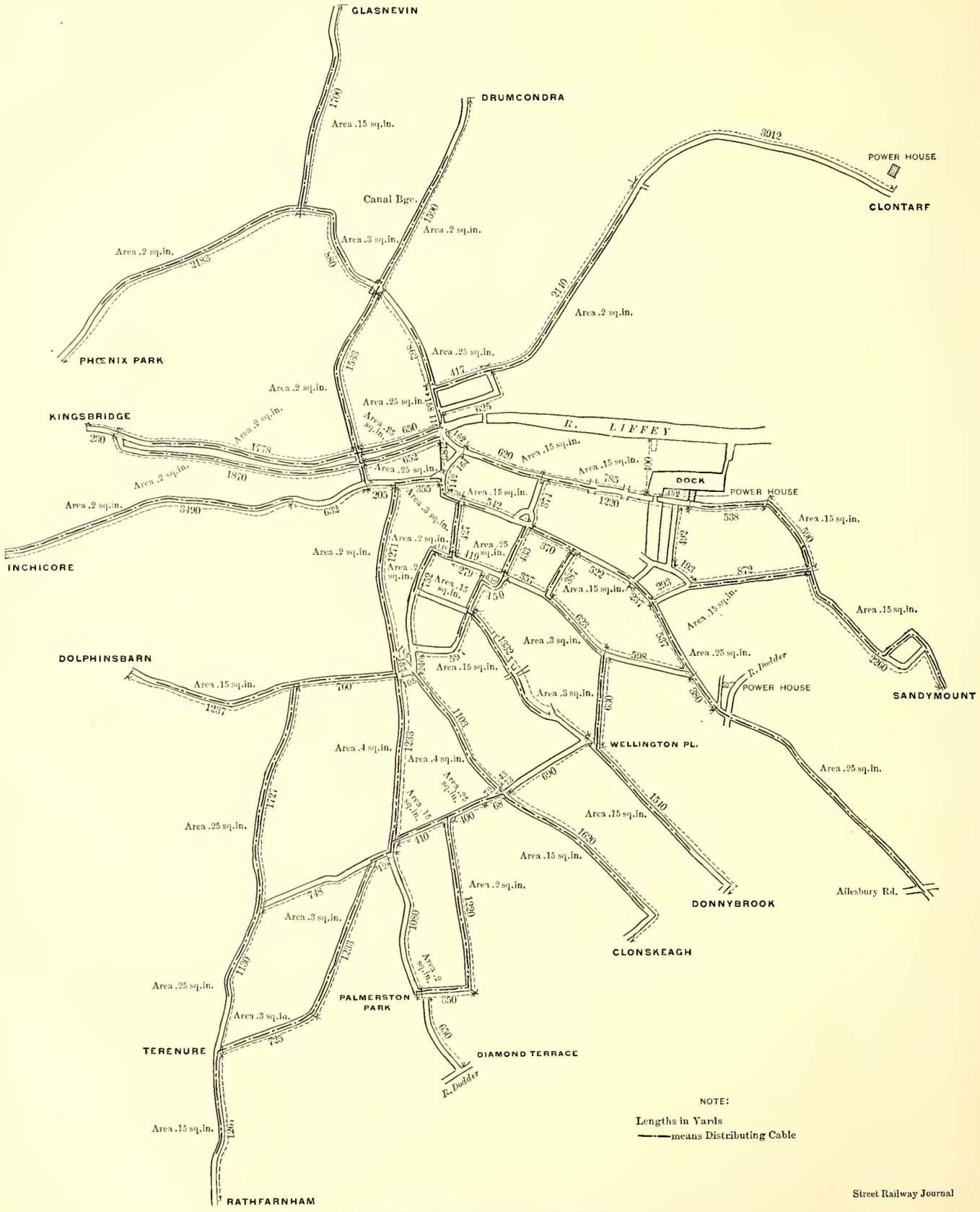


FIG. 5.—PLAN OF FEEDER SYSTEM

The trolley wire is No. 0 Roeblings, and each quarter mile is insulated, so that any section of line a quarter mile long can be made dead by opening the circuit breaker controlling it, placed in an iron box fixed to the pole nearest the center of the section.

In the subdivision of the cables, as controlled from the power house, the object has been to provide alternative routes for cars approaching or departing from the center of the city in case of emergency. For instance, any car approaching the railway terminus near Harcourt Road

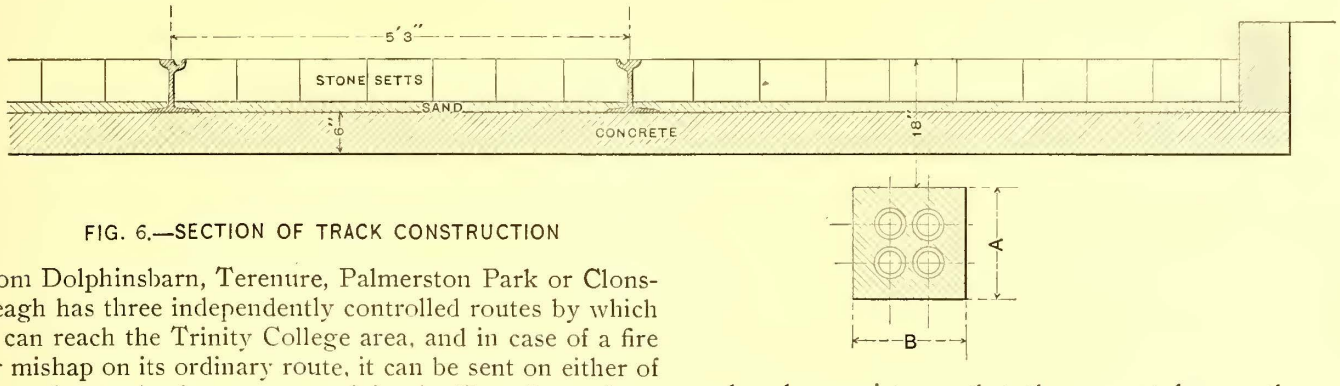


FIG. 6.—SECTION OF TRACK CONSTRUCTION

from Dolphinsbarn, Terenure, Palmerston Park or Clonskeagh has three independently controlled routes by which it can reach the Trinity College area, and in case of a fire or mishap on its ordinary route, it can be sent on either of two others. Again, any car arriving in Clare Street from the south has an alternative route from there to O'Connell Bridge. This principle is carried on throughout.

A drawn-in underground conduit system is adopted, the conduits being cement-lined, wrought-iron pipes, supplied by and laid under the direction of the National Conduit &

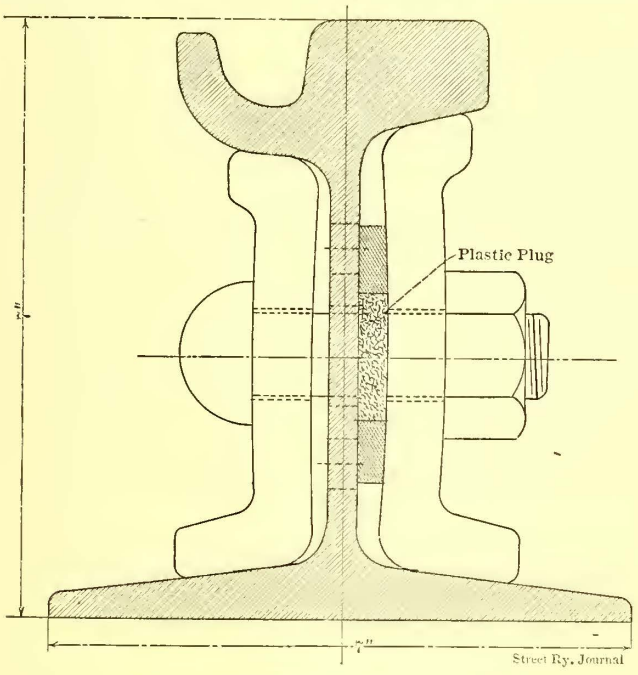


FIG. 8.—SECTION OF RAIL AT JOINT

Cable Company, which has also supplied the cables, which are insulated with paper and lead covered. Pilot wires connected to the track at the various termini are brought back to the power house to voltmeters, which continuously record the drop in the return. A recording ammeter measures the current entering the station from the earth plates. The method of bonding is shown in Fig. 8. Both Chicago and Edison-Brown plastic bonds are used. For the purpose of calculating the cables, the current per car is taken at 16 amps.; this is never exceeded, from 11 to 14 amps. being an average figure.

The majority of the long-distance feeders are not supplied directly from the bus-bars, but are grouped and taken off the subsidiary bus-bars through a booster, which is one of the most interesting features of this plant. This system has been devised by the consulting engineer, H. F. Parshall, and practically does away with any danger from electrolysis. The maximum drop in the earth return or rails allowed by the Board of Trade is 7 volts. The rails are bonded, as shown in Fig. 8, and cross-bonded every 240 ft., but experiments and tests on actual lines have conclusively proved that even these precautions are not sufficient to do away with electrolysis, the reason being that the enormous surface of rail exposed to the earth offers such a low resistance that the current leaves the rails and flows parallel to them in the earth and adjacent pipes returning to the rails again, as the track nears the power house, so that while the current from the earth plates at the station to the negative bar may be practically nothing, and the drop along the rails down to as low as 3 volts, yet a considerable quantity of the current will be returning in parts of the system via the earth instead of by the rails. The above mentioned booster arrangement is entirely successful in doing away with this most serious difficulty. The system is shown in diagram form in Fig. 5.

The feeder or group of feeders supplying an outlying district are fed through a subsidiary bus-bar, which is sup-

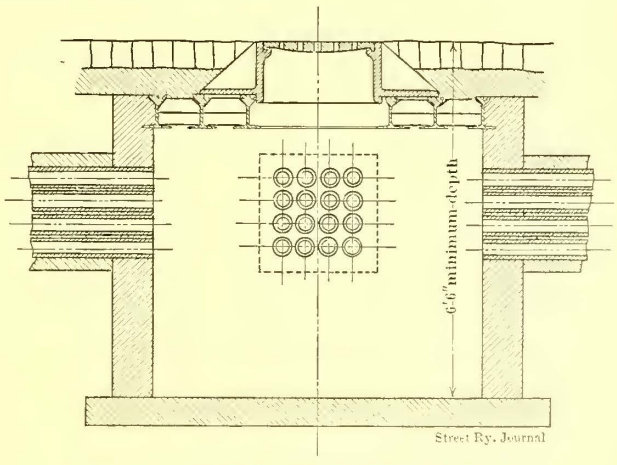


FIG. 9.—SECTION OF FEEDER CONDUIT

plied from the main bar through the field of a booster. The armature of this booster is placed in series with the return feeder from a point or points of the track supplied by the line feeders in series with its field. The booster is so wound that it compensates for the drop in this return feeder, and of course the pressure at the point of connection of the rails can be maintained in consequence at any desired voltage above or below that of the earth. The use of this system of negative boosting thus enables districts to be reached which would, owing to the length of track, otherwise necessitate the use of a substation and an entirely different method of supply, besides reducing to a reasonable size the area of the feeder required for the return current. The booster is driven by a shunt motor from the

main bus-bars, which is protected against an overload by a circuit breaker. The booster panels are arranged so as to allow the booster being temporarily shut down if required without interrupting the traffic; the system has been in use for some time in Bristol, and has given most satisfactory results. As originally schemed, the return booster system was not adopted, but in its place a number of three-inch cables were run to the south side of O'Connell Bridge, and another set in still another direction, amounting in all to some 8.25 sq. ins. of copper. This has been replaced by 2.68 sq. ins., with the inestimable advantage of insuring freedom from electrolysis.

The poles are formed of steel tubes in three sections shrunk together hot and under pressure. The bracket arms are formed of steel tubes 2 ins. in diameter, with ornamental wrought iron scroll-work. In sharp curves extra long ears are used, as this is found to materially assist in the working of the trolley. The whole of the overhead construction is doubly insulated. No splicing tubes are used. Where the trolley line passes under a bridge, section insulators are fitted at both sides of the same, so as to completely insulate the under bridge portions of the line from the rest of the trolley line system. At one end of such insulated portion of trolley line, a quick-break single-pole switch is connected across the insulators, so as to charge this portion of the line in the event of a car having to stop there. This portion of the line is further protected by an insulating L-shaped wooden screen, so as to prevent accidental contact of the trolley wire with the bridge or any person traveling on the cars.

ROLLING STOCK.

Fig. 11 illustrates the general appearance of the motor cars, with a total seating capacity of fifty-three passengers. The whole of the bottom framing is of well-seasoned selected straight-grained oak. Ash is used for the roof framing, and the upper deck is of hard pine in narrow boards in single lengths. The roof is strengthened for the trolley base by a plank 16 ins. x 2½ ins. run the full length of the car body, so as to support the trolley standard. The electrical equipment consists of two G. E. 52 railway motors, with a gear ratio of 4.8. The car bodies are mounted on Peckham's standard cantilever extension trucks. Ferro-nickel wheels are used, 30 ins. diameter over tread, 31 ins. over flange. The weight of the wheel is 300 lbs. The trolleys are of the swiveling arm type, and a spherical trolley head is used.

The total weight of the car is approximately 7 tons.

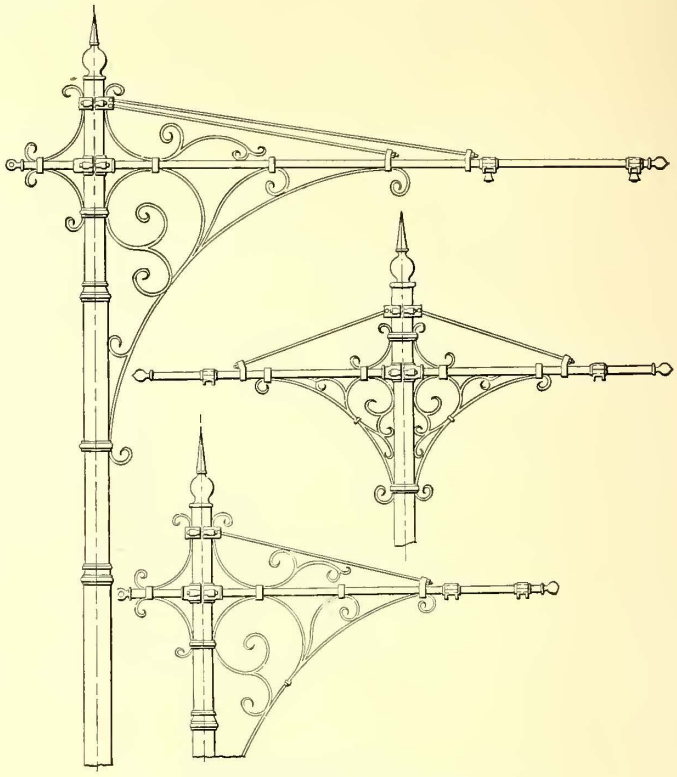


FIG 10.—TYPES OF BRACKETS EMPLOYED

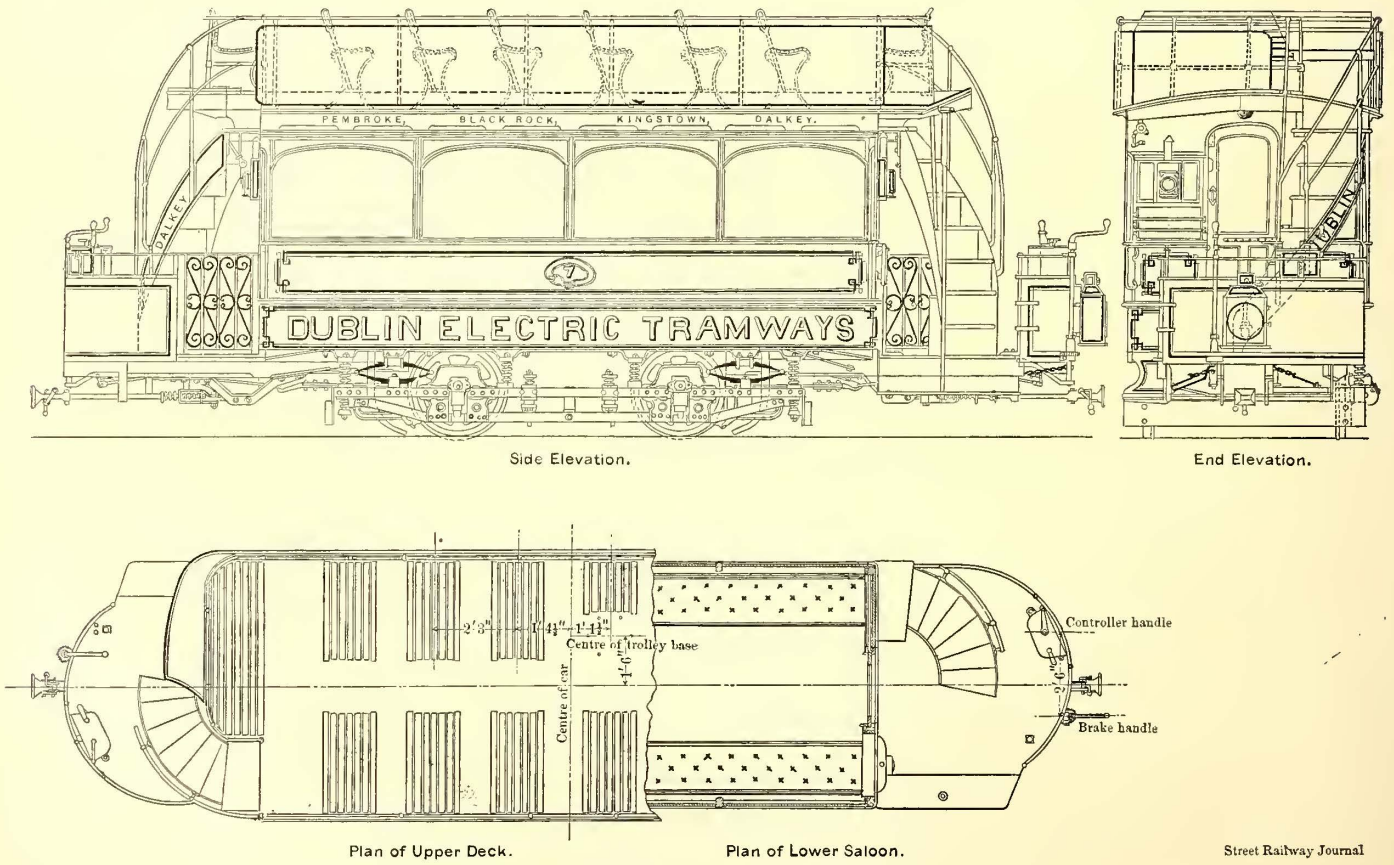


FIG. 11.—PLAN OF SIDE AND END ELEVATIONS OF CAR

FINANCIAL.

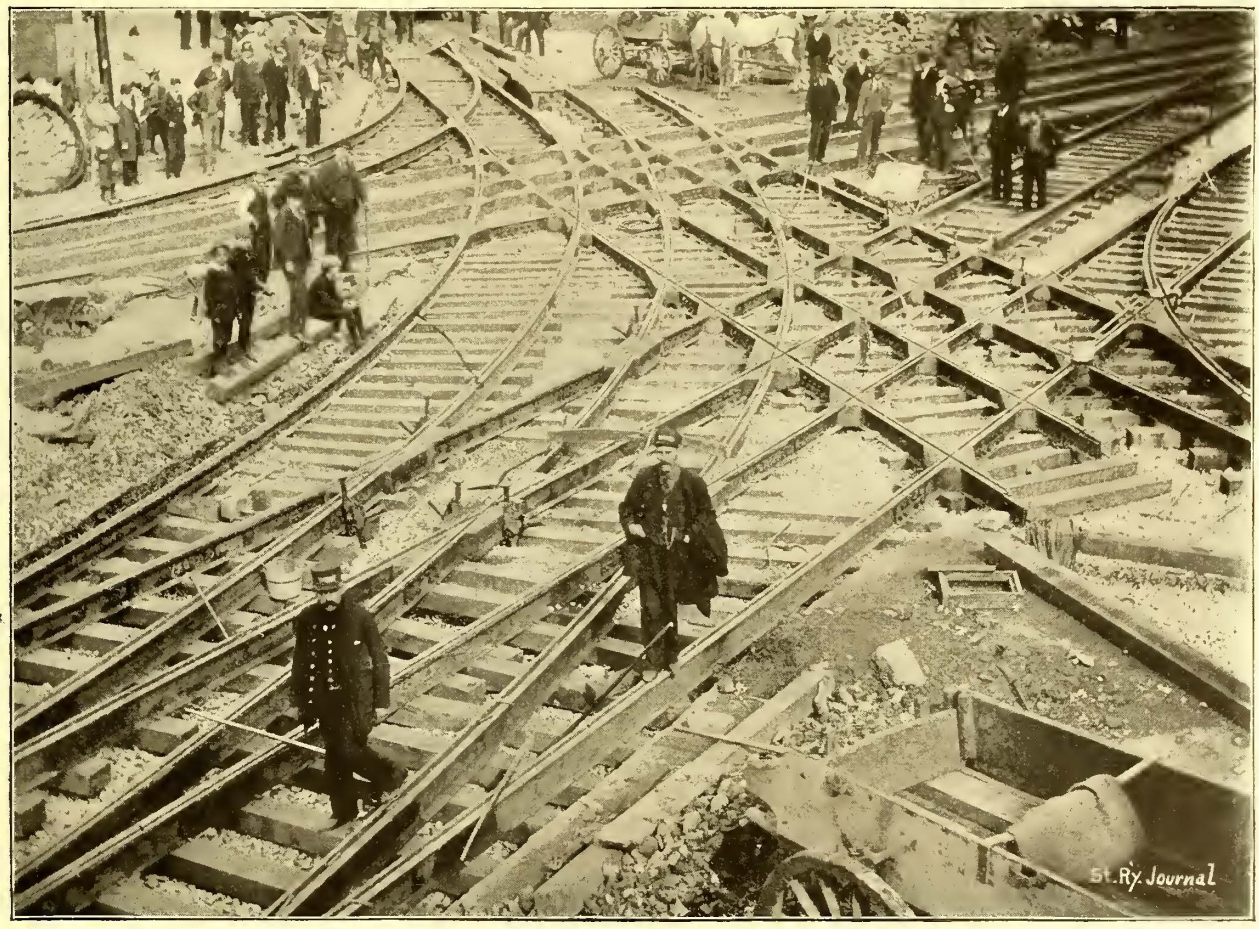
It may be interesting to note in this connection the way in which the electrical equipment of the Dublin system has been financed. The old Dublin company was capitalized at £592,310, in ordinary shares fully paid up, and there were also £84,500 in debentures upon the property. A London syndicate, headed by J. B. Concanon, agreed to furnish the money necessary for electrifying the system. A new company, formed by the syndicate, took over the old company, guaranteed its debentures, made its old ordinary shares—first £592,310—6 per cent preference shares, and issued at £171,500 of new ordinary shares, fully paid in, and afterward £343,000 additional ordinary shares, 20 per cent paid in. The net result of the syndicate's operations is this: It has furnished to date £240,100 of actual capital to the new Dublin company, and has received in return ordinary shares, which, at their present quoted prices, represent a market value of £800,150. This certainly indicates a profit which ought to be highly satisfactory to members of the syndicate, and the market quotations of the Dublin stock seem to show that British investors are coming to have a marked confidence in the future of well managed tramway investments.

Special Work in Pittsburgh, Pa.

The accompanying illustration shows a very complicated piece of special work, which has just been installed at the intersection of Centre, Highlands and Ellsworth Avenues, Pittsburgh, by the Johnson Company.

The company for whom the work is being done is the Consolidated Traction Company.

As will be seen from the illustration, this consists of a Y-shaped piece of track, the two arms of which are double tracked and are inclined at an angle of 17 deg. The arms of this Y are intersected by a second double track, which intersects one of the arms at an angle of 66 deg., and the other at an angle of 48 deg. There are also two single-track connecting curves and one double-track connecting curve. These are spiral curves with the radius in the center. The radius of each of the single curves is about 70 ft., and the radius of the double track curve is 128 ft. for the outer track and 150 ft. for the inner track. There are fifty frogs in this entire construction, nine tongues and nine mates. This work is the Johnson 9-in. guaranteed construction.



LARGE PIECE OF SPECIAL WORK IN PITTSBURGH

Double Deck Car for Mixed System—Paris

The Compagnie Francaise Thomson-Houston, of Paris, has recently been called upon to design and construct a double deck electric car for the Paris & Department of the Seine Tramways for that section of their line running from the Place de la Republique to Pantin and Aubervilliers. One part of this section lies without the city fortification where a trolley line can be strung, the other within the fortification where a trolley line is not permitted by the city ordinances, and where storage batteries must, therefore, be relied upon for the motive power. This will explain the peculiar appearance of the lower part of the car.

In order to avoid any possible intrusion of acid vapors into the interior of the car, and to allow of easy manipulation, the box containing the storage batteries is suspended beneath the car between the two trucks. This has caused a radical modification in the shape of the truck, while it has placed the storage batteries in the most convenient po-

sition possible. The trucks are of the Brill maximum traction type.

In view of the conditions to be met by the Cie. Fcse. Thomson-Houston, and the peculiar by-laws regulating the movement of electric cars in Paris and its environs, the car in question is not unsymmetrical. The upper deck is covered in, and has a sliding door at each end. Access

COMBINED STORAGE BATTERY AND TROLLEY CAR--PARIS

can only be had to this *imperiale* from the back of the car in whatever direction the car may be moving. The front platform is occupied by the "watt-mann" only.

The electrical equipment consists of two G. E. 800 motors, one to each truck, two electric brakes and two B. A. series parallel controllers. The trolley base is placed in the center of the upper roof, and has also been the object of a special design in order to allow the trolley pole to pass beneath very low bridges. In some cases two or three inches only of space separate the roof of the car from the ceilings of certain of the arches under which the road passes.

Elevated Railroad Equipment in Brooklyn

The changes necessary in the equipment of the section of the track of the Brooklyn Elevated Railroad selected, on which electric power is to be used, are being pushed rapidly forward. As contemplated, the section of track to be equipped is that extending from the Navy Street station to the Brooklyn Bridge, and includes a communicating link to the elevated structure now being built between the present Bridge terminals and the present structure of the elevated railroad. The Navy Street station is a "long stop" station, being at the junction of the three principal lines of the company, and time has to be allowed here for passengers to change cars. During this time the steam dummy which has drawn the train to this point will be disconnected, and the electric motor car will pick up the train and draw it over the Bridge to New York. It will then return with it to this station, and will run on a stub track, when the steam dummy will again pick it up.

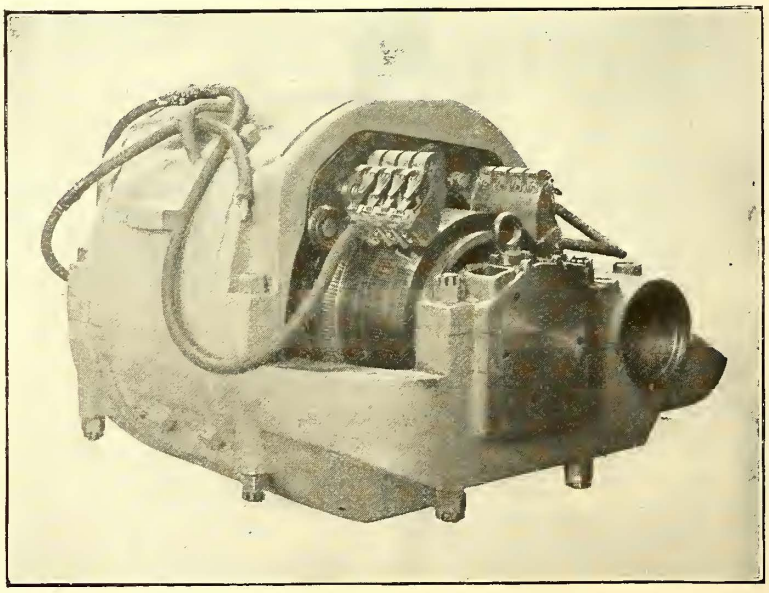
As was stated in the last issue of the Street Railway Journal, twelve motor cars will at first be installed. These cars are being built by the Pullman Car Company, and are being equipped with four 80-h.p. Walker motors each, and will be mounted on McGuire trucks. The cars will be equipped with Christensen air brakes, and power will be taken at 500 volts from a rotary transformer, located in the local lighting station of the Edison Electric Illuminating Company. A full description of the motors to be employed was given in the last issue. An engraving of one of the motors is shown herewith.

Storage Battery Cars in New York

The Dry Dock, East Broadway & Battery Railway Company, of New York City, as stated last month, has recently put in operation several storage battery cars. The equipment consists of three cars, of which two are kept in regular service and one as a reserve. The storing station is at the company's car house, on Grand Street, near the Grand Street Ferry. It consists of a three-cylinder 90-h.p. Westinghouse gas engine, taking ordinary illuminating gas from the city mains, and directly connected to a Westinghouse generator. The engine is self-starting, by means of compressed air, stored in a special reservoir, and admitted to the cylinders, on commencing operation. The gas is ignited by electricity, the storage batteries being used on starting and a current direct from the generator after running.

The charging pit has room for two battery equipments. The batteries are carried normally on the truck, as in the plants of the Chicago Electric Traction Company. When the batteries are to be charged, the car is run over the pit, and a hoist elevator raises the frame holding the batteries a slight distance, when they are automatically disengaged. The batteries are then lowered and wheeled on a truck to the connection terminals, which automatically make the necessary connections. The battery frame is of $1\frac{1}{4}$-in. oak, with four iron channels $\frac{1}{2}$ in. x 5 ins.

The battery for each car consists of seventy-two cells,



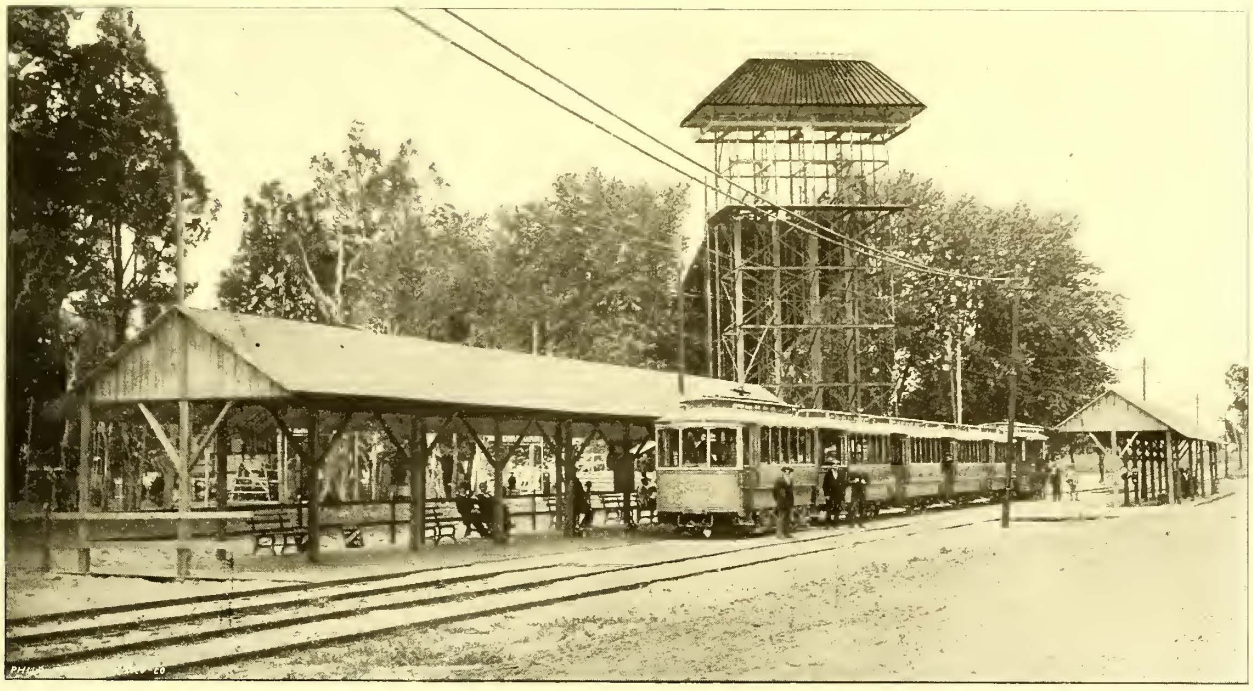
BROOKLYN ELEVATED RAILWAY MOTOR

The cars are some formerly used on the line of the Chicago Electric Traction Company, and measure about 33 ft. over all, and are vestibuled. They were built by the St. Louis Car Company, are mounted on Dupont trucks, and are equipped with Walker motors. The weight of the car without battery is 10 tons, and with the battery it is 14 tons.

Practical Hints on the Design and Improvement of Street Railway Parks

By Henry Pincus.

In the laying out of amusement grounds or buildings for street railway parks, haste is most undesirable. As my old preceptor, the late Dion Boucicault, would say: "Make haste slowly." Mistakes are expensive; parks are peculiar propositions. They cannot be constructed strictly upon commercial lines, neither can they be built solely upon amusement principles. On the one hand, they will be inartistic and impracticable, and on the other, too elaborate and of no business value. Results from a given expenditure are what railway managers are after, and having once decided upon the establishment of a park, they should bear the following rules in mind: The investment must be judicious; economy does not mean cheapness; liberality does not mean extravagance; the designs should be practical, and not merely pretty pictures, commonly known as "color schemes."



ENTRANCE TO WASHINGTON PARK.

As the park season is very limited, it is often a question whether amusement resorts of this kind can be made self-sustaining. The fact that street railway companies have found that parks, at the terminus of their roads, greatly stimulate traffic, is the cause of their rapid increase, and it is only a question of time when every street railway will have a park or amusement resort at the terminus of their roads.

The cardinal principle of park development is to utilize as much as possible the natural attractions which exist in the area selected for the park. The next important matter is the construction and arrangement of the various buildings with a view of getting the greatest amount of income with the least possible investment. In order to do this the area should be treated commercially; that is, the buildings should be so arranged in relation to each other that the crowds can be handled to the best advantage and at the smallest expense. This means that the main point of entertainment or amusement should be located near the point of distribution for food, drink, etc., so that visitors to the park can be served with what they order quickly and at a minimum expense for attendance. The reason for this is obvious. Make it as easy as possible for your patrons to spend money. Where there are several attractions it is more important to have certain ones close to the restaurant than others. Thus the band stand and theater should be near the restaurant, while the toboggan slide and the more active amusements of that character, if necessary, could be further away.

Lack of knowledge of what has been done elsewhere often leads to expensive originality, so that a consideration of what others have accomplished in this field is of considerable value. The manager can thereby avoid unnecessary outlay, and when too late, of realizing the fact that he is all wrong and obliged to tear down and rebuild.

Charles Lamb, in his celebrated essay on "Roast Pig," tells of how a Chinese subject was left to take care of a litter of pigs, and through negligence, the house caught fire and the pigs were roasted. Fearful that his master might punish him, he tried to save the bodies from the ruins. In so doing, he burnt his fingers and when placing them in his mouth to cool, suddenly discovered that it tasted good. When the master returned he was in a fearful rage, and about to vent his anger upon the boy, when he, too, discovered the taste, and then they both fell to eating. The greatest secrecy was maintained, and every once in a while a litter of pigs were roasted in the same way, when, all of a sudden, some genius came along, and discovered that it was not necessary every time he wanted roast pig to burn a house down. Neither is it necessary, every time you want a park, to tear down and build up again.

After having decided upon the style and arrangement of buildings, the next important question is that of the best color to paint them. This is quickly answered. There is no color so desirable for park buildings, whether old or new, as plain white; there is none so bright, none so cool and none so cheap, for the ordinary laborers about the park can be employed to do the painting, since anyone can put on a body color with a brush. Do not give your buildings different hues. You can get your colors, if you need them, from the green grass, the blue sky and the foliage

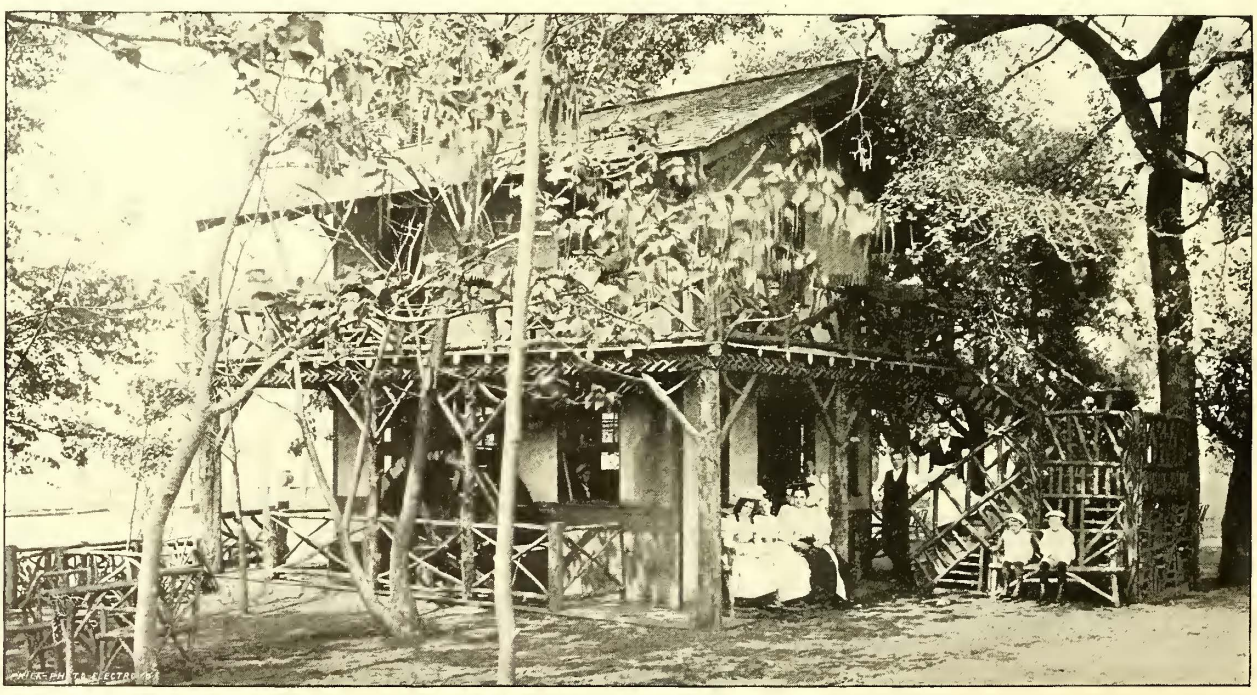
and bloom of the flowers; there is plenty of color there, and you want nothing better.

Having now discussed the buildings and their arrangement, a few words on entertainments may be of interest. These should depend upon the surroundings in the midst of which the park is situated, and on the character of the people who patronize it. For instance, in the case of a park situated in a manufacturing district, vaudeville entertainments, or perhaps light opera, would pay. On the other hand, for a park located in a more aristocratic neighborhood such entertainments would be entirely out of place. Instead, music of any suitable character would be more appropriate and profitable. The manager of a park should be like a physician and should diagnose and prescribe in a similar way for his patients—the public. He should make a study of the symptoms, and if the results are not satisfactory, should change the treatment, as his medical brethren often do.

Generally speaking, however, and considering the average run of parks, entertainments can be divided into two classes—the profitable and the unprofitable. Another division which could be made is that between "standard" attractions and "extra" attractions. Among the less profitable attractions may be classed those which require considerable help to run them, and those which are shown in inclosed and darkened halls, such as moving picture exhibitions, illusions and scenic theaters, and, in fact, any exhibition where darkness and closeness are necessary. These are very rarely successful in any place. When people go to a park they want fresh air and plenty of it. The best evidence of this is found in the well-proved experience, that with all our modern mechanical inventions in connection with amusements, there is nothing that pays so well as the old-fashioned merry-go-round. This, the toboggan slide and the scenic railway make up the list of standard and best-paying attractions for a park of this description.

The great advantage of these amusements from a commercial standpoint, apart from their popularity, is the small amount of help required to run them. The largest merry-go-round takes only two men to operate it—one in

LADIES' ORCHESTRA—WASHINGTON PARK



RUSTIC DAIRY—WASHINGTON PARK

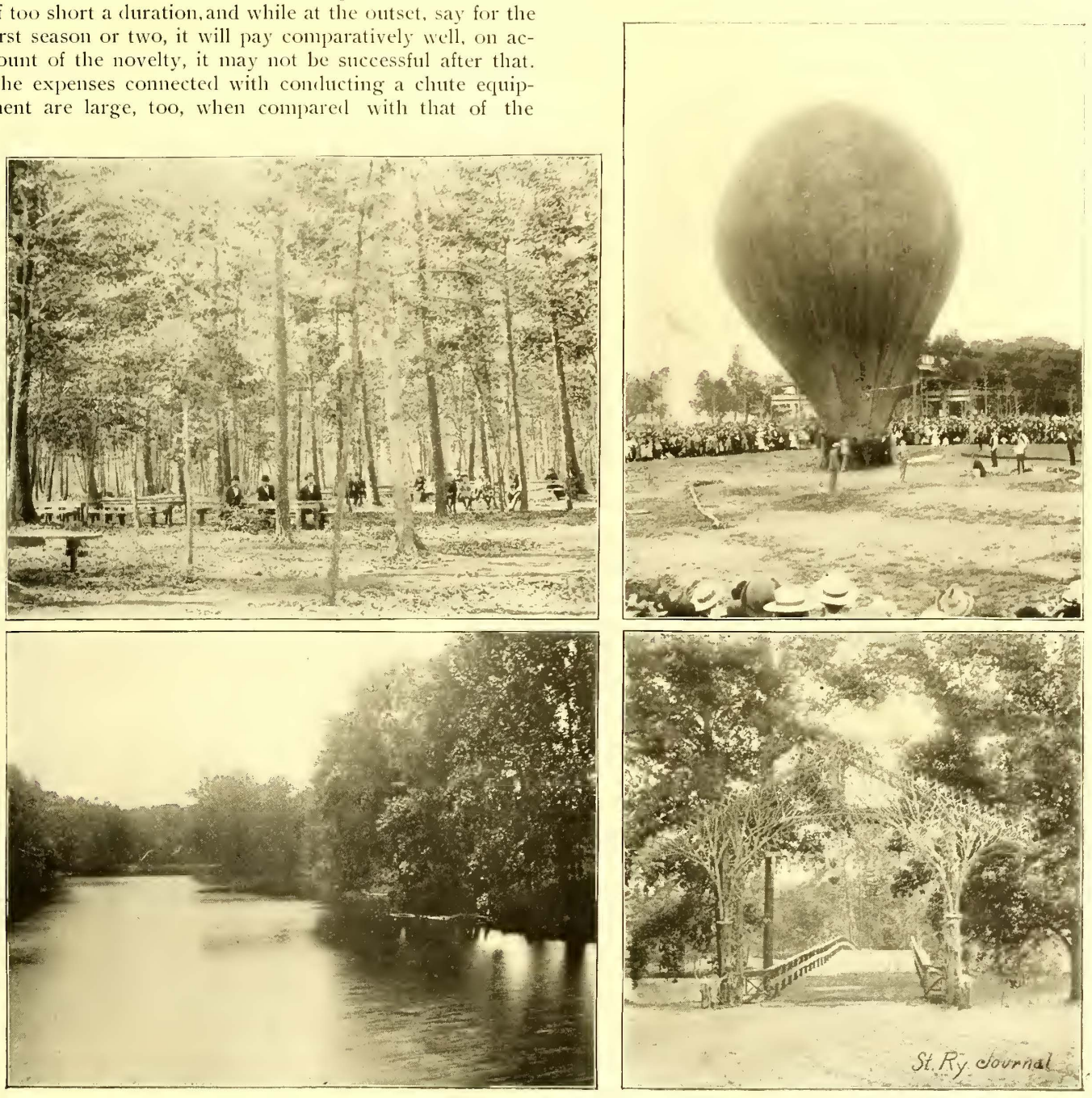
charge of the machinery and the other to collect the money—while any number of people up to fifty or sixty, or perhaps even more, can patronize it at the same time. The same is true of the toboggan slide and the scenic railway, which only require one man to start the cars and another to stop them, with perhaps a third to assist in pushing the cars up to the top or to operate the machinery to accomplish this. "Shooting the Chutes," on the other hand, is an amusement which provides a sensation of too short a duration, and while at the outset, say for the first season or two, it will pay comparatively well, on account of the novelty, it may not be successful after that. The expenses connected with conducting a chute equipment are large, too, when compared with that of the merry-go-round, toboggan slide and scenic railway, as it requires a man with each boat, switchman, attendants of various kinds, etc., while the charge to patrons is usually just the same as for the less expensively conducted entertainments. The Ferris wheel has met with favor ever since the World's Fair.

Shooting galleries and billiard rooms in some localities are just what are wanted by the people, and in others they would not pay; but in the average park, with the average run of all classes of people, such amusements have a fair earning capacity.

Where there is a large body of water, all kinds of boats are desirable, particularly electric launches, which furnish a superior form of attraction to those who like to spend their time on the water. A bicycle track and baseball grounds are also profitable features for a park, as they attract those who would not otherwise attend such places as a pleasure resort simply.

If, however, the facilities for amusements are limited, and a street railway company should want to know whether there was any one attraction which ranks far and above others in popularity and in returns, I should say unquestionably "yes," and that the merry-go-round is an indispensable adjunct to every pleasure resort. It is remarkable how this invention appeals to every age and condition. Ever since the days of Agamemnon and Don Quixote the wooden horse has demonstrated its claim to be a remarkable animal, and any manager would make a great mistake who did not include one of these attractions in his list of amusements.

There still remains to be discussed what may be termed "extraordinary" attractions, such as spectacular entertain-



VIEWS IN WASHINGTON PARK

ments, fireworks displays, musical festivals, balloon ascensions, etc. These very rarely result in any direct profit to the park owner, but are undoubtedly useful on special occasions when large numbers of people are to be attracted and entertained. Again, there are times when it is harder than at others to attract people to a park, say during the months of June or September—in the early summer and the early fall. Balloons will gather together a larger crowd of people than almost any other form of attraction, but they have their disadvantages, as while the process of filling the balloon is going on the people will do nothing else but gaze at the operation, and will not patronize any of the side entertainments. Then, when the moment of ascension has come, the crowd will rush pell-mell after the balloon, over the grounds and flower-beds, very often doing great damage.

One of the most popular attractions at Washington Park last summer was an electric fountain of uncommon character; in fact, it is the only one in this country of its kind so far as the writer is aware. In addition to the prismatic displays and designs common in the usual electric fountain, a stage was arranged in the center, upon which were exhibited living groups, dancing girls, etc., who thus appeared to be in the midst of the falling waters. The stage consisted of a glass elevator, so arranged that it could be made to lower to the open space beneath the fountain, where the groups of dancers, etc., were posed, and then raised to the required position in the center of the fountain above.

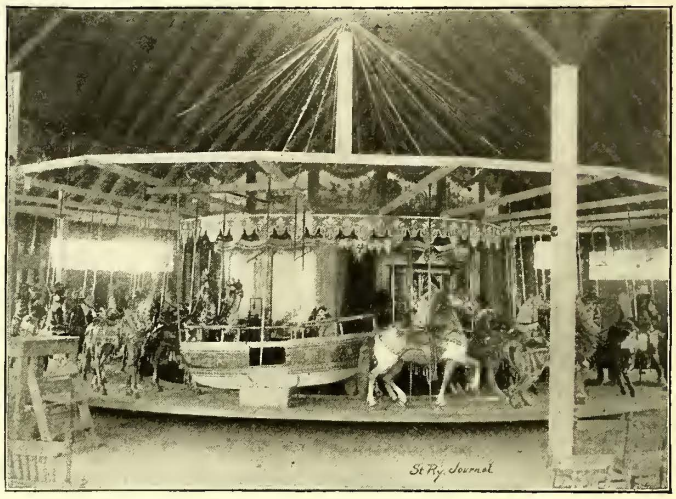
Contrary to general belief and expectation, a high-class restaurant is not by any means a profitable investment, although in large parks it may be a necessity. That it is not profitable is due to the fact that one is obliged to keep in stock a large supply and great variety of food, although comparatively few meals are served. The large majority of the frequenters of a park of this description take their meals at home before coming, or bring their refreshments in baskets and consume them on the grounds. There is, however, a considerable profit in what may be termed "quick lunch," in the way of sandwiches, pies, milk and all eatables of that character. There should also be plenty of

SHOOTING THE CHUTES

facilities about the grounds for supplying cheap refreshments, such as ice cream, candies, soda, pop corn, peanuts, etc., and booths for the sale of these will be found to pay a large profit.

The accompanying engravings show views in Washington Park, of which the writer is manager. It is situated on the Delaware River, in Gloucester County, N. J., in an easterly direction just opposite and within sight of the City Hall of Philadelphia. The grounds lie along the river bank, and comprise an area of over 600 acres, 450 of which are beautiful woodland, and 150 are covered by a natural sylvan lake. It is on the Camden, Gloucester & Woodbury Railway, which, with boats from Philadelphia, furnishes the only means of transportation to the park. The park is owned by W. J. Thompson, who also controls both means of transportation to it.

The central feature of the grounds is the Howe mansion, a relic of Revolutionary times, to which wide veran-



THE CARROUSSELL

das and modern improvements have been added, so that it has been converted into a hotel. Attached to the hotel is a great two-story pavilion, capable of seating at tables not less than 5000 persons at one time. Adjoining the pavilion is the large music shell and theater, illustrated on page 212, where nearly all the great bands have played, and during intermissions the ladies' orchestra has proved a popular hit. The building is so arranged that it can be converted, instantly, into a fully equipped theater, where, if it is desired, entertainments of a dramatic, operatic or vaudeville character can be presented.

The entrance to the grove, which consists of a thickly wooded strip of land, comprising about 250 acres, is a rustic arch, illustrated on page 213. This arch was erected by five inexperienced men, under supervision, in a week's time. The material used was rough cedar logs, which had been cut down on the place, and which were practically of no value for anything else. The dairy building, illustrated on page 212, was also erected from logs cut on the place, and it has proved a good investment. A herd of Alderney and Jersey cows is kept in one part of the park called the "stock farm," and their milk is served at the dairy and elsewhere. All the vegetables used in the restaurant are raised on the grounds.

Another of the chief advantages of Washington Park, and one which cannot be too strongly insisted upon in any park establishment, is an inexhaustible supply of pure spring water. No less than twenty artesian wells have been driven in different places, and people send to the park from a distance for water, thus advertising it in an excellent way.

We have had as many as 120,000 people at the park in a single day. The average attendance for three months last summer, taking the good with the bad, was about 30,000 per day. These crowds are drawn from Philadelphia, Camden, Woodbury and neighboring towns. No admission fee is charged, and the owner of the park depends entirely for his returns upon the transportation charges and the sale of refreshments and privileges.

I shall be pleased to give any further information to those interested in parks at all times.

Accounts of Materials in Store—II

By A. O. Kittredge, F. I. A.

Before inquiring into the special blanks and forms that may be advantageously used in connection with materials and supplies kept in store, let us give brief attention to the general principles underlying all store accounts.

Many street railway accountants in considering this general question are confronted at the outset with the apparent need of a huge warehouse under lock and key, or, more particularly, in charge of an intelligent and trusty man, who is constituted the custodian of all the materials placed in stock, and who in turn is responsible for the proper delivery of the same to the different departments as demanded for consumption. This idea, however, is only a theoretical conception of the requirement of the case, and while complying with some of the assumed conditions of the problem does not in any respect meet them in a practical fashion. A full-fledged warehouse system, with its attendant expenses, is not necessary. Under ordinary conditions the stores system can be managed simply as a feature of the regular accounting of the company. Equipped with proper blanks and forms, and thoroughly instructed, the different division superintendents, foremen and others who have to do with the stores, leave such records behind them, without the supervision of a special storekeeper as to afford the general accountant all necessary information.

Reduced to its lowest terms, it is essentially a question of receipts and disbursements of materials evidenced upon proper forms. Stores are to be delivered for use only upon requisitions properly signed. In turn, reports of the use of the items by those immediately in charge of the work to which they are applied are to be similarly made and likewise properly signed.

Instead of a single warehouse, into which all stores are put, the stores may be located in a dozen or twenty different places, the different items being placed where they will be the nearest to the points of consumption, and where they can be most readily cared for. Thus some may be in the car barns, some in each of the shops, some in the office building and some in other places. Each particular lot under these conditions would be nominally in charge of some man whose regular work keeps him always in close proximity to the stock, and who would honor the requisitions presented and report them to the office. So far as possible, articles that are liable to be purloined and are easily carried away or lost should be kept under lock and key. In any event the invariable rule is to be established that no material, whatever its character, is to be taken from store save only upon a proper requisition showing upon its face the quantity, the use to which it is to be put, together with such other facts as may be necessary to make the account intelligent as to its real and final use.

Probably the best unit for use in keeping the accounts of stores is the unit of value—that is to say, take coal by the price per ton, iron, brass and other metals by the prices per pound and manufactured articles of any sort used for replacement and repairs by the price per piece. As stores are bought and entered upon the purchase records of the company, the lots should be identified by some system of reference numbers, letters or symbols, so that they can be traced accurately and definitely whenever occasion may demand. Units should be carefully considered in this preliminary work, and a cost price unit in each case worked out in a way to meet all subsequent requirements. Care must be exercised that in the matter of the requisitions the same basis of units is observed. These preliminaries attended to, all the materials are charged on the general books to stores. As they are withdrawn for consumption charges are made to the proper expense accounts, with corresponding credits to stores. Entries in the latter case are based upon the requisitions returned by the several store-keepers, who, as before explained, are employees of the company engaged in other work, but entrusted also with the care of certain parts of the stores. These entries are also based upon the reports of the foremen or others in charge as to the use that was made of the materials. From time to time, by way of check and verification, an inventory is taken of the stores on hand. If the inventory accounts correspond with or closely approximate to the balance, as shown in the stores accounts, then it is to be assumed that the system is running correctly and that there is no dishonesty or carelessness upon the part of employees. If, however, any discrepancy is found, it is the signal for such an investigation as may be appropriate under the circumstances.

One more point should be made in this connection: It is necessary to introduce it in order to remove what has been a stumbling block to many who have commenced to investigate this question with a view to conducting store accounts, and that is, the variation in prices of materials from time to time. A certain article may be worth to-day 25 per cent more or less than it was thirty or sixty days ago. Coal, for example, may be worth to-day five cents or twenty-five cents a ton more or less than it was some time since, when a stock was purchased. As a fact, the markets are continually fluctuating. How does this affect stores?

To the novice fluctuations in prices would seem to upset any plan of stores accounts most completely, or at least to involve it in almost endless complication. As a fact, fluctuations in costs have no bearing upon the case at all. It is simply necessary to establish the unchangeable rule that materials shall come out of stores at the same price that they went in. If 100 tons of coal, for example, went into stores account at 25 cents a ton less or more than what is being paid for the same grade of coal at the present time, it is only necessary to see that 100 tons comes out at this price, and is charged to the cost of power. It may be the identical hundred tons or not, but in any event it is the same amount in value, which is the all-essential point. There is always present a certain speculative element in buying materials ahead of consumption, but the price that is paid for the materials consumed always determines the cost of the operation of the road. If the buying has been particularly advantageous, then the profits are to that extent enhanced. On the other hand, if the markets have changed in the opposite direction, then buying in advance has been a disadvantage to the road. Present market values have nothing to do with the use of the materials in store. Of course, in carrying balances forward from one fiscal period to another, in the case of a falling market, prices may be cut to agree with present rates. But in doing this we take the materials out of the old stores account at the cost at which they went in, and then charge them to the new stores account at the price at which we expect to use them. The difference between these two amounts is, of course, to be adjusted through the general loss and gain account.

An ordinance has been introduced to compel the street railway companies of Kansas City, Mo., to pay a license of $30 per year on each car operated. The companies now pay $30 each for the average number of cars operated during the year.

Apportionment of Pay Roll Charges

In the last issue of the Street Railway Journal reference was made to some special accounting forms that had been prepared by J. F. Calderwood, auditor of the Twin City Rapid Transit Company, Minneapolis, Minn., for use in the accounting of that company. One of these is entitled "Comparative Statement of Pay Rolls for Half Months." The blank was described in considerable detail, but so much interest attaches to the analysis of the company's pay roll to make it correspond with the Standard System of Accounts that it will undoubtedly be of interest to refer to it again, and further to comply with the suggestions of several correspondents that the list of items should be given in detail. The following is a transcript of the column on the left of the sheet, opposite the items of which the amounts are to be extended into the different columns, as explained in the description referred to:

MAINTENANCE OF WAY AND STRUCTURE.

Track and Roadway.
- Roadmasters.
- Roadmasters' Assistants.
- Laborers, track repairs.

Electric—Overhead Repairs.
- Linemen.
- Laborers.

Conduit—Electrical Repairs.
- Laborers.

MAINTENANCE OF EQUIPMENT.

Repairs and Renewals of Power Plant.
- Machinists (steam plant).
- Laborers (steam plant).
- Machinists (Falls plant).
- Laborers (Falls plant).

REPAIRS AND RENEWALS OF CAR AND CAR EQUIPMENT.

Shops.
- Master Mechanic.
- Carpenter shop.
- Paint shop.
- Blacksmith Shop.
- Machine Shop.
- Brass foundry shop.
- Armature shop.
- General repair shop.

Car Station Shops.
- Bloomington.
- Minnehaha.
- Thirty-first Street.
- Midway.
- East Side.
- Washington Avenue.
- Smith Avenue.
- Seventh Street.
- Selby Avenue.
- Rice Street.

CONDUCTING TRANSPORTATION.

Power Plants.
- Engineers (steam).
- Oilers (steam).
- Electrician (steam).
- Firemen and helpers (steam).
- Laborers and others (steam).
- Engineers (Falls).
- Oilers (Falls).
- Electrician (Falls).
- Laborers and others (Falls).

Car Service.
- Superintendents.
- Clerks.
- Aids.
- Secret Service.
- Conductors, time card.
- Conductors, extra time.
- Motormen, time card.
- Motormen, extra time.
- Other car service employees.
- Car house foremen.
- Car house employees.
- Cleaning, watering and sanding track.
- Removal of snow and ice.

GENERAL EXPENSE.

- Salaries of general officers.
- Salaries of clerks in General Manager's office.
- Salaries of clerks in Auditor's office.
- Storekeeper and Purchasing Agent.
- Storekeeper and Purchasing Agent help.
- Claim Agents.
- Claim Agents' help.
- Legal department.
- Stable expense.
- Parks and Park Properties.
- Janitors.
- Contingent.

Park Advertising of Street Railways

So many street railway companies have found it advantageous to establish parks and other amusement resorts at their terminals, for the purpose of increasing their passenger traffic, that the accounting which has to do with parks and amusements becomes a matter of considerable importance in every auditor's department. In the classification of expenses reported by the committee on the Standard System of Accounts at the Niagara Falls Convention, the expenses of park properties were grouped with advertising and placed under the head of general expenses.

Expenditures for park properties, in the sense of administration, keeping up the attractions, etc., are to be carefully distinguished from expenditures made for the real estate and the buildings thereon. These have an inventory value and very properly should appear in the list of assets in the company's balance sheet. The whole of a park scheme, therefore, will be represented by two accounts, one indicating the investment and the other the expense of maintenance and operation.

A letter has been received recently from one of the members of the committee on a Standard System of Accounts referring to the following sentences, which occurred in an article published in the February number of the Street Railway Journal: "In the case of parks, however, there are real estate values, buildings and various improvements, which have a value in themselves and which in this respect are unlike anything that is ordinarily classed as advertising." Commenting on this, this correspondent says it was not the committee's intention to charge to this account the cost of any park property, buildings or improvements. "These would properly be charged to Construction Account, because they have a permanent fixed value. On the other hand the expense of maintaining and operating parks should be charged to the same account as advertising, for the only object of having a park is to produce increased travel. Its object is precisely the same as that of other kinds of advertising."

The distinction thus clearly brought out by this correspondent is one that is of importance, and while it seems scarcely possible that any one among the great number of street railway accountants, who are carefully following this matter, could make a mistake with respect to the intentions of the committee, yet it may not be out of place to dwell upon this point to the extent of these remarks.

Several additions to the membership of the National Association of Street Railway Accountants are reported. Among these are the following: Honolulu Tramways Company, Honolulu, H. I.; Aurora & Geneva Railway Company, Aurora, Ill., and the New Orleans & Carrollton Railway Company, New Orleans, La.

LEGAL NOTES AND COMMENTS*

Edited by J. Aspinwall Hodge, Jr., and George L. Shearer, of the New York Bar

When Plaintiff's Negligence is Not a Defence

The rule that a plaintiff cannot recover where he has himself been guilty of negligence is so broad and far-reaching that its limitations are oftentimes forgotten.

More than half a century ago a farmer negligently allowed his donkey to wander on the highway, and tied his forefeet together, thus impeding his movements and rendering him the less liable to take care of himself. The donkey was run over in broad daylight by defendant's wagon, which was being driven at an improper rate of speed.

Here there was negligence on both the part of the plaintiff and the defendant, but the English court established a new precedent, and held that, since the defendant's driver, by proper care, could have seen the danger the donkey was in and so have avoided the accident, therefore the plaintiff's negligence was not the proximate but the remote cause, and in that sense had not contributed to the accident. (Davies v. Mann, 10 Mees. & W., 546.)

This case has been followed in the English courts, the Federal courts and in the courts of nearly all the States of the Union. The doctrine has been criticised by some text writers, but can now be considered to be the law of the land.

It is to be noted that, where this rule applies, or this exception to the general rule, the negligence of the plaintiff must antedate the negligence of the defendant, and must occur long before the negligent act of the defendant, to allow the defendant to observe it and to avoid the accident. Manifestly, if the negligence of the plaintiff and the defendant are contemporaneous, or if the negligence of the plaintiff, although occurring before that of the defendant, occurs in such a way, or so immediately before, that the defendant has no time or opportunity to act, then the plaintiff's negligence plainly is contributory, is one of the proximate causes, and he cannot recover. As it has been well put, "the party who has a last, clear opportunity of avoiding the accident, notwithstanding the negligence of his opponent, is considered solely responsible."

One of the questions which has not been clearly determined, and upon which there is ground for argument on both sides, is whether in order to hold that the defendant is responsible, notwithstanding the negligence of the plaintiff, is it necessary to show that the defendant actually discovered the peril in which the plaintiff was placed by his own negligence, or whether it is sufficient to show that the defendant ought to have, by the exercise of reasonable care, seen the danger.

It would appear that this question is answered by placing the proper emphasis up on the words *ought* and *reasonable* in the above question.

There is no duty imposed upon a defendant to assume or anticipate that the plaintiff is going to be negligent, or to take special care in looking for negligent acts on the part of the plaintiff.

In other words, where the defendant is to be held, it certainly should be shown that the plaintiff's negligence was of a character which the defendant, if he did not see it clearly, should have seen in the exercise of reasonable care, a care not necessarily including the keeping a lookout for acts of a negligent character on the part of the plaintiff.

It is also plain enough that, if the defendant, after seeing the plaintiff's peril, uses due care, and notwithstanding his reasonably prompt action the accident occurs, that then the plaintiff's negligence becomes one of the proximate causes, and the defendant is not liable.

Such are the general doctrines which are established by a long line of decisions, but it may be interesting to note a few of the typical cases which have been decided, and in selecting them the writer has confined his examples almost wholly to street railway cases.

Where a passenger on a street car allowed his arm to protrude outside of the car, where it was hit when the car crossed a bridge, and where the conductor had seen the perilous position which the passenger had assumed, and had failed to warn him, the company was held liable. (South Covington St. Ry. v. McCleave (Ky.), 38 S. W., 155.)

Where a passenger aided a driver to place a street car, which had jumped the track, back upon the rails, and then attempted to get back upon the front platform by climbing over the railing 3 ft. high, and where, while he was doing so, the driver started the car without signal or warning, and the passenger was thrown beneath the car, it was held that notwithstanding his negligence in climbing over the railing, it was a proper question for the jury to determine whether the driver ought not to have seen the plaintiff's dangerous position, and have avoided the accident by not starting the car until he was in a position of safety. (Texas & P. Ry. v. Overall, 82 Tex., 247.)

Where a passenger negligently fell from the rear platform of a moving train upon the track, and while laying helpless there, was run over by another train, and where the employees of the first train, having noticed that he had fallen, did not stop or notify the second train by telegram, it was held that the plaintiff could recover. (R. R. v. Kassen, 49 Ohio St., 230.)

Where an action was brought by an administrator and the evidence established the fact that the deceased's leg became entangled in the guy rope of a derrick because of his own negligent act, and as a result he was hoisted head downward some 15 ft. above the deck of the boat, it was held that it would not necessarily follow that the administrator could not recover the action, since the jury might find that the accident was caused by the negligence of the defendants in suddenly lowering him from his position of peril, and so causing his fall and death. (Sweeney v. N. Y. Steam Co., 6 N. Y. Supp., 528. Aff. 117 N. Y., 642.)

Where an engineer could see a trestle, upon which plaintiff's intestate was walking, for a mile before the train reached it, and could see that he was in a perilous position and unable to escape, it was held that the railroad company was liable for the accident, which occurred when the locomotive caught up with the pedestrian. (Clark v. Wilmington & W. R. R., 109 N. C., 430.) This case is one in which the doctrine is fully discussed.

Where a passenger on a street car was injured by its collision with the railroad car left standing close to the street car track, the negligence of the railroad company, in leaving the car on the track was only the remote cause of the accident, and the plaintiff cannot recover against the railroad company. (Texas & P. R. R. v. Doherty. (Tex.) 12 Lawyers R., 248.)

Whether an engineer, after seeing a child upon the track of a suburban railroad, used reasonable diligence to stop the train, was a question properly submitted to the jury, and the youth of the child, if it could be discerned by the engineer, might well affect his duty in the premises, and was a proper subject for consideration by the jury. (Swift v. Staten Island Rapid Transit Co., 5 N. Y., Supp., 316.)

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

CHARTERS, FRANCHISES, ORDINANCES, ETC.

NEW YORK.—A street railway corporation, organized under Act 1884, c. 252, as amended by the general railroad law of 1890 (section 98), which provides that every street railroad corporation shall keep in repair the portion of the street between its tracks and the rails, and two feet in width outside of its tracks, under the supervision of the local authorities, and whenever required by them to do so, and in such manner as they may prescribe, acquired the stock and privileges of another street railroad corporation organized under the general railroad law of 1850, and for whose benefit Laws 1869, c. 34, section 5, was passed, providing that such corporation should repair the surface of the streets inside the rails of its tracks, but need not make any permanent improvements. Held, that such acquired corporate property was controlled by the laws under which the corporation acquiring the same was organized, so far as improving the streets is concerned.

A power in a city charter to assess the expenses of repairing a street upon "lots and parcels of land" deemed benefited by the improvement confers no authority to assess the tracks, ties, or franchises, of a street railroad corporation.

Although a street railroad corporation is bound by the general railroad law of 1890 (section 98) to make permanent improvements whenever required, and, in case of neglect to comply, the city is authorized to make the repairs at the expense of the company, such statute does not authorize the city to impose an assessment on the company for the expense of repairing a street. (Conway v. City of Rochester, 49 N. Y., Supp. 244.)

NEW YORK—The legislative authority to construct surface railroads being a legitimate exercise of the power to regulate public rights for public uses, a taxpayer cannot maintain an action to annul the acts of the Legislature and of the municipal authorities granting to a corporation the right to construct surface railroads in public streets, and to enjoin the municipal officials of the corporation from proceeding further in the construction of the railroad in the manner authorized, when it is not shown that fraud existed, or that such acts would result in a waste of, or injury to, public property of the municipality.

Ward, J., dissenting. (Kittinger v. Buffalo Tr. Co., 49 N. Y., Supp. 713.)

LIABILITY FOR NEGLIGENCE.

PENNSYLVANIA.—Plaintiff's husband attempted to cross from the north to the south side of the avenue. Just as he left the curb, a car approached on the north track, the one next him, running westward. He stopped about four feet from the track, and, as soon as the car passed, attempted to cross, and was struck by a car running eastward on the south track. He stopped until the west-bound car passed in front of and away from him; then immediately started to cross both tracks, and did not stop before being struck. The court says, "He could have stopped for a second on the track of the car which had just left him westward, or for half that time on the 6-ft. space between the tracks. If he had done either, he would have been safe.

* * * * *

"What is the unavoidable inference? Clearly, one of two: Either he did not look for a coming car, where ordinary intelligence and care dictated there might be one; or, seeing one perilously near, he recklessly ran the risk of passing in front of it. The argument of appellee, that the westward car obstructed his view of the east-bound one, is without weight. If he had stopped for a moment on that track to look, the car on the other would have passed him, whether he saw it or not; if he had stopped but a moment on the space between the tracks, he would have seen it coming, and safely passing him. From the testimony of the two witnesses, who say that, without stopping, he 'cut cater-cornered' across the tracks, it is not improbable the second inference is correct; that is, he attempted a not unusual experiment, to match his speed against that of a car. Every day on the streets of this city we see agile persons bound from one side of the street to the other, rather than wait a second or two, until an approaching car which they see passes. Probably, 999 get across safely. The one-thousandth one miscalculates his own speed, or that of the car, by half a second, and is injured or killed. But whichever of the two inferences, in the case before us, be correct, each points, unerringly, to contributory negligence." (Blaney v. El. Tr. Co., 39 At. Rep., 294.)

NEW YORK.—In an action for personal injuries the material question was whether the street car which caused the injury was in motion when plaintiff attempted to alight. Plaintiff, a boy 9 years of age, and his younger brother, testified that he directed the driver to stop the car, which was done, but it started again before he got off, thereby throwing him down, and causing the injury. The accident happened two years before the trial. Shortly after the accident, in a prosecution against the driver of the car, plaintiff, although represented by counsel, did not testify that he instructed the driver to stop. Other disinterested witnesses testified positively that plaintiff jumped off while the car was in motion, and one witness testified that plaintiff stated, immediately after the accident, that he got off while the car was in motion. Held, that a verdict for plaintiff was so much against the weight of the evidence as to warrant a new trial. (Fick v. Met. St. Ry. Co., 49 N. Y., Supp. 693.)

NEW YORK.—Decedent was stopped by a street car, whereupon she looked for the approach of a car on the other track, and saw none. She crossed the track as soon as the car had passed and was struck by a car on the other track going in the opposite direction. It was dark, and she held an umbrella to protect herself from a driving wind and rain. Held, it was a question for the jury whether she was negligent in not taking a second look after she had crossed the track at the rear of the car which stopped her.—(Conley vs. Albany Railway, 47 N. Y. Supp. 738.)

UTAH.—A street car company operating electric cars in a public street which increases the hazards and dangers to pedestrians is held to a degree of care proportionate to the increased danger arising from the use of such propelling power. The greater the danger, the greater the care must be to avoid injury.

Where deceased was deaf and dumb, but a well-grown boy, of 14 years, possessing average intelligence and good eyesight, held that, under such circumstances, he was the more bound to use his eyesight, and that the question of his contributory negligence was properly submitted to the jury.

Where it appeared that when the motorman saw the deceased approaching the track, with an evident intention to cross, without seeing the car, the motorman applied the brakes, but they were so defective that they did not work, and he received a shock from the defective motor that delayed his purpose for a second; that he could not stop the car until the injury was done, because of the defective brakes; that the car ran 50 ft. after striking the deceased; that the defendant had repeated notice of the defective brakes and motor, but failed to repair them; that, if the car had been in repair, it could have been stopped within 8 ft.—held, that the defendant was negligent in the use of such car.

If the defendant knowingly placed in operation upon the public street a defective car that could not be controlled because the appliances provided for that purpose were out of repair, and the injury complained of was occasioned by such defective brakes and appliances, and the motorman was unable to avoid the effect of the contributory negligence of the deceased, because of such defects, then it could properly be said that the defendant's negligence was the proximate cause of the injury. (Thompson v. Salt Lake Rapid Transit Co., 52 Pacific Rep., 92.)

NEW YORK.—It appeared that deceased was riding in one of defendant's electric cars with his back toward the front of the car, and his side next to the guard rail along the side of the car nearest the line of trolley poles standing between the two tracks; that, the wind having blown off his hat, he arose, grasped the stanchion of the car at his right hand, and stood for an instant, as though to signal the conductor; that he then suddenly swayed, though he remained standing on the floor of the car, and was struck by a trolley pole. There was also evidence that at the time of the accident the car swayed from side to side, and moved at a dangerous rate of speed. Held, that a finding of negligence on the part of defendant and of freedom from contributory negligence on the part of deceased was justified by the evidence.

On an issue as to the negligent operation of an electric car at the time of an accident, testimony that another car, moving over the same part of the road, a month later, was negligently operated, was inadmissible, where it did not appear that such car was similar to the one on which the accident occurred, or that it was operated under like conditions. (Schmidt v. Coney Island & B. R. Co., 49 N. Y., Supp., 777.)

KANSAS.—A girl 11 years old, going on the track of an electric railroad at a crossing without looking for the approach of cars, cannot, as a matter of law, be held to the same responsibility as an adult, though she was familiar with the running of cars; and the degree of care required by her was for the jury.

In an action for injuries to a girl 11 years old, caused by being struck by an electric car at a crossing, the jury found that she went on a skip to the track, without looking or listening for a car, which could have been seen for a distance of three blocks; that she was "of sufficient age to know the danger attending the running of cars at that crossing;" that she was not "of sufficient age to be charged with the duty of looking out for her own safety in avoiding cars in passing that crossing;"

and that, "if she had looked for the approaching car the accident would not have happened." Held, that such findings were inconsistent with each other and with a general verdict for plaintiff. (Con. & C. P. Ry. Co. v. Wyatt, 52 Pac. Rep., 98.)

NEW YORK.—It is error to refuse a requested charge that, if plaintiff stepped from the car while it was in motion, verdict must be for defendant, where the action is for injury received while alighting from a street car, and the complainant alleges, and plaintiff's evidence tends to show, that the car came to a standstill before she attempted to alight, and then suddenly started with a jerk, and defendant's proof is directed to this issue alone, and tends to show that the car did not stop, but that plaintiff attempted to alight while it was in motion. (Patterson v. Westchester El. Ry. Co., 49 N. Y. Supp. 796.)

NEW YORK.—The car of a surface railway company, in approaching a cross street, has no right of way superior to that of the driver of a wagon who is there about to cross the car tracks, and, if they are likely to meet, the right of each must be exercised with due regard to that of the other, the duty of each being the same as would be imposed upon the drivers of any other two vehicles in the same situation. (Hergert v. Union Ry. Co., 49 N. Y. Supp., 307.)

MISSOURI.—Verdict in an action by a passenger on the S. Company's line against it and the L. Company for injury received in a collision of their cars, having been against the L. Company alone, it cannot complain that it was made answerable for the high degree of care imposed on the S. Company, as carrier, by instruction that if the jury, in addition to finding that the L Company failed to exercise ordinary care, find that such failure directly concurred with a want of a high degree of care on the part of the S. Company in causing the collision, verdict should be against both defendants.

In an action against two defendants for negligence, instructions as to their liabilities inter se have no place, the issues only involving their duties antd liabilities to plaintiff. (O'Rourke v. Lindell Ry. Co., 44 S. W. Rep., 254.)

NEW YORK.—In an action to recover damages for the death of plaintiff's intestate, it appeared that he was riding south, at a rapid rate, on his bicycle, on Seventh Avenue, between the rails of defendant's westerly track, and behind a south-bound car. When the car stopped at a flag station just above Fifty-third Street, he turned out to the west, when he first came within the line of vision of defendant's flagmen stationed at the intersection of the street and avenue, and of the motorman of a north-bound car just turning westerly into Fifty-third street. He was struck by the latter car, and died from the injuries received. It appeared that great care was observed in the management of defendant's cars at that place, and neither the flagmen nor the motorman were shown to have omitted anything that should have been done to prevent the accident. Held, that the defendant was entitled to a verdict. (Cardonner v. Met. St. Ry. Co., 49 N. Y.. Supp., 527.)

NEW YORK.—In an action to recover for injuries resulting from defendant's negligence, it appeared that at the time of the accident plaintiff was fifty-six years old, and had been engaged on and off for 30 years in the produce commission business, making from $1,200 to $1,500 a year. The business occupied only half the year, and he was temporarily acting as a conductor for defendant, "simply to fill up the winter months," and for such work received $2 a day. His leg was broken in four places; he was confined to his bed for three months; and the injuries sustained practically deprived him permanently of the power to earn a living. Held, that a verdict in his favor for $9,000 was not excessive.—(Furman v. B'klyn Heights R. Co., 49 N. Y. Supp., 194.)

PENNSYLVANIA.—It is not negligence, as a matter of law, for one approaching a crossing of a street railway, in the business part of a city, to go on, though seeing an approaching car, where it is 250 feet away, and he, in order to cross the tracks, has to go not more than a tenth of that distance.—(Callahan v. Phila. T. Co., 39 At. Rep., 222.)

NEW YORK.—While no right of action can be based upon an injury resulting from pure fright occasioned by an accident, yet, if there is also present the essential element of physical injury from which the jury are authorized to say that the damage resulted, then the presence of fear as a concomitant element does not destroy the right of action, but may be considered as an element of damage.

Bartlett, J., dissenting.

So held where an incandescent light globe fell and struck the plaintiff upon the temple, exploding with a loud report and the metal part also fell striking her upon the abdomen with sufficient force to discolor the flesh, and three weeks thereafter a miscarriage resulted.—(Jones v. B'klyn Heights R. Co., 48 N. Y. Supp., 914.)

NEW YORK.—In an action to recover for injuries received by plaintiff's intestate, and resulting in his death, it appeared that he was about ten years of age, and was struck and killed by one of defendant's trolley cars. There was evidence that in attempting to cross the track he fell upon it face forward, at which time the approaching car was about 80 feet away. There was no evidence that he looked to see whether a car was approaching. Held, that it would not, as matter of law, have constituted contributory negligence to attempt to cross the track under the circumstances, even if he had looked, and that, therefore, the failure to prove that he did look was not fatal to recovery.—(Kitay v. B'klyn, Q. C. & S. R. Co., 48 N. Y.. Supp., 982.)

GEORGIA.—One of the plaintiff's most material contentions being that a horse attached to a vehicle in which she was riding became frightened on account of unusual and unnecessary noises alleged to have been made by the defendant's car, and it being, under all the evidence submitted, a question for the jury whether the defendant was or was not in this respect negligent, it was error to charge that there was no evidence authorizing a finding that the defendant was responsible for the fright of the horse, and that, if the animal was in fact frightened by the car, the defendant was not liable therefor, nor for injuries resulting therefrom, unless guilty of some negligence after the horse became frightened.

A city ordinance which, by its terms, manifestly relates exclusively to railroads upon which cars are moved by locomotives propelled by steam, and which regulates the "running speed of trains and engines" within the city limits, has no application to an electric street railroad, and, therefore, is irrelevant in a trial of an action against the latter.—(Hill v. Rome St. Ry. Co., 28 S. E. Rep., 631.)

NEW YORK.—Plaintiff's intestate had been employed by one M. for some months as driver of a wagon. The wagon was peculiarly constructed, so that by backing it against the curb in front of M.'s premises, and turning the front wheels under it, so as to stand at right angles with the body of the wagon, it did not interfere with the passage of the defendant's surface cars, there being a space between the hubs and the nearest rail of the car track of some ten inches. Plaintiff's intestate was familiar with these facts. While in the wagon, thus placed, and when a car about fifty feet distant was rapidly approaching, he attempted to descend on the side towards the track, and with his face towards the wagon. M., who had directed him to come down, saw the car, and heard its bells. While in the act of getting off the hub, plaintiff's intestate was struck by the car. Held, that the facts established contributory negligence, as matter of law. Williams, J., dissenting.—(Crawley v. Met. St. Ry. Co., 48 N. Y. Supp., 863.)

PENNSYLVANIA.—Act April 4, 1868 (P. L. 58), § 1, declaring that when any person shall be injured while lawfully employed on the road of a railroad company, of which company he is not an employee, his right of action against it shall be only as he would have if an employee of it, has no application to the case of a conductor of one street car company injured while in his car on the tracks of his company by collision with the car of another company, caused by the negligent attempt of the motorman of the latter to cross in front of his car.—(Wetzel v. Phila. Tr. Co., 39 At. Rep., 1.)

NEW YORK.—Plaintiff, while driving a heavily loaded dirt wagon over one of defendant's cable-car tracks, at a cross street, was struck by an approaching car. Upon the trial of an action to recover damages to his person and to his horses and truck, the questions of fact as to defendant's negligence and plaintiff's freedom from contributory negligence were close. In charging the jury, the court said: "They were bound to use the same degree of care—the same degree of prudence. Each was bound to look out for, and, if possible, prevent any accident." Held, that this was erroneous, as tending to make the defendant an insurer of safety, especially in view of the court's refusal to charge that "the defendant's gripman was not bound to stop the car when he first saw plaintiff."—(Reardon v. Third Ave. R. Co., 48 N. Y. Supp., 1005.)

MICHIGAN.—Plaintiff drove on a street crossing in front of one of defendant's street cars, which was about to pass over the crossing, and which he could have seen if he had looked. He was seen by the motorman as he was about to enter on the track. From that time on the motorman did all in his power to stop the car, and prevent collision, but the car struck plaintiff's wagon, and injured him. Held, that a verdict should have been directed for defendant.

Where plaintiff in an action for injuries was guilty of contributory negligence, he cannot recover by showing gross negligence by defendant.—Borschell v. Detroit Ry., 73 N. W. Rep., 551.)

MINNESOTA.—Evidence considered, and held, that it was sufficient to take the case to the jury upon the issue as to the incompetency of the defendant's gripman, and whether it had notice thereof prior to the accident here in question.—(Morrow v. St. Paul City Ry. Co., 73 N. W. Rep., 973.)

NEW YORK.—Decedent was stopped by a street car, whereupon she looked for the approach of a car on the other track, and saw none. She crossed the track as soon as the car had passed, and was struck by a car on the other track going in the opposite direction. It was dark, and she held an umbrella to protect herself from a driving wind and rain. Held, it was a question for the jury whether she was negligent in not taking a second look after she had crossed the track at the rear of the car which stopped her.—(Conley v. Albany Ry., 47 N. Y. Supp., 738.)

PATENT DECISION.

The Sprague patent, No. 324,892, for an electric railway motor, consisting of a field magnet, journaled, at one end, on the axle of the driving wheels, and hung, at the other, on a spring from the truck or car body, and carrying the armature shaft upon its pole pieces parallel with the shaft of the driving wheels, and connected to them by gearing, held valid as to claims 2, 6, and 9; and said claims held infringed by structures differing in some respects from those of the patent, and containing improvements thereon, but having all these parts working together in the same relation, for the same purpose, and producing the same result. (Sprague El. Ry. & Motor Co. v. Union Ry. Co., 84 Fed. Rep., 641.)

The Circuit Court of the United States for the Eastern Division of the Eastern District of Missouri, has rendered a decision in the case of William Wharton, Jr. & Company, Inc. vs. the Lindell Railway Company, of St. Louis, for infringement of the complainant's letters patent No. 505,075, dated Sept. 12, 1893, awarding decision to the complainant and decreeing the validity of the patent. The patent was one on the use of unbroken main line switches, and as the complainant waived account of damages, they were assessed at $1, with $1 costs.

Municipal Ownership by Street Railways

Under this title a correspondent from one of the Southern States humorously writes us:

For some years the street railway fraternity has been considerably worked up by certain well-meaning political economists, who have insisted that it was desirable to effect municipal ownership of street railways. Just why this subject has so worried the railway men I am unable to state, because, as every one knows, most of the street railways are now practically owned by the municipalities. Anyhow it has worried them, and worried them badly, so much so that they have gone to any amount of trouble to prove their position in the matter. Now, however, all their worry ought to vanish, for a saviour has appeared, and all that is necessary is to follow his example.

The saviour in question is not really a "he." It is more properly an "it," for it is none other than a prominent railway in our own favored South. The company, acting under the old saying "It is a poor rule which won't work both ways," has reversed the order of things, and has effectually set the economist and his followers to do the worrying. To prove my words, I will recite you a little bit of history which occurred not many days back:

Some months ago a small road here discovered a route by which it could enter the heart of the city and secure much better terminals. With exquisite verdancy this company actually went and applied to the City Council for a permit to lay its tracks on the street selected! Its petition, like many others, was referred to the committee on street railways, and, as might have been expected, was soon sweetly slumbering in a nice little bed, prosily called a "pigeon-hole."

About two months later another and much larger road decided that it would occupy the street in question, and with more wisdom than the first-mentioned road, proceeded to order rails and special work and to make active preparations for constructing the track. After the material had arrived the president of the large road, in a moment of absent mindedness, so far forgot himself as to appear before the council, where he demanded a permit be given him immediately. With fear and trembling the permit was made out, and was just about to be handed to him when some member of the Council awoke and said something about the petition of the small road. At this piece of foolishness Mr. Large President jumped angrily to his feet and told the Council that he had ordered his material, and that if he did not get the permit he would have to pay storage on it. When this telling argument had been finished the Council apologized in a body, and declared that he should have the permit at once. Mr. Little President then demanded to know why he had been refused the permit, when his petition had been before the Council months before.

"Have you ordered your material?" asked the Mayor.

"No, I have not. I was waiting for the permit," was the answer.

"Well, if you have not ordered your material you won't have to pay any storage on it, if you do not get the permit, while Mr. Large President will have to pay storage if he does not get the permit."

As this argument could not be answered, Mr. Little President left the Council chamber a sadder and wiser man, while Mr. Large President went away feeling as a wise man should. Several days later active work was commenced by the company represented by Mr. Large President.

Many a road would have adopted the slow method of laying one track and then laying the other, but the road in question did nothing of the sort. Instead the street was torn up from curb to curb, and the residents were told that if they wanted to get to their houses or offices they could enter by the back way. After working a few days a line of city water mains was found to be in the way, and it was necessary to lower them before the ties could be placed. This was an easy matter, for under the new order of things all that was necessary was to notify the city and warn them that the mains must be moved. This was done, and in a short while the city laborers had sufficiently lowered the mains, and the laying of the ties proceeded.

Again everything went well for a few days, when another obstruction was met in the shape of an old artesian well, which the city had condemned and walled over. Before thinking, Mr. Large President set his own men to work taking the top off this well, and in a short while the top was removed. But alas, this was not the end of the trouble, for, when the top was removed, it showed a large reservoir, which was filled to the top with water. This last obstruction to laying the tracks was too much, and the city water authorities were notified to come to the scene at once and empty the well. It is needless to say that the summons was answered, and in less than a day the water was drawn off and the laying of the tracks proceeded. The tracks are now completed, and the city has been notified to relay the Belgian blocks, which, of course, it will do.

This is, in brief, the story I have to tell, and I think you will agree with me that the best solution of the problem of municipal ownership *of* street railways is municipal ownership *by* street railways.

The American Street Railway Association

T. C. Penington, secretary of the American Street Railway Association, is sending out a circular letter containing the following additional information relating to the securing of space and the shipping and marking of goods intended for exhibition at the convention of the American Street Railway Association, to be held in Boston, Mass., on Sept. 6, 7, 8 and 9:

Space must be applied for by Aug. 1. Assignments will be made as promptly as possible after that date, and exhibitors notified of their location. Exhibits of like character will be grouped together and space will be assigned in the order of application. It is earnestly requested that all exhibits shall be in place and all work finished by Monday evening, Sept. 5, which is the evening prior to the opening of the convention. Watchmen will be in charge of the premises, so that exhibits will be safe. All goods should be marked, to the shippers' name, "Mechanics' Building, care of R. S. Brine & Company, 33½ India Street, Boston," who should be notified by bill of laden or advice that the goods have been shipped in their care, giving particulars in regard to shipment, and the goods will be delivered to the proper space in the exhibition hall.

The local committee in Boston is in receipt of a letter from the Massachusetts Charitable Mechanics' Association, which association will hold a mechanics' exhibition from Oct. 10 to Dec. 3, 1898, in the same hall as the street railway exposition will be held. This letter states that the Mechanics' Association will be pleased to make arrangements for having as many as possible of the street railway exhibits left in place for its exposition. All communications regarding this should be addressed to Henry D. Dupee, secretary executive committee Massachusetts Charitable Mechanics' Association, Boston, Mass., who will furnish rules and conditions.

Street Railway Accountants' Association

Full arrangements have been made for the next meeting of the Street Railway Accountants' Association of America, to be held in the Charitable Mechanics' Association Banquet Hall, Boston, Mass., Sept. 6, 7, 8 and 9, 1898. This association will meet at the same time as the American Street Railway Association, using a smaller room in the same building in which that association will hold its meetings. The headquarters of the Accountants' Association will be at the Hotel Brunswick. A number of papers of unusual interest to street and interurban railway accountants will be presented at this convention, and also a large assortment of accounting blanks and forms will be on exhibition. It is intended to make this latter feature of the meeting an extremely interesting one, and it is earnestly hoped that each member will send an assortment of blanks, even though he cannot be present in person. The papers already decided upon are, "Statistics—Their Use and Abuse," "Car Mileage—How Arrived At, and Its Use." The report from the permanent committee upon a standard system of street railway accounting will also be presented.

International Convention at Laredo, Tex.

The first international convention of representatives of electric light, gas and street railway interests of Mexico and Texas was held at Laredo, Tex., on March 9, 10 and 11. Unusually interesting and valuable papers were presented, and a good-sized exhibition was made by the supply men. The delegates present formed themselves into the Southwestern Gas, Electric and Street Railway Association, to embrace particularly the territory of Texas, Mexico, Louisiana, Indian Territory, Oklahoma, Arkansas and New Mexico. The following officers were elected for the ensuing year: President, Carl F. Drake, Austin, Tex.; first vice-president, J. H. Fitzgerald, Houston, Tex. (to represent the gas interests); second vice-president, E. Dysterod, Monterey, Tex., (to represent the interests of the electric lighting fraternity); third vice-president, W. H. Weiss, San Antonio, Tex. (to represent the street railway interests); treasurer, F. Rries, San Antonio, Tex.

The addresses at the meeting were translated and delivered by Louis de Antin, Superintendent Public Schools of Laredo, Tex., the English addresses being translated into Spanish, and vice versa. A number of the papers presented will be found on another page of this issue.

NEWS OF THE MONTH

The cars of the Salt Lake City Railway Company, of Salt Lake City, Utah, are now being operated by power furnished by the Utah Power Company. This latter company owns a large power house situated in the mouth of Big Cottonwood Canyon, this plant being operated by water power derived from the Cottonwood Creek. The power house is equipped with two Westinghouse generators of 1000 h.p. each, direct-connected to Pelton water wheels. The current is generated at about 400 volts, and by means of step-up transformers is raised to 12,000 volts for transmission to Salt Lake City, a distance of about fourteen miles. At the station of the street railway company, the current is reduced to about 500 volts by means of a rotary transformer.

A verdict for unusually heavy damages was rendered in a Brooklyn, N. Y., court recently, the amount being $25,000. The verdict was rendered against the Brooklyn Heights Railroad Company in a suit brought by a woman whose husband was killed by one of the defendant's trolley cars.

The question as to the proper speed for street cars in cities is being agitated in Europe as well as the United States. The Dublin (Ireland) Southwestern District Tramway Company has petitioned for permission to increase the speed of its cars in the city, but the petition is being quite vigorously opposed. Some of the opponents of the company think that the speed should be limited to 2½ miles an hour within the city limits.

The St. Louis, Belleville & Suburban Railway Company, of East St. Louis, Ill., is building an interurban road between the Eads Bridge in East St. Louis and Belleville, Ill., a distance of fourteen miles. It is expected to have this road in operation by April 15. This company will charge a fare of 10 cents on commutation tickets between Belleville and East St. Louis, while the charge for a single trip will be 20 cents. The officers of the company believe that the only way to make an interurban railway successful is by reducing the fare to the lowest possible point, at least until the road becomes popular, when the increased amount of traffic handled will repay the owners of the road what is lost in the beginning by the low rates. This company's rate is probably the lowest fare for the distance traveled charged on any interurban electric railway in this country.

The Boston Elevated Railroad Company, Boston, Mass., has recently awarded a $1000 prize, which it offered for the best design for the new elevated railroad stations to be erected by this company. The prize was awarded to A. W. Longfellow, Jr., an architect of Boston.

Considerable interest was aroused in the vicinity of the offices of the Metropolitan Street Railway Company, of Kansas City, Mo., one day recently, by the arrival of 10,000,000 new transfer tickets. This is probably one of the largest single shipments of transfer tickets for use on a street railway ever made.

All the street car lines of the city of Saginaw, Mich., were tied up recently on account of a strike of the employees.

The Nashville (Tenn.) Street Railway Company has decided to build a number of new cars in its own shops. This company is now building a car which is nearly completed, which it is expected will give complete satisfaction.

The Union Traction Company, of Anderson, Ind., is arranging to put into service a new method for conductors to collect fares, both on its interurban and city lines. Under the new method, conductors will carry small boxes into which the passengers will drop their fare. It is thought this new system will prevent dishonesty upon the part of the employees of the road and will also make it unnecessary for conductors to make out daily reports.

The Duluth (Minn.) Street Railway Company is equipping its cars with fenders.

The Chicago, Milwaukee & St. Paul Railroad has asked the Common Council of Chicago for permission to change the motor power on its Evanston suburban line to electricity or compressed air. The ordinance was referred to the committee on railroads.

It is reported that the magnetic observatories at Toronto, Ont., and Washington, D. C., have been rendered useless, owing to the disturbing effects of electric railway currents in the vicinities of each.

The second annual ball of the conductors and motormen of the Pawtucket Street Railway Company was held Feb. 14, and was an unusually successful and pleasant affair.

It is announced that the Erie Railroad is making a number of tests with a combination steam and compressed air motor, with the view of adopting this motor on several of its branches. According to reports, the motor is so arranged that steam may be used entirely as motive power, compressed air may be used entirely, or there may be a combination of steam and compressed air used. It is stated that while working with this combination, the motor attained a speed of fifty-five miles an hour during a recent test.

J. S. Polk, president of the Des Moines Street Railway Company, recently delivered an address on the subject of municipal

ownership, before the Des Moines Union Municipal League. Mr. Polk is opposed to municipal ownership, and gave a number of strong arguments to support his position. Mr. Polk thinks if municipal ownership of public plants is once commenced, it will be difficult to draw a dividing line. He says in substance, if a city can own its electric lighting and street railway plants, it may also own and operate hacks and transfer wagons, hotels, banks, department stores and every other business carried on in the city, or in other words it may absorb the entire business of the city.

It is evident that the service given by the electric cars of Brooklyn, across the Brooklyn Bridge, is extremely popular, as all the cars crossing the bridge are usually full to their utmost capacity.

The Third Avenue Railway Employees' Mutual Relief Association, of New York, is one of the largest and most prosperous relief associations connected with any street railway in the country. The treasurer's report, which was submitted at the last annual meeting of the association, showed for the year ending February 28, 1898, gross receipts, $15,976; disbursements, $8758; cash on hand, March 1, 1898, $7218. This is an increase in surplus of $2631 over the previous year. At the annual meeting the following officers were unanimously re-elected, two or three of these gentlemen also being officers of the Third Avenue Railway Company: President, John H. Robertson; vice-president, Isaac Hough; treasurer, J. Beaver; secretary, Charles C. Swertfager; sergeant-at-arms, Samuel A. Jessup.

The Brooklyn Rapid Transit Railway Company has recently made a number of changes in its operating department. As announced in another column, J. T. Whittlesey has resigned as chief engineer, and has been succeeded by J. C. Brackenridge. The track department of this system will hereafter be combined with the electrical engineering department, and the chief engineer will have charge of all construction and maintenance of track, overhead line work, power house, repair shops, car equipment and buildings. The motor repair shops and the car cleaning at the various depots will be under the direction and control of the general superintendent.

The Market Street Railway Company, of San Francisco, Cal., has issued a good-sized circular, giving the history of this company's experiments with different kinds of fenders. This circular was published for the consideration of the people of San Francisco, in view of the criticism which has been made upon the Market Street Railway Company for not providing a fender that would save life in all cases. This circular proves conclusively that this company has done all in its power to secure a perfect fender, and will be of interest to all street railway companies that are interested in the fender question.

It is interesting to note that an electric railway in Ohio is being operated entirely under the management of a woman. C. E. Mitchener, the owner of the Tuscoraras Railroad, an electric railway in Tuscaroras, Ohio, was called West on business matters and during his absence has placed the entire management of the road in the hands of his daughter, Miss Mitchener.

The entire street railway system of Houston, Tex., which is controlled by the Houston Electric Street Railway Company, has been tied up by a strike of the employees. The attitude of the strikers has been so threatening that the company has not made many attempts to run cars as proper police protection could not be secured. While endeavoring to get the road into operation with non-union men, H. C. Chase, secretary and treasurer of the company, was badly injured on the head by a striker.

The Legislature of New Jersey has passed a bill providing that street railroad franchises may be granted for a term of seventy-five years by ordinance, and that the company receiving the same be required to pay a percentage of the annual gross receipts to the municipalities through which the road passes.

The Cincinnati, Newport & Covington Railroad Company has recently issued its annual report for the year ending December 31, 1897. This report is printed in the form of an exceedingly tasteful little pamphlet, which is bound in heavy yellow paper with deckel edge. The report shows that the gross earnings for 1897 were $638,477; operating expenses, $427,280; net earnings $211,197; and net surplus, $28,125. Ratio of operating expenses to gross earnings was 47.83 per cent.

The Metropolitan Street Railway Company, of New York, does not require collateral or bonds from its employees when they enter its service, except a deposit of $2 for badge, buttons and a conductor's punch; the deposit being returned to the men when they leave.

Foreign Notes

It is interesting to note that the tramway lines of Buenos Ayres, S. A., are deriving quite an income from the rent of advertising space in their cars. The advertising privileges are all leased to one company, which sub-leases the spaces in the different cars. The rates charged to merchants for advertising in the different companies' cars are as follows:

Companies.	No. of Coaches.	Terms for 12 Months.	Passengers. per Month.
Anglo-Argentina	450	$300	2,274,804
Gran Nacional	220	200	819,316
La Nueva	120	160	341,723
B's A's & Belgrano	130	180	475,172
Metropolitano	70	120	279,512
La Capital	70	120	283,614

A great many European firms carry cards in the cars of this city as well as the local merchants.

The municipal authorities at Warsaw, Russia, are inviting proposals for supplying the town with electrical power for purposes of lighting, tramways, etc. Applications should be addressed to the president of the town of Warsaw, from whom particulars can be obtained. As the proposals will not be considered until August there is ample time for the American manufacturers and contractors to submit their prices after the rules, regulations and conditions have been sent them.

The annual report of the Dunedin Street & Suburban Tramway Company, New Zealand, for the year ending Nov. 30, 1897, shows receipts from passengers and mails to have been £20,528 15s.; receipts from other sources, £397 5s, making a total of £20,926 1s. The operating expenses were £18,433 17s; surplus, £2492 4s. This shows an increase of revenue over last year of £2714 14s.

La Capital Tramways Company, Ltd., has been registered by Budd & Company, 24 Austin Friars, London, E. C., with a capital of £100,000, to acquire the benefit of a certain tramway concession granted by the municipality of Buenos Ayres, in the Argentine Republic, for the construction and working of tramway lines in the city of Buenos Ayres, from a point on the tramway system of La Capital Tramways Company, to Mataderos, to undertake and carry on the same, to work such tramways by horse, steam, electrical or other power, and to carry on the business of an electric light and power company.

The Gas and Electric Committee of Bradford, England, has arranged to commence laying supply cables in connection with the projected electric tramways to Great Horton and Bolton. At the same time provision will be made for lighting the routes by electricity.

The Manaos Railway Company has been incorporated under the laws of the State of New York to construct and operate 20 miles of steam or electric railroad in the city of Manaos and elsewhere in the State of Amazonas, Brazil. The capital stock is said to be $500,000. The directors are A. J. Moxham, of Lorain, O.; A. N. Brady, of Albany, N. Y.; C. R. Flint and E. C. Converse, of New York City; J. W. Scott, of Orange, N. J., and F. E. Hebbelthwaite, of Manaos, Brazil.

A report recently submitted to Parliament shows that there were on June 30, 1897, 1031 miles 31 chains of tramways open in the United Kingdom, 367 miles 63 chains belonging to local authorities, and 663 miles 48 chains belonging to companies and other bodies. On tramways belonging to local authorities there had been a capital expenditure on lines and works open for traffic of £3,222,438, with a total expenditure on capital account of £4,459,488. On tramways belonging to other than local authorities there had been a capital expenditure on lines and works open for traffic of £8,177,735, with a total expenditure on capital of £10,405,622.

At a recent meeting of the Matlock, Eng., Town Council, Sir George Newnes presented the undertaking known as Matlock Cable Tramway Company to the town. The gift is worth £20,000, and was unanimously accepted.

An electric tramway running east and west across Berlin, Germany, taking in the Leipziger Strasse and traversing the Potsdamer Platz, the busiest thoroughfares in the city, was recently put in operation.

Chilian parties have recently formed a company in London to light Santiago with electricity, and also to run the present horse car lines, at the same time furnishing power to industries depending on coal. Another company is at present being formed for the same object for the port of Valparaiso. This latter city has a population of 100,000 and Santiago 200,000. It is generally believed that these companies will give an impetus to the use of electricity, and although British capital will back the enterprises American manufactured material will be much used.

The Town Council of Bristol, Eng., has appointed a committee to renew negotiations with the Tramways Company with reference to the electrical equipment of the tramways now worked by horses. The company has a bill in Parliament asking for powers for this purpose, and they will persevere with it whatever attitude the corporation assumes.

Consul Jackson, of Cognac, France, reports that the city of Niort proposes to construct an electric railway and to light its streets with electricity. Communications should be addressed to Monsieur le Maire de la Ville de Niort, Deux-Sèvres, France. There is also a movement on foot to connect La Rochelle and La Pallice, by an electric line 2½ miles long. Communications should be addressed to Monsieur P. W. Morch, Chamber de Commerce, La Rochelle, France.

An electric tramway is projected in Yarmouth, Eng. The Yarmouth & Gorleston Tramway Company proposes buying up a local omnibus company, and transforming the stables into an electric generating station.

A resolution has been passed by the stockholders of the Bristol Tramway and Carriage Company (Ltd.), of Bristol, England, looking to the conversion of the present horse-car lines to electricity and the extension of the present routes. C. H. Low is chairman.

Foreign Tramway Visitors

A party of four engineers of the Chemin de Fer D'Orleans, of Orleans, France, is now in the United States making a very extensive inspection of electric railways and also investigating the advantages of equipping railroads already operating by steam with the third rail electric system. The names of the engineers are Victor Sabouret, Henry Valton, Charles De Fremenville and Alfred Hibertz. It is stated that if these gentlemen find that the problem of equipping steam roads with electricity has been successfully solved in this country, that electricity will be introduced to a large extent on the steam roads of France.

Electrical Orders from South America

A New York daily newspaper prints the following: "Constant orders are being received from the Argentine Republic for electrical material of every description; and, as the developments in this line are being undertaken with considerable energy, parties well informed on the subject say that the continuance of trade will be uninterrupted so long as the prices of the American manufacturers can advantageously compete with those of European makers. What the Americans should try to increase in the electrical line with Argentina is telephone and telegraph supplies. Communications received show that England still controls more than 75 per cent of the trade. In the large apparatus for electric lighting and railway work, however, America is making good progress at securing the trade. American manufacturers have already equipped the largest electrical roads in the country. The last report shows that American supplies are being almost exclusively used in the equipment of La Capital electrical railway of Buenos Ayres. The rails are 9-in. 90-lb. grooved girder, made by the Johnson Company; the bonds, Edison-Brown plastic and Syracuse soldered; the entire rolling stock was built by the J. G. Brill Company, is mounted on Brill trucks and equipped with General Electric motors. The iron poles were furnished by Morris Tasker & Company, and the overhead material by the H. W. Johns Company. In the power-house three vertical Ball & Wood engines are coupled direct to Walker generators of 300 k.w. each. Steam is supplied by four Stirling boilers of 250 h.p. each. The plant includes Green's fuel economizer, Conover's condenser and two Worthington pumps. A portion of the system is already in operation with 41 cars."

Death of Nelson W. Perry

Mr. Nelson W. Perry, at one time editor of "Electricity," and a very well known electrical investigator, died at his home in Brooklyn, N. Y., on Sunday evening, March 27, at 7 o'clock. Mr. Perry was performing an experiment in a dark-room, and accidentally drank a glass of bichromate of potash thinking it was a glass of water.

Consolidation in New Jersey

The stockholders of the Consolidated Traction Company, of New Jersey, on March 28, voted to lease their franchises and plant to the North Jersey Street Railway Company. The leased company is capitalized at $15,000,000, and the lease provides for a guaranteed dividend of at least 2 per cent for the first year and a slight annual increase for eight years. When the lease is consummated, which will be in the course of a few weeks, the North Jersey Company will control all the trolley lines in the northern part of the State with the exception of those operated by the North Hudson County Railway Company in Hoboken, Jersey City Heights, and the northern section of the county.

New York Electrical Society

The New York Electrical Society, one of the best-known societies of its kind in this country, was organized in 1881 for the advancement of electrical knowledge and the study of electrical and other scientific phenomena. In carrying out this purpose the endeavor of the officers of the society has been to make it a help and a stimulus to young electricians and an up-to-date means for the general public of discussing and illustrating the most recent and interesting developments in electrical work. Any person of good repute who is connected with or interested in electrical work is eligible for admission to the society.

The New York Electrical Society, in accordance with its aim to be of the greatest possible value to the electrical industry, has taken a great interest in the electrical exhibition to be held May 2 to May 31, 1898, at the Madison Square Garden, New York, and this exhibition will be held under its auspices. The society has recently issued a neat circular, giving a list of the subjects which have been treated at its principal meetings.

Rail Bonding as a Power Saver*

By H. C. Chase

I believe that few managers of street railways realize what their loss on account of poor bonding amounts to annually. The losses appear in various ways, principally, of course, in the direct loss due to energy required to overcome the resistance in the track. On many roads with a station voltage of 550 the average over the whole line is not over 400, or a direct loss of 27.8 per cent, while at distant points it may be as low as 350 or 300 volts, a direct loss of 36.3 and 45.4, respectively. Let us consider what a loss of 15 per cent on the track means to the railway company in dollars and cents. Take a road operating twenty-five cars daily, and assuming that fuel costs $1.25 per car per day, or $31.25 as total cost per day, which will give us $11,426.05 annually. Now, 15 per cent saved on this amount equals $1,710.92 annually, or 5 per cent on an investment of $34,218.75. In addition to the direct loss above referred to in fuel there are losses due to burning out of the electrical equipment, an item hard to estimate, but it is safe to say that 75 per cent of the burn-outs of armatures and fields on electric cars are due to the insulation on wires becoming overheated, and therefore are weakened by being subjected to a current for which they were never intended. A motor wound for 500 volts to develop 25 h.p. requires 37.3 amps. It will carry that amount of current without injurious effect, but to do the same work with only 300 volts requires 62 amps., a current for which the motor and fields were never intended, and which they cannot stand for any length of time without danger of the resistance becoming injured through excessive heating.

The Houston Electric Street Railway Company is using No. 0 tinned copper wire, with 19-32-in. channel pins. Nearly two years ago we placed some bare copper and tinned copper No. 0 bonds in our track as an experiment. I recently took pains to look at them. The bare copper wire was nearly eaten through by corrosion. The tinned copper wire was as bright and perfect as the day it was placed in the track. We are using the bonds both alongside and underneath the fish-plates. We find that if special care is used in drilling the rails, inserting wire and channel pins, driving flush to web of rail, there is little chance for moisture to enter. During the month of January we had two or three blocks of double track removed and replaced with 60-lb. steel, operating cars on both sides of reconstruction work. Before the completion of track and bonding our ampere meter indicated 500. After completion of track, and thoroughly bonding the same, our meter showed an average of 450, a reduction of 50 amps., and a saving of 10 per cent, lessening the load to the generator, consequently reducing the fuel expense. This proved to us what we could do on one line by thoroughly bonding the track.

We have double bonded the track entering both ends of the car shed, also all lines in close proximity to the power station, In addition we run an overhead No. 0000 ground feeder, tapping the different lines at equal points and the belt lines on all sides, and we find our fuel bill has been reduced 30 per cent, and the load easy to carry and comparatively free from violent fluctuations. Our Franklin Street line runs close to the power house, and several lines are connected with it. We double-bonded each joint on this line. When we reached San Jacinto Street, three blocks from the power house, the ends of the rails commenced to arc, and it was with great difficulty our men could drill the rails and insert the bonds. After the remaining three blocks had been thoroughly bonded, the drop in the load at the power station was perceptible at once, showing conclusively the necessity of good ground return. We have had some trouble in keeping our overhead ground feeders connected with the rail. They have been burned off several times at the rail connection. We find the trouble was caused by using too small contact, and accordingly we increased the contact circuit by attaching the ground feeders to both rail and bond wires, and have had no trouble since this was done.

Rail-bonding as a power saver depends upon the following three points: first, bonds to be of ample capacity; second, perfect connections; third, large contacts.

Trucks and Their Maintenance*

By George D. Hartson.

The truck bears about the same relation to the equipment of a car as the management does to the road; it receives the blows, shocks and strains from the hard conditions in which it may be placed and delivers them softened and equalized to the traveling public in the form of comfort and pleasure. It is the court where justice is turned to mercy.

The first or incipient attempts at trucks were simply pedestal boxes fastened to the car body to furnish bearings for the axles, but now they are built to support and strengthen the car sills and protect the car and its load from the blows, jars and strains of severe service. Much work and cost of maintenance can be saved by a careful selection when getting equipment.

The first quality to look for is strength—ability of the parts to hold up and last. They should be braced so strong that they will stay in line and hold the wheels in line both on straight track and in going around curves. It is almost certain that sharp flanges and double treads are caused by the trucks allowing the wheels to get out of line.

The second is simplicity. A solid side bar is better than one built up of pieces bolted or rivcted together, for it is almost needless to remind you that every bolt, nut, rivet or joint calls for inspection and attention or it will be only a matter of time when they will work loose and repairs, if not worse, will be necessary. The fewer pieces, the less attention will be required.

The third point is convenience. Some trucks seem designed so that you can only get at the renewable parts in your mind and hardly with tools. To hang a motor it is necessary to take off the car body, and to replace a pair of worn-out wheels will take all hands half a day, and to renew a brake shoe the car has to go over the pit. Motors must be inspected and overhauled, wheels will wear out and must be changed, and brake shoes must be renewed; and speaking of brake shoes—when will the truck maker win the lasting gratitude of the motorman and shopman by arranging an adjustable brake spring to let out as the shoe wears thin? Many a broken brake spring and many a cracked rib have been the results of the usual "once for all" spring in common use. The spring should have an adjustment of at least 1½ in. to allow for wear of the brake shoe and wheel.

The fourth quality, and an important one, is its riding quality. Some trucks ride easily at no load or light load, and others ride easily only when the car is loaded. A happy combination is one not too stiff when light and not "hard down" when loaded. The springs of a truck should have a short memory, a pitch hole in the track should not be repeated over and over again by the springs after the rough place has been passed. From common practice it appears necessary to have both coil and leaf springs.

The area of brake shoe surface should be sufficient to stop the car, but not enough to cause the wheel to slide. Many patterns of shoes could be shortened with safety in running and longer life to the car wheel.

The lubrication of the axle is better accomplished by oil and wick feed than by heavy grease. Who has tried roller bearings and gained experience from their use?

In closing, I will suggest a question: Why can there not be a standard axle—standard in length, at least, if it is impossible to be standard in diameter?

Car Bodies; Their Maintenance and Repair*

By Frank E. Scovill.

The cost of maintenance and repairs of car bodies is on the same basis as that of any other part of the equipment, a great deal depending on the original purchaser and the honesty of the builder.

To maintain car bodies properly every system should have at least one extra body to every five cars in service in order to be able to spare one or more at any time for repairs. They should be frequently examined and great care should be taken to prevent the bodies getting loose in the joints or otherwise seriously injured before having proper attention, as in that case the expense of repairs will be much greater and the life of the car be very much reduced.

Car bodies that are used in this climate must of necessity have more attention and greater care than those used in most other parts of the country, owing to the long and continued hot seasons. The hot sun of this climate is exceedingly hard on wood work and paints. Continued drought, often lasting five or six months at a time, causes joints to open and paint to crack and peel, and in many sections of our State the alkali or lime dust is very destructive to the interior finish of the car, and experience has taught us that plush or cloth cushions are in all cases to be avoided.

It is our belief that the only way that car bodies can be properly and economically maintained is to put them first in as good and strong condition as it is possible to do, using only the very

*Abstract of paper read at the Meeting of the Texas Street Railway Association.

*Abstract of paper read at the Meeting of the Texas Street Railway Association.

best grades of materials, including paints and varnishes, and to employ for this work only thoroughly competent workmen. Cheap labor is always dear at any price. To paint a car properly is an art in itself, and requires judgment and experience. A few cents added to the cost of material or to a day's labor may give the car an extra year of service.

All car bodies should go into the shop once each month and have the bolts and screws tightened up, and at least twice each year all marred and grazed spots should be touched up with paint and the body be given two coats of good varnish. This will preserve the paint, and the car will look nearly as well as when it first came from the repair shop. In this way car bodies can be kept in good condition for four or five years even in a climate like this. Owing to the small rail, low joints, bad track and generally faulty construction, which is the rule rather than the exception in the cities in this State, it is especially necessary that extraordinary care and diligence should be used in the repair and maintenance of car bodies.

When first appointed superintendent of the Austin Rapid Transit Railway I found the cars in a very dilapidated condition. Five of them were closed, and the others were open cars rebuilt and partially closed. We have rebuilt the closed cars after a style peculiarly our own, and which we find excellently adapted to the conditions that surround the operation of our property, but which might not be as satisfactory for others whose necessities are not identical with ours. We are fortunate at Austin in having streets that are wide enough to accommodate the travel of a much larger city, and the few extra inches taken up by the steps of this style of car are not noticed more than with open cars. The balance of the old cars were turned into animal cages at the park and sleeping rooms for our men.

When our road was rebuilt for electric service pine ties and light rails were used and after five years' service you all know the result, the car bodies telling the tale. The consequence was that at the time the whole system was like the wonderful "one horse shay," going to pieces all at once. Our people were made to realize the necessity of doing something, so we began, a little at a time, and now we are in a fair way to have a good roadbed and to be able to keep up our rolling stock at much less expense than before, we having used over 18,000 cedar ties in the past two years.

With the rebuilt cars, we run a new sill under the entire length of the car, platforms and all. This had to be done on the first three in order to hold them together, and this sill has an iron plate ⅝ x 3½ ins. bolted on the outside of the entire length of the sill, thus making a strong support for the lookout platforms. The first ones of this style have been in service for over a year and a half, averaging 140 miles per day over the poorest piece of our track. To operate these cars we use a single G. E. 800 motor equipment, and the cars to-day show no signs of breaking away at any point. We purchased several light closed second hand bodies late in 1896. We ran them through the winter, then decided to rebuild them after the manner of others that were giving such excellent satisfaction, and to-day our closed bodies, excepting two purchased in December last, are after this style. The cost of this work, including material, labor and supplies, besides adding many improvements, was a trifle over $200 per car, and the first cost of these bodies to us delivered in Austin was not that much. We consider that we have a good and reasonably cheap lot of car bodies.

You will notice that our steps are the same as the running board on open cars. This will accommodate about as many passengers to and from our parks and in crowds as an open motor would, and remembering that we take power on a meter basis we do not care to haul trailers more than is absolutely necessary to accommodate the travel. Some of you will ask, are you not more liable to accidents by this manner of handling passengers? We answer no, as the facilities for hanging on are just the same as on open cars, and for over two years our claims for damages have been less than $1000 and over one-half of this amount was due to a lady falling out of an open car, and the balance was principally for broken vehicles, etc. We operate all closed motors with fare boxes now, and use trailers with conductors when necessary.

It is my belief that by the time our cars now in use are worn out there will be great improvements in the construction of bodies. I believe that steel I-beam construction will be almost exclusively used, reducing the dead weight and adding much strength to the bodies at possibly a smaller first cost and at a greatly reduced maintenance expense.

There has been a disposition in the past on the part of our Legislature to somewhat hamper the operation of street railways, and some three or four years ago there was introduced in the Legislature of this State a bill to force all systems to operate either open or closed cars during certain months of the year, thus necessitating a double equipment, something no line can afford, and had this measure become a law it would have forced us to materially contract our service, much to the inconvenience of our patrons and at a material loss to ourselves, and we hope that every representative of a street car line in Texas will make it his business to become acquainted with the member of the Legislature from his district and so educate him as to our needs and to the great number of evils that now surround us and hamper our growth and development that he will see the necessity of assisting us rather than to add further loads to our already overburdened shoulders. Municipal governments also seem disposed in some cases to adopt a similar course, and we believe as much to the detriment of the people as to themselves.

Ties, Their Life and Preservation*

BY D. D. WILLIS.

The ties used by the street railways of our State are, for the most part, pine, though some few roads have in the past few years tried other woods. When the San Antonio street railway was first built in 1877 a part of the track was put down on sawed cedar ties 6 ins. x 4 ins. x 6 ft. When the road was equipped for electric traction in 1890, all pine ties, 7 ins. x 6 ins. x 6 ft. were put down. In 1897, when a system of sewers was being constructed in our city, some of the old cedar ties of mule car days were dug up, and found to be in a perfect state of preservation, after having been in the ground 20 years. In some of these ties the old spikes were still firmly fastened, and the ties showed the saw marks as plainly as on the day they came from the mill.

In low, moist climate, cypress ties last fully as well as cedar, but in a dry climate they are no better than sap pine. Good, heart pine ties last from five to eight years, while pine ties of young trees, even with some heart, last no better than those of old trees of all sap.

In 1894 our company purchased quite a lot of cypress ties, and put part of them in use without treating; the others were treated with C. A. wood preserver. In 1897 we took out some of both; those that were not treated were in a fair state; some could be put back, and some could not; those that were treated were as good as when first put down.

One reason the life of a tie is longer on a steam than a street railway is that only the centers are surfaced; where a tie is covered with earth in its entirety, it will decay much more rapidly than where only partially covered. There appears to be a great deal of rotten lime in our soil that causes our pine ties to decay very rapidly. In most climates a well seasoned, white oak tie will last well, but here they are very little, if any, better than a sap pine. Bois d'arc and mesquite wood are both said to make fine ties, though I cannot speak, from experience, of either. But the best tie for Texas street railways is the red mountain cedar. I know there are some objections urged against them by some street railway managers, but we have given them a fair trial, and I know they are good. Some say they will split when spiked; this is true to some extent, though the percentage of ties that will split in spiking is very small indeed. Others say they will not hold the spikes after being down a short while, and will permit the rails to spread. This has not been our experience; we have found in the last three years that they hold well even on sharp curves where the strain is great. The supply is almost unlimited in this State, and the price not much in excess of treated pine, or other ties, and when one considers the cost of labor in renewals, say every six years, the cost of the cedar tie is in the end much cheaper, as I am satisfied that a sound cedar tie, 8 ins. x 10 ins. x 7 ft. will last from 25 to 30 years.

Our company treated some all heart pine ties with C. A. wood preserver in 1895, put on at 200 deg. F., and I very recently took up some and found them perfect. I am led to believe from this that good heart pine may last well if properly treated, though I cannot, from experience, say how long, as I can with cedar, for I have talked with several old residents of our city, who tell me that they know, personally, of cedar posts that have been set 25 years and are still perfect, and while this is not personal experience, still I am satisfied it is true. To all who are able to obtain them, I would say; buy a good heart, red mountain cedar tie, 8 ins. x 10 ins. x 7 ft.; use Goldie spikes, and a good roadbed of about 10 ins. of gravel, and your track repairs will be light during the years to come. To those not able to obtain cedar, buy a good heart long leaf pine tie, 7 ins. x 8 ins. x 8 ft., treat it well with C. A. wood preserver, and with a good roadbed, I am sure you will obtain good results.

There is no economy in putting down cheap ties. The cost of labor alone in renewals will, in 10 years, be more than double

*Abstract of paper read at the Meeting of the Texas Street Railway Association.

the cost of good cedar or treated pine ties. A good roadbed is one of the essential parts of any railway, be it steam or electric, and without good ties, this cannot be obtained.

There are in use quite a number of wood preservers; of their merits I cannot speak, except as to one, and that is the C. A. wood preserver, or carbolinum. This I know to be good. We think so well of it that we use it on all bridge and culvert timber and on all of our poles, or rather those parts of our poles that go into the ground. The only objection we have to it is its cost.

Oscillation of Cars

By JOHN A. BRILL.

In the January number of the STREET RAILWAY JOURNAL an article appeared which was devoted largely to the subject of the oscillation of four-wheeled cars. It was scientific on its face, and made the usual parade of grammar school mathematics. At first glance it had the appearance of respectability. It is an unfortunate article, however, because the author demonstrates that he does not know how a car oscillates. One could almost believe that he had never ridden on one nor seen one in motion. This is the charitable view to take of the case. If this brave scientific statement was made by one familiar with the operation of street cars, his mind must be in a state of confusion bordering upon lunacy.

A street car carried on four wheels and having overhanging ends oscillates when in motion, but the oscillation does not take place about its center of gravity. It moves about its points of support and the center of gravity rises and falls or moves longitudinally as the axes of revolution change their location. The height of the load has very little influence upon the oscillation, hence the double-deck car does not present greater difficulties in this line than a car of the same length of overhang and the same weight of car and load.

To understand this, we must inquire why and how a car pitches or oscillates under any conditions. The first step is for a wheel or pair of wheels to drop into a low spot, say a joint. The load falls and the overhang end, moving through a considerably greater distance than the top of the spring, obtains a great increase of momentum. This still further compresses the spring and brings the movement of the end to a maximum in a downward direction. This movement must take place from the point of support of the car body, which is at the other end of the car, and is furnished by the spring, which spring depends very much upon the character of those used in the upper and lower spring bases.

Here some mention must be made of the fact that general four-wheeled trucks have two spring bases. One of these is that formed by the journal springs, and the length of this base is of great importance. If these springs are soft, the car will rock and oscillate upon them without regard to the length of base provided by the body springs. In many instances cars with apparently very long spring bases pitch and oscillate in a most surprising manner, as in the case of the cars mentioned in the article referred to. The reason is found in the soft springs of the lower spring base and the short length of the base itself. The ends of the car rise and fall with the opposite end pivoted, as it were, in the springs under it. At the same time the center of gravity of the car moves back and forth nearly in a horizontal direction. Practically the rapid movement of the car results in its oscillating about a point at the level of the springs centers and midway of the car body.

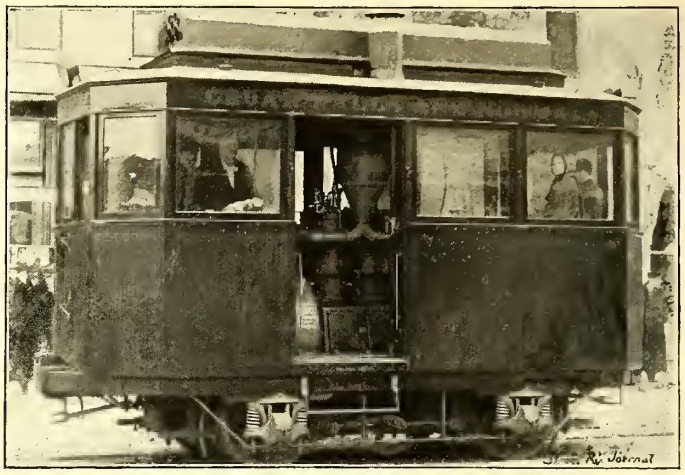
The reasoning of the article has no application to the motions of double or single deck cars, The mathematics might prove something if the body of the car was hung on trunnions, whose axis passed through the center of gravity. It is not yet the fashion to hang cars on trunnions 4 ft. 6 ins. from the line of the rails.

The cars fitted with the "under tension springs" "pitch and scind," as a sailor would say, like a ship at sea, as soon as the speed passes the most moderate limit. This is noticed on all except the very best track. The theory of the article is wrong, and the construction is as bad. No conception of the true mechanical principles of a four-wheeled truck appears to have been entertained by either the writer or the builder. The persistent galloping or oscillation of these trucks is a sufficient proof of this.

In construction, the springs which most easily dance or oscillate are placed where the tendency to oscillate is greatest, while the springs which would greatly resist this tendency are placed where they are least needed. The half elliptic, which in itself refused to oscillate regularly, is not used at all. Again upon the journal a soft spring is used, much softer and more flexible than those of the truck frame. The result of this is to make all the oscillation take place upon the journal springs. Though the trucks may normally have a large spring base and be expected to ride steadily, yet by this misplacement of the spring capacity it will be carried on a very short one, and it will then oscillate as might be expected where a car has an even and moderate overhang.

Long Distance Test of the Patton Motor

The most thorough test to which the Patton motor has ever been put was made on March 20 and 21. The system is in use



PATTON MOTOR

on the Cedar Falls (Ia.) & Normal Railway, and the motor tested was sent to take the place of one running temporarily on the above-named line.

Instead of shipping the motor on board train as usual, it was decided to run it over the tracks of the Great Western Railway.

The start was made from Forest Home, five miles out of Chicago, at 6:10¼ A. M. on Sunday morning. As the motor proceeded as an "extra," it was necessary to make many stops to allow the regular trains to pass. At Dubuque, Ia., a stop was made over night. The entire trip of 274.1 miles was made without a mishap to the machinery beyond the heating of two rear truck journals.

The distance and the average speed in miles per hour between stations is shown in the following table. The average speed per hour includes the intermediate stops, but does not include the stops at stations.

Station.	Distance in miles.	Average speed in miles per hour between tastions.	Station.	Distance in miles.	Average speed in miles per hour between stations.
Forest Home	0.0	0.0	Fairground	17.0	13.9
Bellewood	2.7	9.6	Durango	5 5	13 2
St. Charles	22.6	15.5	Graf	8.0	14 2
Sycamore	20.6	16.6	Farley	8.3	12.4
Zindewood	18.5	18.5	Dyersville	6.2	19.8
Stillman Vy	8.4	16 8	Thorpe	18.0	17.6
Byron	4.5	16.3	Dundee	4.9	22.6
S. Freeport	18.7	17 0	Aurora	10.0	16.5
Stockton	24 3	17.6	Oelwein	10 0	17.8
Rodden	18 9	18.9	W. Waterloo	26.7	19.2
Aiken	6.5	15.6	Wilson J	5.3	14.9
Galena J	1 4	11.2	Cedar Falls	7.1	10.9

By reference to the above, it will be seen that the longest run without a stop was 26.7 miles and at a speed of 19.2 miles an hour. The fastest run was for a distance of 4.9 miles at 22.6 miles per hour. The total running time for the 274.1 miles was 16 hours 45¼ minutes or an average of 16.36 miles per hour for the trip. The motor weighed at Dubuque 33,250 lbs. Seven passengers were carried from Chicago to Dubuque and five from Dubuque to Cedar Falls; a member of the STREET RAILWAY JOURNAL's staff accompanied the motor from Chicago to Cedar Falls in order to secure the data contained herein.

A total of 58 gal. of gasoline were consumed. The Standard Oil Company quotes this at 5 cents per gallon laid down in carload lots in Chicago. At this price the expense for fuel for the trip was $2.90, 1 1-17 cents per car mile or $.00064 per ton mile.

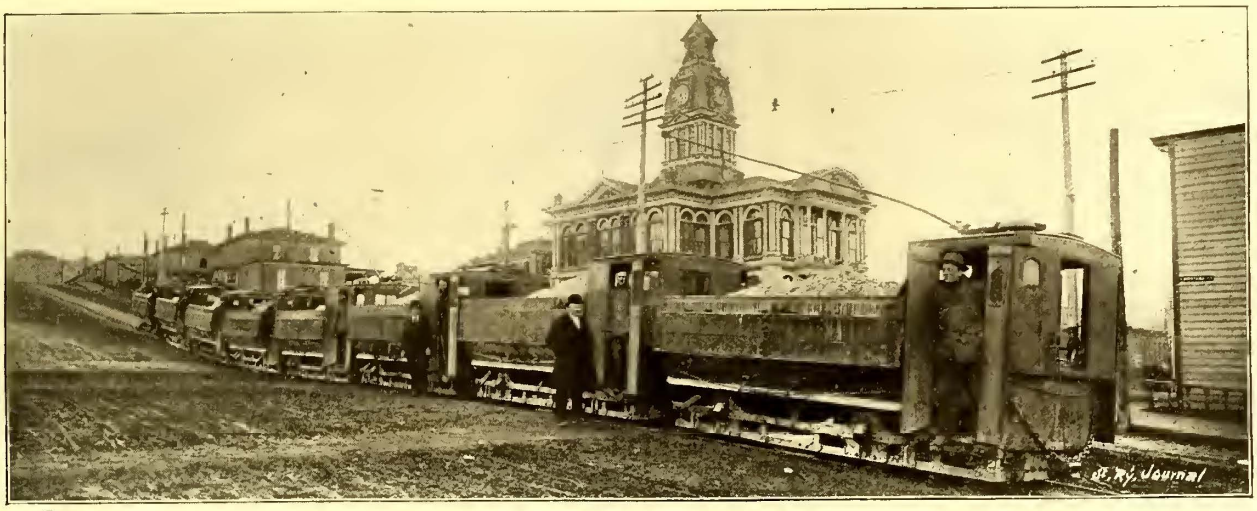
The old motor running at Cedar Falls is said to have run the last forty days without losing a trip.

The car just tested was equipped with testing instruments which showed the pressure of the storage battery to be 1.2 volts per cell at the end of the run. The engine was shut down at all stations where a stop of more than ten minutes was made.

The car in question is 17 ft. 8 ins. long, over all; is equipped with a McGuire truck, two Westinghouse motors, a 25 h.p. gasoline engine, direct connected to a dynamo and a storage battery of ninety-eight cells. The accompanying illustration shows the general appearance of the Patton motor.

Handling Ore on an Electric Road

The accompanying illustration shows a train of motor and freight cars which is employed for handling ore on the lines of the Butte Consolidated Railway Company, of Butte, Mont. The cut shows the train at the foot of a 11 per cent grade, the front car being on the commencement of a 9 per cent grade. The cars are each loaded with eleven tons of ore and it will be seen there are five trail cars and four motor cars. The train is made up with two motor cars in the center, one at the front and one near the rear.



TRAIN FOR HANDLING ORE—BUTTE, MONT.

The trucks in use on the motor cars were furnished by the Peckham Motor Truck & Wheel Company, and the car bodies were built by the Ramapo Iron Works.

Double Truck Cars for the Metropolitan Street Railway Company

The Metropolitan Street Railway, of New York City, is having a considerable number of new cars built for its electric service by the J. G. Brill Company. These cars are particularly interesting because they are departures in many respects from ordinary construction. They are also worthy of attention, as they are intended to meet the heaviest possible surface traffic and are to be operated under the shortest practicable headway.

Externally the features first striking the eye are the great length, which is 28 ft. over the end panels, 36 ft. over the dashers, and 38 ft. over all. The colors are as usual, the standard of the road, cream for the concave and orange for the body panel. The dasher is cream color with the iron work black. There are ten windows upon each side, fitted with French 26-oz. glass 28 ins. x 30 ins.

The width of the car body at the sill is 6 ft. 6 ins.; width at belt rail 7 ft. 6 ins. The sills are 6¾ ins. x 4¾ ins. The corner posts are 6 ins. thick, the window posts 1⅞ ins. There are five iron carlines in each car, and behind the seat back there is an iron belt on each side going through the car. Under this belt there is a heavy truss rod; it comes nearly up to the level of the window rail. At the corner posts long angle irons secure the plates and take a long bearing on them. On the outside of the cars a wide and deep corner plate of pressed steel covers the joints between the letter board, corner post and the head pieces. These corner pieces not only impart a great strength to that part of a car corner which is usually weak, but they add greatly to the durability by protecting the joints from the entrance of water. At the panels and belt rail there are other plates completely defending all the joints. The straps on the belt rails and other straps as far as possible are made continuous. The inside framing is of the usual steam car type, except that beneath the seats a new feature has been introduced from the steam car practice. This is a truss plank extending the whole length of the car. It is 12 ins. wide by 1½ ins. thick, and is gained on to each post one-quarter of an inch. It is cambered ¾ of an inch at each end and bolted down to the sill at short intervals. This practically gives a sill 18¾ ins. deep. This adds very greatly to the stiffness of the car and enables the full benefit to be obtained from the use of the inside truss rod. Under the sill a separate truss rod is used which has a single strut in the center. The platforms are 4 ft. from end panel to dasher and are fitted with folding gates which, when turned back, are entirely out of the way. Each dasher has an electric headlight; Sterling brakes are used. These brakes, which are very powerful, are the invention of Thomas Millen, the master mechanic of the road. The inside finish is of second growth white ash. The lumber used was particularly fine in grain and white in color, making a fine effect when finished. The transoms are filled with white chipped glass. There are four 4-sided signs on each car. These are operated by hand wheels from the inside of the car or from the hood.

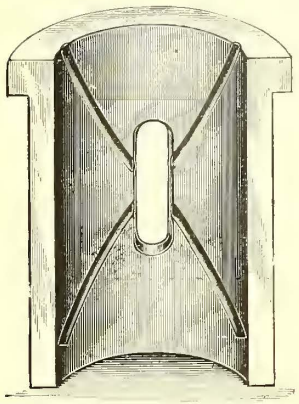
DOUBLE TRUCK CAR—NEW YORK

The trucks are of the Brill maximum traction pattern. The large wheels are 33 ins. in diameter and the small ones 20 ins. The truck is designed to give a very large adhesion, while employing but one motor per truck and in this case the motors are G. E. 1000, one mounted on each of the trucks. The axles are of cold rolled steel.

The new cars are very handsome in appearance and will be a credit to both purchaser and builders.

Solid Babbitt Bearings

The accompanying engraving shows a solid babbitt metal bearing for motor shafts, supplied by David C. Sanford, Bridgeport, Conn. This style of bearing is in use on a number of roads, including the Union Traction Company, of Philadelphia; the New York, Queens County & Suburban Railway Company, Brooklyn; the Fair Haven & Westville Railroad, of New Haven, Conn.; the New Haven Street Railway, New Haven, Conn., and the Consolidated Traction Company, of Newark, N. J. It is cast, as shown, with oilways and furnished complete ready for installation, and is designed to replace the iron shells now used, lined with babbitt. These solid babbitt boxes are furnished by the maker at a certain price per pound, and are all ready to slip into the motor, with the exception of the armature bearings, which should be bored to accurately fit the shaft. When worn out, the bearings may be returned, and a liberal allowance will be made for the actual weight of metal. Another feature is the oilways, which are cast in, and are much smoother and will carry the oil better than those drifted in after the box is finished. Upon the commutator end the box is solid, and as it is almost an impossibility to drift proper oilways in bearings of this character, the advantage of having them cast in will be apparent.



SOLID BABBITT BEARING

Mr. Sanford supplies bearings for motors of all makes, which are cast upon small mandrels, so there will be sufficient stock to bore and face them to correctly fit the armature shafts; or, if the equipment is a new one, and the shafts all up to standard size, they will be supplied correctly bored and faced. In case large consumers should prefer to cast their own bearings, perfect jigs with water backs will be supplied; and also, if there is any difficulty in boring the boxes accurately, owing to the oilways being cast in, a suitable boring tool is furnished.

Another good feature is that the bearing for the commutator end of the armature shaft is cast all in one piece, and therefore there is no chance of the end of the shaft becoming exposed and dust and grit working in, as is often the case when the sheet iron cap used with the iron shells drops out and is lost. Solid babbitt journal bearings are also in use upon a number of prominent street railways, and are said to give better service than "brasses." They are furnished of proper shape and size for all standard makes of trucks, and are ready to put right in without any scraping or fitting, as they seat themselves, and there is absolutely no danger of either cutting the shaft or melting out.

In the last issue of this paper the merits of genuine babbitt were thoroughly discussed, and these shells are made of a metal approximately the same, but a little harder, without sacrificing any of the strength and toughness of the original formula.

Self Feeding Rail Drill

The self feeding rail drill, shown herewith, was especially designed to meet the demand for a light drill with over-hanging fastenings that could be used in yards and other places where the under clamping device could not be conveniently used. In the construction of this drill the manufacturers have aimed to make it thoroughly effective and yet so simple that it will require but a few seconds to adjust the over-hanging clamp and secure the rail to be drilled by an eccentric readily fastened by foot pressure, and which can be as quickly released when necessary, for passing trains.

This drill is made under the patents recently obtained from the original inventor, M. M. Moore, by the Q. & C. Company, and which permits the main upright of drill to be removed in a few seconds for passing trains, leaving all parts of drill below the rail.

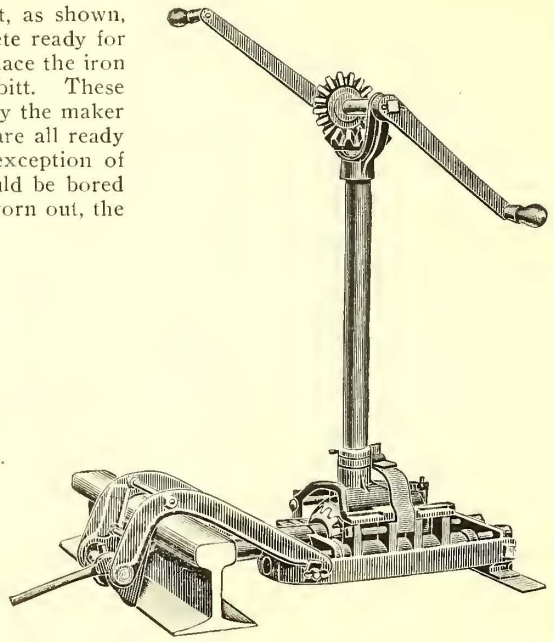


FIG. 1—SELF-FEEDING DRILL IN WORKING POSITION

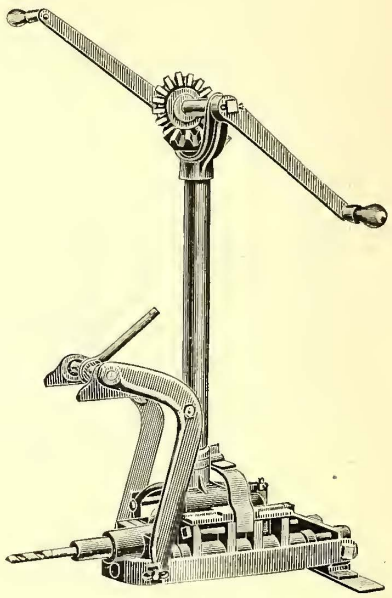


FIG. 2—DRILL READY TO FASTEN TO RAIL

In the construction of this drill the aim has been to meet the requirements of the street railway trade, the drill being made quite narrow, so as to necessitate the removal of the minimum amount of ballast in order to insure effective work.

The weight of the drill is but 65 lbs., this having been reduced as much as possible consistent with strength and durability, so as to insure most rapid results and easy handling. Fig. 1 shows the drill in position for work, and Fig. 2 shows it ready to fasten to the rail.

A New Fender and Wheel-Guard

The accompanying illustrations show a new fender and wheel-guard, which have been placed upon the market by George A. Parmenter & Company. Fig. 1 shows the fender and wheel-guard as applied to a car in actual operation. The fender is built of the best of material, and is entirely of metal. It is shown in detail in Fig 3. As will be seen from the cuts, the fender projects in front of the car for a short distance, and is absolutely under the control of the motorman, who can, by a slight motion of his knee, drop the fender to the roadbed, thus enabling a person to be picked up, even though they are in a prostrate position. The fender can be easily folded up and transferred from one end of the car to the other.

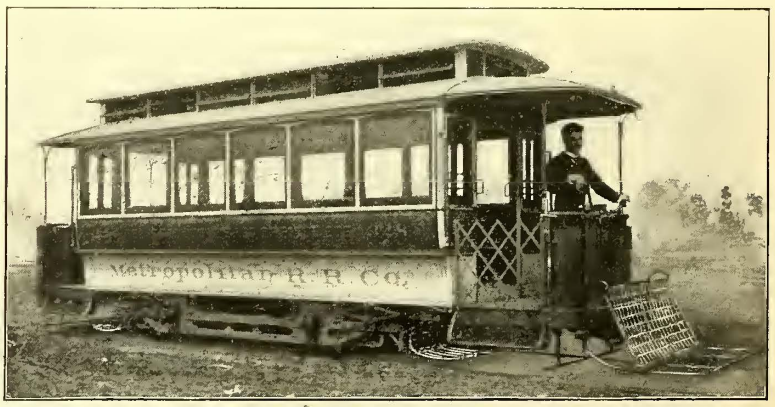


FIG. 1—CAR EQUIPPED WITH FENDER AND WHEEL-GUARD

The wheel-guard is shown in detail in Fig. 2. This guard is entirely automatic and positive in its action, and is designed to be placed upon the car with the fender, in order to make it absolutely impossible for the wheels to pass over a body that in any way should get past the front fender. This feature is of great importance, because a person who is struck by the fender is sometimes simply pushed to one side, leaving an arm or leg upon the track. With this guard in use, even if this happens, it is impossible for the wheels to pass over a person. The wheel-guard is light in construction, and, like the fender, is made of the best of material. As will be seen from Fig. 2, this device consists of a trigger, which is placed immediately under the front end of the

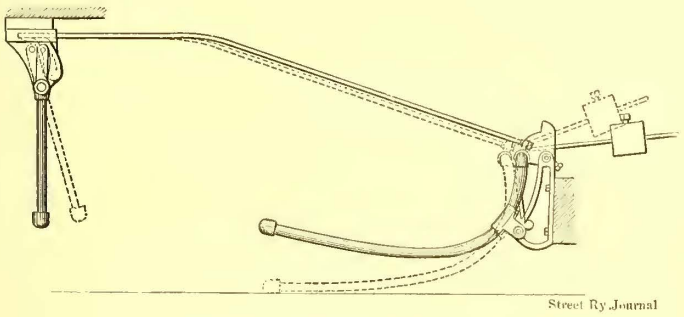


FIG. 2—NEW WHEEL-GUARD

platform. This trigger comes down to within a short distance of the ground, and is designed to be pressed back by any object upon the track. When pressed back the trigger operates an arm, which in turn permits the guard to drop to the rail immediately in front of the wheels.

These fenders and wheel-guards have come into quite extended use during the past year, and over 2000 have been sold; they have been adopted by the Metropolitan Railway, of Washington; the Capitol Traction Company, of Washington; the Union Railway Company, of Providence, R. I., and others.

Non-Magnetic Watches

The accompanying cut illustrates a non-magnetic watch which is being placed on the market by A. C. Becken, and for which it is claimed that it will absolutely preserve its proper movement, no matter how strong a magnetic influence may be brought near it. The non-magnetic watch is undoubtedly an absolute necessity with electrical engineers and dynamo tenders,

NON-MAGNETIC WATCH

and in fact to anyone who is required to be near electrical apparatus. In this watch the hair-spring and balance are not manufactured of steel, but of a material that is unaffected by magnetic influences.

The Brunswick Traction Company, which operates an electric railway on the eastern side of the Raritan River to Bound Brook, and the New York & Philadelphia Traction Company which controls right of way from Bound Brook through Somerset County to within a mile and a half of New Brunswick, on the western side of the river, are reported to have consolidated their interests. The Brunswick Traction Company will extend its line from this city so as to connect with the lines of the New York & Philadelphia Traction Company at Bound Brook. A spur will then be built to connect the surrounding villages.

An Interesting Power Plant

A striking example of the utilization of water power made possible by wheels of the impulse type, is presented in the arrange-

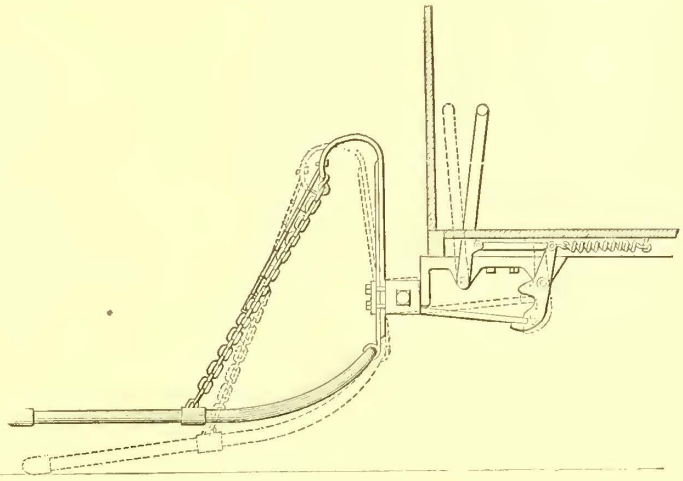
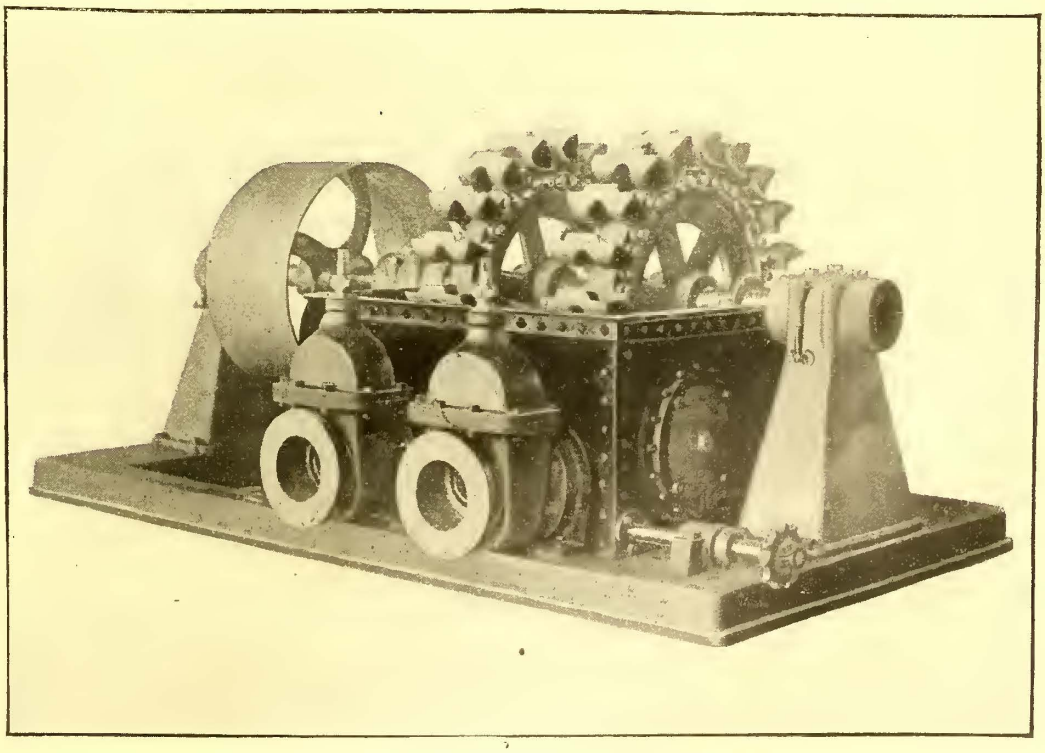


FIG. 3—NEW FENDER

ments recently made for power in the textile goods factory of M. Benoist Cadet fils, La Bastide, a town south of Bordeaux, in the Department of Tarn, France. Here a steam engine which formerly was used to furnish the power for the entire factory, is now held in reserve for periods of low water, and the greater part of the time power is furnished by a 36-in. twin impulse wheel, working under a head of 128 ft., at 285 r.p.m., and developing 40 h.p. The use of contracting nozzles makes a high efficiency possible with the varying loads.

The illustration herewith presented shows the wheel sent to La Bastide, by Powell & Colne, export agents. This wheel was furnished them by the American Impulse Wheel Company.

The photograph was taken with the top casing removed and the shape of the buckets peculiar to this wheel can be observed. The high efficiency of the wheels made by this company is due to the close attention and study which its engineers have given to every detail and to the great care exercised in manufacturing. A prime



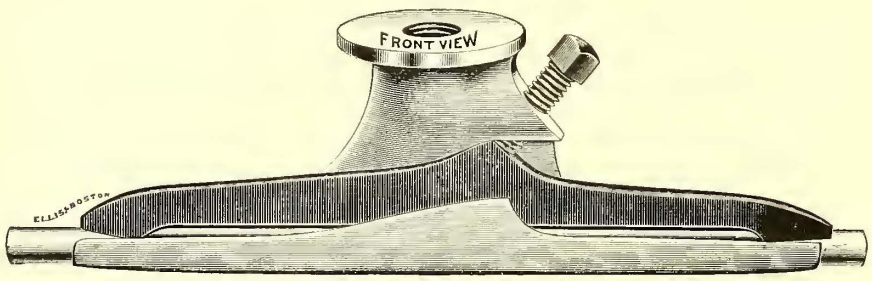
IMPULSE WHEEL—LA BASTIDE, FRANCE

mover with so low a first cost, and almost negligible expense for repair, and requiring little or no attention while running, is an attractive one to large numbers of manufacturers who are at present burdened with heavy expenses in connection with their motive power. The possibilities of the electrical transmission of energy are now so great that many concerns might at comparatively small expense utilize water powers even though they were located at considerable distance from their establishments.

A New Trolley Ear

The accompanying illustration shows a new trolley ear, which is being placed upon the market by the W. S. Hill Electric Company. As will be seen from the cut, this ear is supplied with a steel japanned casting, which can be easily removed and the ear, together with the insulating material, can be put in place before the trolley wire is put up. After the trolley wire is placed in position and tightened, it is elevated into place in each ear. The steel spring casting is driven into place with a hammer and a set screw is then tightened to hold it there. There being a constant spring tension on the screw, it cannot work loose.

One very desirable feature of this ear is the fact that if at any time it is necessary to tighten the trolley wire, it takes but a very short time to disconnect any given length, tighten it up and replace the ears. The W. S. Hill Electric Company also makes every form of quick break switches necessary for the operation of an electric railway.



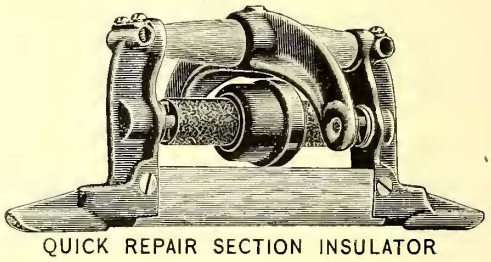
NEW TROLLEY EAR

A "Quick Repair" Section Insulator

The accompanying engraving shows a section insulator or trolley wire break, which has been designed with the particular aim in view of providing a quick method of renewing the insulated run-way which, through sparking and jumping of the trolley wheel, is certain to wear and require repairs sooner or later. In this break the insulated run-way consists of a bar or stick of hard wood 8 ins. long, the ends of which are retained in the end frames or castings by screws. When required, the wood is quickly removed and can be replaced by a simple and inexpensive bar obtainable in any carpenter shop. The repairs can be made from the repair wagon; there is no necessity for removing the break from the line.

The break has a straight under-run and is very strong and reliable, as will be apparent from the illustration. The end castings are securely held together and insulated from each other by bolts, insulated with molded mica. These bolts sustain all end strains, the wood compression bar at the top relieving the wood run-way and screws from all strains which would otherwise interfere with the repairs. The weight of the break is 6 lbs. It is furnished with three methods for suspension—with a socket for attachment to the standard 5/8-in. bolt in hanger, with malleable iron span wire yoke, and with pull-over attachments for side wires.

This break or insulator is known as the "Hartford," and is sold by the H. W. Johns Manufacturing Company, at a price which, combined with its practical features as a section insulator, will no doubt recommend it to many electric railroad engineers.



QUICK REPAIR SECTION INSULATOR

A New Motor Truck

The Dorner Truck & Manufacturing Company is placing upon the market a new motor truck that embodies a number of novel features. This motor truck has a 7 ft. 6 in. wheel base and a 16-ft. spring base (this can be changed to suit), and has half elliptic springs over each journal box, also spiral springs on each side of the box which are held in place by a frame suspended from side bars, thereby insuring easy riding for the passengers, as the car and motors are carried by the half elliptics. It also has four elliptic springs on the ends, preventing the cars from oscillating; the side bars go over the top of the journal box, thereby giving greater strength than by bending around the box, this construction also permitting the removal of wheels and axles in a few minutes. The pedestal yoke is in two pieces, riveted to the side frame, thereby giving greater strength and making it easier and cheaper to repair in case of breakage.

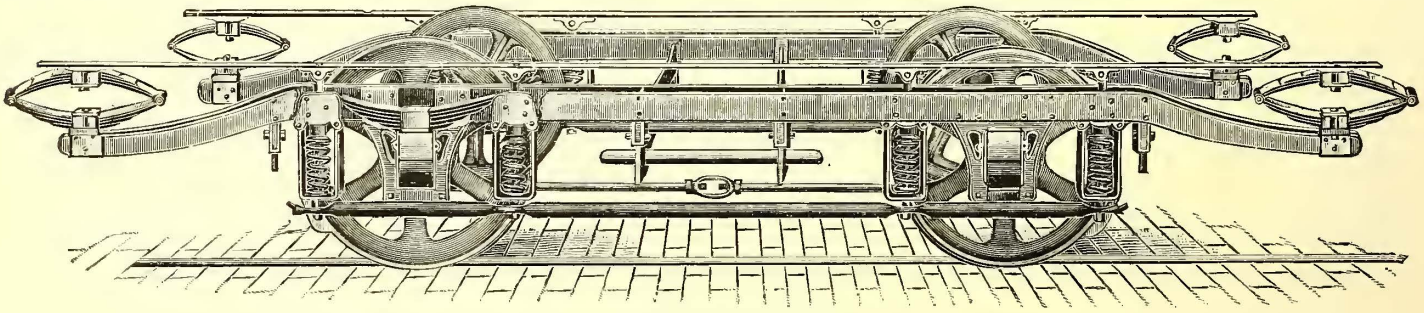
This company has introduced a particularly novel feature in its system of holding the spiral springs, in case of breakage, as these springs can be replaced by detaching the spring frame from the side bars. These repairs can be made anywhere, and it is not necessary to have the car over a pit or elevator. This feature will recommend itself to general managers.

In this truck an easy method of detaching the truck from the car has been provided. This is done by releasing the spring posts from the brackets, which are riveted to the sill plate, and it is not necessary to take out all the bolts from the sill plates.

The construction of the brakes on this truck is simple and saves repairs in the shop; the brake pulls up on all four wheels alike, and is very powerful.

This company also claims an important feature in the method of suspending the spiral springs; instead of setting them in a cup on the bottom bar it suspends them in a frame to the side bars. This allows the springs to automatically seek their center of gravity and also lessens the wear in all guiding places in the frames.

The half elliptic springs over the journals thoroughly cushion the blow and prevent any broken axles. This truck also has a new dust guard for the journal box, which is very efficient. The box can be used for either grease or oil. The truck is constructed of the best material, and is strong and well made.



NEW MOTOR TRUCK

A Special Number

The popular and business review of electricity known as "Lightning," which is printed in London, Eng., has recently published a special number devoted to the subject of street lighting by electricity. This number is published with a special cover and contains a number of very fine half tones. This issue also contains much valuable matter dealing with the subject of street lighting.

A Safety Third Rail System

The use of a third rail has many advantages over that of an overhead system of conducting current to a car, but its drawbacks, consisting principally of troubles when the entire third rail is kept alive continuously, has militated greatly against its adoption for surface roads operating over highways. The reduction of these troubles by dividing the line into sections, and keeping alive only that in actual use, has been the dream of many inventors, but in spite of the fact that efforts were made early in the history of railroading to perfect a system of this character, but little has so far been accomplished, if success be judged by the number of installations made up to the persent time.

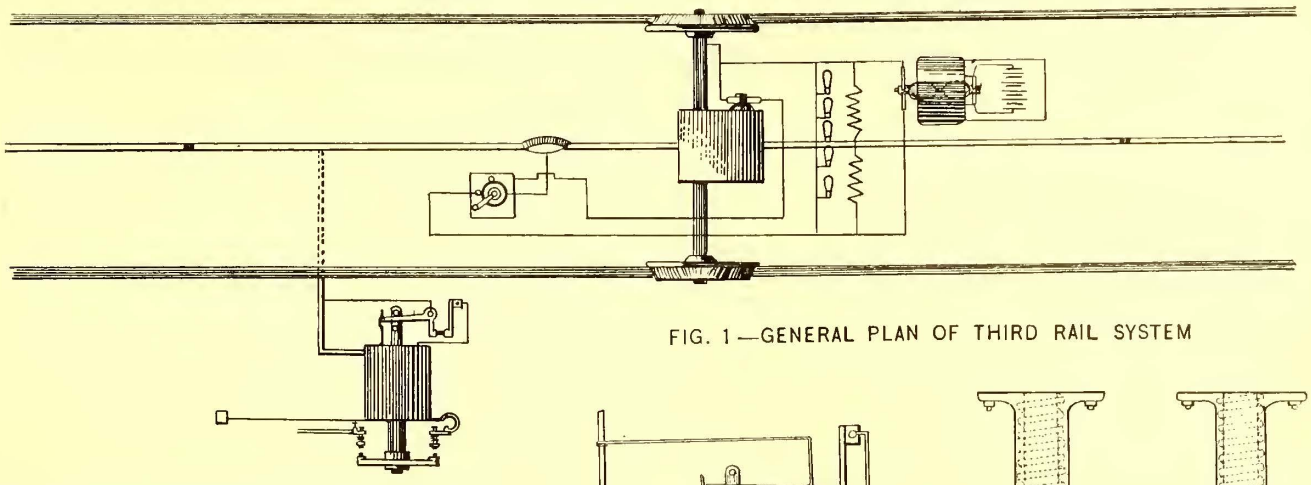


FIG. 1.—GENERAL PLAN OF THIRD RAIL SYSTEM

A system involving a new principle of sectional third rail operation has been put on the market by the Safety Third Rail Company, and is illustrated in the accompanying engravings. The system consists essentially of exciting the section of third rail over which the car is about to pass by electro-magnetic means, and cutting the section out of circuit automatically after the car has passed. The arrangement of the system, as proposed by the inventor, Capt. S. M. Murphy, is illustrated in Fig. 1. Every car carries upon it, under the seats, 10 cells of storage battery, giving a tension of about 20 volts. These batteries are employed only when the car is starting, and then only to make the necessary connection between the feeder supply and the third rail section over which the car is standing. To do this, they drive a rotary converter, as shown in Fig. 1. This converter produces 500 volts at its generator end, exciting an electro-magnetic switch, shown in the engraving, which automatically connects the section on which the car is standing, and the one immediately in front of it, with the main source of supply. The 500 volt current is then admitted to the motor, and the car proceeds as in ordinary practice. The rotary converter then operates in the opposite way, storing the battery until it is again needed. The electro-magnetic switch cuts out the sections after the car passes, rendering them dead. The chief feature of the system, as will be seen, lies in the construction of the switch, which is, necessarily, the critical point of a system of this kind. The switch employed depends upon a novel principle of breaking the circuit, and is shown in section in Fig 2. The chief point of the switch lies in the ingenious method of preventing arcs. It consists of a solenoid plunger, carrying at its lower extremity two carbon contacts which, when the current is flowing, are pressed against two spring carbon contacts, as shown in the cut. There is also a second circuit of about twenty times the resistance of the first, and in shunt with it, making contact with the two upper carbons shown in Fig. 2. After a car passes a section the circuit is broken at the two lower points of contact, but no arcing ensues, as the upper contact momentarily remains closed. When this is subsequently broken, the quantity of current interrupted is not sufficient to occasion any trouble.

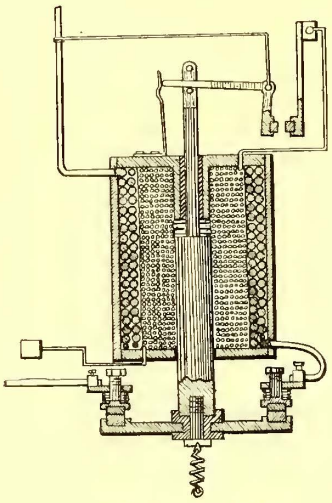


FIG. 2.—SWITCH

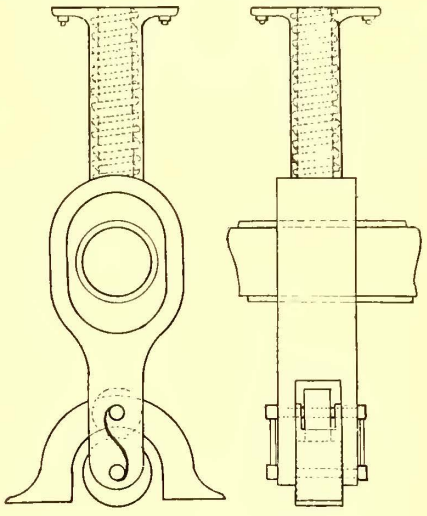


FIG. 3.—PLOW

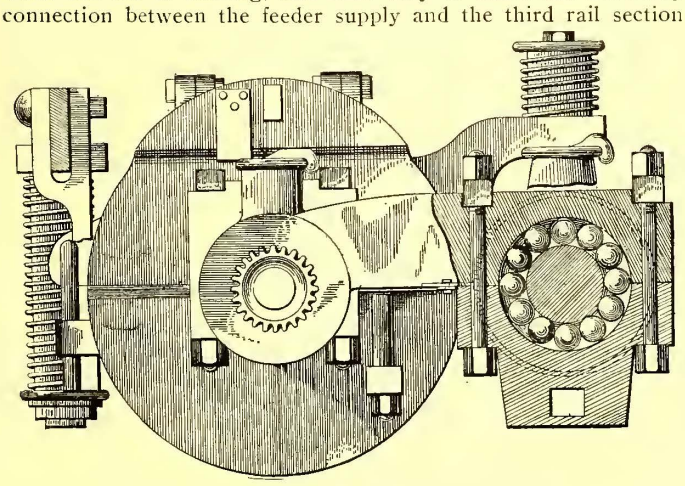


FIG 4.—METHOD OF HANGING MOTOR

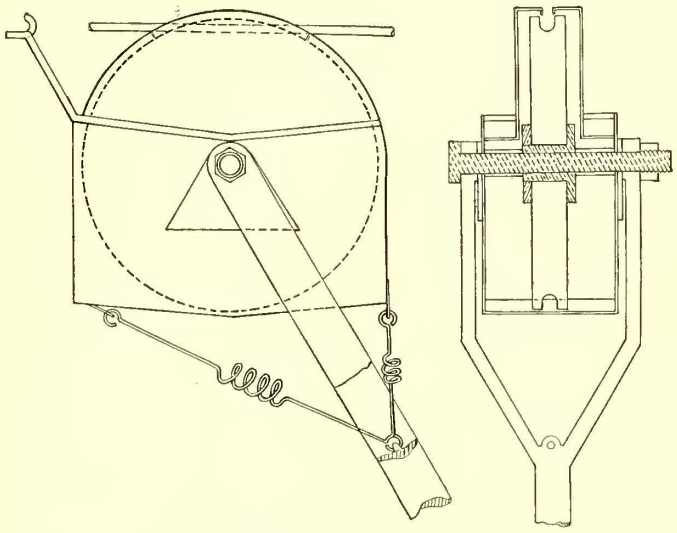
Fig. 3 shows the contact shoe employed. It consists of a shank sleeved to the axle, with about ⅜ in. play on all sides, and carrying at its lower end a traveling trolley wheel, and also an inverted U-shaped yoke, fitted to the lower part of the shank, and pressed upon the rail by the spring shown in the dotted lines in the cut. Resting on the trolley wheel and held to it by spring pressure is a second wheel pivoted to the U-shaped yoke. The rear end of the latter trails along after the trolley wheel, while the front toe of the U is carried some distance above the third rail. In this way the shoe touches the third rail at two points, viz., at the wheel and by the trailing shoe, independent of the direction of the car. Each toe of the shoe carries a small roller, not shown in cut, to reduce friction. During the progress of the car, if an obstruction should be met, the natural tendency of the trolley wheel is to jump, breaking the contact with the rail. This will not, however, break contact between the shoe and the track, as the current will pass by the rear end of the U. In case a severe obstruction should be met on the track, there is a play of ⅜ in., as stated, between the plow and the axle upon which it is sleeved, so that the plow will pass over the obstruction. The shoe and its support are well insulated from all metal parts of the car. Where the axle passes through the shoe shank, it is protected by 1 in. of insulation, and another sleeve of 1 in. insulation surrounds and protects the upper part of the shank.

Fig. 4 shows a method of carrying the motor on the car, and is equally applicable to the trolley system and to all types of motors. As will be seen, roller bearings are introduced at the axle bearing of the motor, greatly reducing the friction at this point.

The system is equally applicable to surface or elevated roads and can be installed while the cars are in operation by any other power without interfering with traffic.

Appliance for Applying Grease to the Trolley Wire

The accompanying illustration shows an appliance which has recently been invented for the purpose of applying grease to the overhead trolley wire in order to prevent ice from forming thereon. As will be seen from the illustration, the device consists of a wooden wheel, the lower half of which turns in a receptacle provided for oil, or grease, and the upper half of which is protected by a hood or cover. A small opening is left in the top of the hood to enable the wheel to touch the wire. The wheel, when



PLAN AND SECTION OF GREASER

pressed against the wire will, of course, revolve and carry with it the oil or grease in the receptacle, the hood or cover catching any portion of the oil which does not remain on the wire. A piece of felt is also provided for taking up the drip oil and returning it by slanting channels to the receptacle. This appliance is attached to a trolley pole, and an extra base is put on the car roof, so that the oiler or greaser follows the contact wheel and pole. One greasing suffices to protect the wire for four weeks. This device was invented by R. H. Dalgleisch, and it has been in operation on the Chevy Chase Division of the Capital Traction Company, of Washington, D. C., with good results. About 7½ miles of the overhead trolley wire on this division were successfully oiled with 1½ gals. of oil.

Maximum Traction Truck No. 14 D

The maximum traction truck, illustrated in the accompanying engraving, and built by the Peckham Truck Company, is a novel departure in truck building. Some details of this truck have already been published, but the interesting features of this truck are so many as to require more detailed attention. As will be seen, the motor is carried outside of the axle. The truck has also a center bearing, and in addition a swing bolster, and it is the only maximum traction truck built combining these two features.

In general construction this truck resembles that of the same company's No. 14 A truck. It is composed of composite side frames, united at the ends by strong transverse members, and at the center by two heavy transom bars, between which the bolster is free to move, both vertically and laterally. The bolster is of a design sufficient rigid to carry the entire weight of the car body in the center, thus reducing the friction for turning the truck under the car to a minimum.

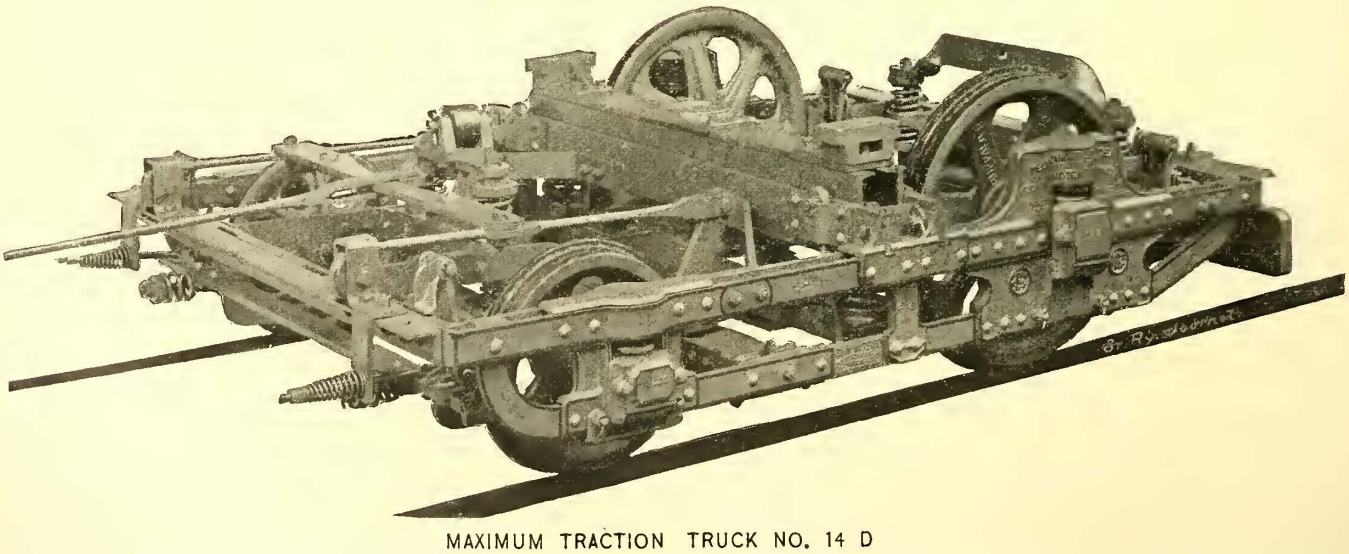
The bolster is supported on a series of one elliptic and two spiral springs, which rest on a spring plank, which in turn is supported by four links resting upon the transoms. These links leave the spring plank and bolster free to move a limited amount in a direction transverse to the length of the car body, giving the numerous well-known advantages to a swing bolster construction. This swing bolster construction is claimed to be particularly desirable in a maximum traction truck, inasmuch as it greatly eases the blow on the flange of the leading wheel on running into a curve, and enables the trucks to bring the car body into the new alignment required by the curve, by degrees.

As will be seen, a roller is placed near the pilot axles, by which additional weight can be transferred to the pilot axles if desired. The tension on the springs supporting this roller is adjustable. It is the custom of the manufacturers to so adjust this tension as to leave about 75 per cent of the weight upon the driving wheels.

The wheel base of the truck is 54 ins., and the distance from center of driving axle to center of bolster carrying the weight of car body is 22½ ins.; in other words, the driving wheels carry 32-54 of the weight of the car body if no motor were mounted on the truck. Supposing the weight of the car body and load to be 16,500 lbs., viz., car body 9000 lbs. and load 7500 lbs. This would give 8250 lbs. to each truck, or the driving wheels would carry 4896 lbs. of this weight.

Assuming the weight of the motor without gear to be 2000 lbs., and the distance from center of axle to center of armature shaft (the center of armature shaft being assumed as the center of gravity of the motor) to be 14 ins., which is the dimension for a G. E. 1000 motor, the weight imposed by the motor hanging beyond the driving wheels will be $36 \div 22 \times 2000$ lbs., or 3274 lbs. In other words, the center of gravity of the motor hangs on the long end of a lever, whose fulcrum is the center of the bolster carrying the weight of the car body, and whose point of reaction is the center of the driving axle. Of the weight of the car body there are 4896 lbs. impressed on the driving wheels, and the weight of the motor impressed upon them is 3274 lbs. additional, or a total of 8170 lbs. on the drivers out of 10,250 lbs. This is a total of about 81 per cent of the whole weight, supposing that no weight was impressed on the traction roller over the idle wheels.

The brake rigging is of the usual upright lever type. The levers, however, are provided with a fixed fulcrum, supported by a 6-in. channel carried across the truck between the lower members of the side frame. The pilot shoes are applied to the pilot wheel through the medium of springs, which show very plainly in the engraving. By this device no more pressure can be applied to the pilot shoes than that provided for in the strength of the springs, consequently the pilot wheels cannot be skidded, while at the same time the fixed fulcrum of the lever insures the rigid application of the full force of the leverage to the driving wheels.



MAXIMUM TRACTION TRUCK NO. 14 D

A number of cars have been equipped with these trucks, among them some cars for the Brooklyn Heights Railroad Company, and their easy riding, especially on curves, is noticeable.

Electric Launches

Electric launches undoubtedly form one of the best attractions that a street railway company, owning a park or pleasure resort that contains a lake or stream, can possibly find. Electric launches are noticeably clean and free from all noise, smoke, ashes and other such annoyances, and this absence of disagreeable features has popularized them so that the patronage is most liberal. The Electric Launch Company is now supplying a large number of street railway companies with electric launches and these launches seem to be giving all the satisfaction that the manufacturers claim they would.

New Suburban Line near Buffalo

The Buffalo Valley Railway Company has been incorporated by the Secretary of State with a capital of $350,000, to construct and operate an electric railway 27 miles long, from the east city line of Buffalo, in the town of Cheektowaga, to the village of Java, Wyoming County. The directors are: Luther S. Bent and Felton Bent, of Philadelphia; Mason D. Pratt and Edgar C. Felton, of Steelton, Wyoming County, Pa.; Herbert P. Bissell and J. Henry Metcalf, of Buffalo; Joseph R. Foard and Fred W. Wood, of Baltimore, Md., and Benjamin Watson, of Strykerville, Wyoming County, Pa. This road will pass through a particularly fine territory and it is stated that steps will be taken at once to secure the rights of way and have the road in operation by Fall.

Test of a Steam Separator

The Harrison Safety Boiler Works have recently issued a folder illustrating and describing an interesting test recently made on one of this company's Cochrane steam separators (high-pressure pattern) by the Edison Electric Illuminating Company, of Boston, Mass. This test was conducted on lines somewhat different to tests usually made on appliances of this kind. Heretofore calorimeters have usually been relied upon for determining the quality of the steam entering the separator, but it is claimed by the manufacturers of this separator that owing to its high efficiency they were able to prove that there was more moisture in the steam entering than the inlet calorimeter showed. The test gave the Cochrane separator an efficiency of 92.3 per cent.

Change in Location

F. M. Hawkins, New York agent for the Crouse-Hinds Electric Company, has recently changed his New York office and now occupies fine and commodious quarters on the ground floor of 26 Cortlandt Street, fronting on Dey Street. Mr. Hawkins has also a large storeroom connected with his office and intends to keep in stock a large quantity of the Crouse-Hinds electrical goods, and also of the Pass & Seymour electrical apparatus, for which he is also agent. He has a very tasteful arrangement of knife-switches and other appliances dealt in by him as decorations, and reports an excellent business during the past few months.

Switch-Back Merry-Go-Rounds

The exclusive right to manufacture switch-back merry-go-rounds in America has been secured by Norman & Evans.

These machines have an undulating rotary motion, operating eight cars each, designed to represent Venetian gondolas. Each car will carry twelve passengers, thus making the entire seating capacity of each machine, when fully loaded, ninety-six passengers. The motion combines the pleasant exercise of the well-known switch-back railway, with the circular motion of a merry-go-round. These machines are designed to afford pleasing recreation to both young and old. They are strongly and substantially built, insuring perfect safety in operation. The decorations of the machines are highly artistic, while music is discoursed by a military-band organ adjusted to play continually.

A New Home

Rossiter, MacGovern & Company announce that they expect to move their principal office to the handsome "Washington Life Building" in New York. Their stock of railway apparatus and electrical machinery will hereafter be carried in stock at their Newark factory, 35-37 New Jersey Railroad Avenue. Their increased facilities at the latter place will enable them to display to good advantage their large and interesting stock of machinery.

In future this firm will pay special attention to the over-hauling of railway apparatus, and is prepared to contract for the repair of almost any style or size of machinery now in use. This would indicate that the firm's rumored consolidation with the manufacturing and repair business of Stucky & Heck Company has been brought about. It would seem that such a consolidation combining as it does two concerns of high standing in their respective fields, should prove very effective.

Personals

MR. C. J. WICK, of the Electrical Equipment Company, of Cincinnati, Ohio, spent a few days in New York last month on a business trip. He reports an excellent trade.

MR. J. T. WHITTLESEY, formerly chief engineer of the Brooklyn Heights Railroad Company, has resigned that position to accept a position with the John Stephenson Company, Ltd.

MR. E. H. BEECHAM, formerly superintendent of the Union Traction Company, of Rutherford, N. J., has been appointed superintendent of the Port Jervis Electric Railway, in place of F. H. Becket, who has resigned.

MR. J. LESTER WOODBRIDGE has accepted the position of engineer at the Boston office of the Electric Storage Battery Company. Mr. Woodbridge is well known throughout the street railway field and was formerly connected with the firm of Woodbridge & Turner. He has been paying special attention to the subject of boosters for some time, and is now an accepted authority on this subject.

MR. HENRY J. CLARK has been promoted to chief engineer of the engineering department of the Syracuse Rapid Transit Railway Company. Mr. Clark graduated from Cornell University in 1895, and immediately accepted the position with the Syracuse Rapid Transit Railway Company. He commenced work in the engineering department, and after six months entered the track department.

MR. T. COMMERFORD MARTIN, editor of the "Electrical Engineer," has been recently appointed by the Government head of the electrical commission to the International Exposition, Paris, in 1900. This tribute to Mr. Martin is richly deserved by his long experience, and the prominent position he has taken in electrical engineering progress in this country, and the honor could not have been better conferred.

MR. J. S. KIDD, whose portrait appears below, is the general manager of the street railway system of Auckland, New Zealand, of which a description is published elsewhere in this issue. The line under Mr. Kidd's management is at present being operated by horses, but he is an enthusiastic believer in electric traction, of which he has made a carefully study, and he is endeavoring the introduction of electricity on the New Zealand lines.

J. S. KIDD

MR. G. PELLISSIER, editor of "La Lumière Electrique," of Paris, was a visitor in New York last month, on a hurried trip to Auckland, New Zealand. Mr. Pellisier will visit the latter city in the interests of a French and English syndicate, which has recently purchased the tramway system there, and expects to convert it to electric traction. Mr. Pellissier is well known on both sides of the Atlantic, from his writings on electric railway subjects, some of which have appeared in this paper.

MR. A. E. WORSWICK, engineer to Wehrner, Beit & Co., of London, Eng., spent a few days in New York last month on his way to the City of Mexico, where he will superintend the electrical equipment of a section of the tramway in that city, which is controlled by Wehrner, Beit & Co. Mr. Worswick was formerly a resident of Canada, and has recently been engaged in installing electric railway equipments in Port Elizabeth and Cape Town, South Africa, which systems are also owned by the firm he represents.

MR. F. O. RUSLING has recently been appointed general manager of the Port Elizabeth Tramway Company, Port Elizabeth, Cape Colony, South Africa. Mr. Rusling is very well known throughout the street railway field, and was formerly general manager of the Rochester (N. Y.) Railway Company. Before going to Rochester, Mr. Rusling was superintendent of the Buffalo Railway Company. Mr. Rusling will sail for Port Elizabeth about April 6, and will take with him the best wishes of his many friends in the United States.

MR. H. P. BRADFORD, formerly general manager of the Cincinnati Inclined Plane Railway Company, has recently accepted the position of general manager of the Compania del Fer-

rocarriles de Déstrito Federal de Mexico, the company owning the street railways in the City of Mexico. Mr. Bradford will assume the position recently resigned by Mr. T. H. McLean, who is going to Toledo. Mr. Bradford, as is well known, has had a long experience in electric railroading, and is well fitted for the position which he has assumed.

MR. LOOMIS ALLEN, formerly superintendent of the track department of the Syracuse Rapid Transit Railway Company, has been promoted to the position of assistant general manager. Mr. Allen has been superintendent of the track department of this road since April 1, 1895, and has had charge of all the construction work since that time. He has had several years' experience in the engineering business in various parts of the country and is intimate with every detail of the work. His promotion was secured by faithful and efficient service.

MR. EDWARD E. WESSELS, who was formerly general manager of the Standard Air Brake Company, has entered the publishing business as publisher of the "Universe," a weekly magazine for young readers, which briefly records current events in such a style as to be readily understood. We notice as in charge of the Science department of this paper the name of Mr. T. Commerford Martin, the well-known editor of the "Electrical Engineer." The first numbers of this magazine which have been published are quite attractive, and Mr. Wessels has the best wishes of his many friends in his new venture.

MR. FRANK X. CICOTT, who is the representative in London, Eng., of a number of electric railway manufacturers, and who is also well and favorably known on this side of the Atlantic, started from London on March 24 for a trip around the world. The object of Mr. Cicott's trip is to investigate the prospective conditions and installations of electric tramways in different parts of the globe, and he will visit on his trip Gibraltar, Malta, Naples, India, Australia, New Zealand, the Samoan Islands, Honolulu, San Francisco and New York. Mr. Cicott expects to take about eight months for his trip, and his long experience in electric railroading will make his observations on the possibilities of electric traction very valuable.

MR. LOUIS E. ROBERT, who was formerly connected with the Sterling Supply & Manufacturing Company, has accepted the position of secretary of the New York Switch & Crossing Company, of Hoboken, N. J. Besides this official position, Mr. Robert will also act as general outside representative of the company. Mr. Robert is well known in the street railway field, and has had long experience in track work, having been for nine years connected with the Lewis & Fowler Girder Rail Company, for whom he made locations for proposed special work installations. The New York Switch & Crossing Company has an able corps of representatives, who are engineers as well as builders of special work, so that they can advise street railway companies as to the proper construction and design of special work and also supply it.

MR. J. C. BRACKENRIDGE, who was recently appointed chief engineer of the Brooklyn Rapid Transit system, in place of Mr. J. T. Whittlesey, resigned, has had a long experience as a constructing and electrical engineer. He was with the Brooklyn and Union elevated railroad companies, as assistant engineer in charge of the foundation construction and track work during the construction of both these roads in 1884-1889; he was assistant chief engineer of the Phoenix Construction Company, in 1889, and had charge of the building of the electrical subways above Fifty-ninth Street, in the City of New York; he was with the Department of City Works, Brooklyn, as assistant engineer on the water works extension, east of Rockville Center, L. I., and had charge of the construction of the waste-weir supply ponds in 1882-1892; he was with the East River Bridge Company as first assistant engineer when it was proposed to build the bridge by a private corporation, on surveys, triangulations, etc., in 1892-1894; he was chief engineer of the track department of the Brooklyn Heights and Brooklyn, Queens County & Suburban Railway Companies, in charge of the track construction and maintenance on both roads, until appointed chief engineer of the whole system now known as the Brooklyn Rapid Transit Railway Company. While chief engineer of the Brooklyn companies he was also made engineer of the associated trolley companies of Brooklyn, comprising all the electric surface roads of the city of Brooklyn, for the purpose of extending the lines across the Brooklyn Bridge to New York City.

Obituary

MR. JAMES A. STRATTON, secretary and treasurer of the Birmingham Railway & Electric Company, of Birmingham, Ala., died very suddenly recently of typhoid fever. Mr. Stratton was 43 years old at his death, and was a native of Aurora, Ind., where he received a liberal education. He was connected for some time with the First National Bank of his native city, as cashier. Fourteen years ago he went to Birmingham, Ala., and obtained the position of head bookkeeper at Alice Furnace. He held this position with credit to himself and the company until the Birmingham Electric Railway Company was organized, when he assisted in the work of organization and became its secretary and treasurer, which position he held until his death. Mr. Stratton was president of the Jefferson County Improvement Company, and secretary and treasurer of the East Lake Company.

AMONG THE MANUFACTURERS

GEIPEL & LANGE, of 68 Victoria Street, Westminster, London, in addition to obtaining the gold medal at the recent Brussels exhibition, have been awarded a special prize of 100 francs for their patent steam trap.

THE CRANE COMPANY, of New York, has recently secured the contract for pipe valves and fittings for the Dayton & Western Street Railway at Alexandria, Ohio, through its representative, G. A. Hurd.

THE BALL ENGINE COMPANY, of Erie, Pa., reports that its factory has been operating night and day since September, 1897, on account of the great demand for its engines for electric light and power purposes.

THE J. A. FAY & EAGAN COMPANY, of Cincinnati, Ohio, have found its business increasing so rapidly that it has voluntarily increased the wages of its employees 10 per cent. This increase went into effect on March 21.

THE SESSIONS FOUNDRY COMPANY, of Bristol, Conn., has recently secured an order for about 260 tons of castings for delivery at St. Paul, Minn., for a counter weight street railway system for operating cars over heavy grades.

HAROLD P. BROWN, of New York City, has secured a number of foreign orders recently for plastic bonds. This bond is now being adopted as standard very extensively by street railway companies thoughout the world, and the manufacturer thinks that it absolutely solves the problem of the return circuit.

THE SPRINGFIELD MANUFACTURING COMPANY, of Bridgeport, Conn., has recently received an order from the Italian branch of the General Electric Company, at Milan, Italy, for one of its wheel-grinders; and also an order from the Consolidated Railway Company, of Baltimore, for one grinder.

THE COLUMBIA MACHINE COMPANY, of Brooklyn, N. Y., reports a very good business for the last month, and the company's factory is working night and day. This company has found it necessary to extend its plant and has added the building 19 Furman Street, where it has established a complete blacksmith shop.

EUGENE MUNSELL & COMPANY, of New York and Chicago, are mailing to the electrical trade throughout the United States their 1898 catalogue of "Mica Specialties." As a preface to this catalogue appears the following very pointed statement: "The rapid growth of our business is the strongest evidence of the superiority of our mica."

S. C. STROCK, of New York, reports an excellent business in ties during the last month. Among the recent orders which he has received is one from the Bridgeton & Millville Traction Company, of Bridgeton, N. J., and one from the Pittsburgh & Leominster Street Railway Company, of Pittsburgh, Mass. Mr. Strock states that there is a good demand for good ties at reasonable prices.

THE BUCKEYE ELECTRIC COMPANY, of Cleveland, Ohio, has received an order from the United States Government Naval Department, at Washington, for the Jandus enclosed arc lamps which this company manufactures. This is a "rush" order, and is certainly a good testimonial to the confidence which the Government has in the Buckeye Electric Company to fulfill its contracts.

HEDDEN & WHEELER, varnish makers, of Newark, N. J., report a large business with electric railway companies in varnishes and paints. Wheeler's manganese iron paint, for structural purposes, for trolley line poles, for bridges, tin roofs and all

exposed metal-work is particularly well adapted to the needs of street railway companies and it is giving excellent satisfaction wherever used.

THE BETHLEHEM IRON COMPANY, of South Bethlehem, Pa., has recently secured an order for the forgings of the engines of the torpedo boat "Rogers," which was built by the Columbian Iron Works & Dry Dock Company, of Baltimore. These forgings broke recently, causing considerable damage to the machinery. The Bethlehem Iron Company is pleased to state that the forgings which broke were not made by that company.

THE DUVAL METALLIC PACKING COMPANY, of New York, is constantly receiving unsolicited testimonials to the satisfaction given by its metallic packing. A letter recently received from the Boston Lead Manufacturing Company, of Boston, Mass., reads as follows: "The packing we previously had from you was for the engine pistons and valves and has proved very satisfactory. After running a year the rods are smoother than when the packing was put in."

THE KENSINGTON ENGINE WORKS, LTD., of Philadelphia, Pa., have received orders for three 66 ft. x 18 ft. return tubular boilers, 125 lbs. pressure, and have just shipped three heaters, one 1200 h.p. to the Cambria Iron Company, Johnstown, Pa., one of 100 h.p. to the Bucks County Railway Company, for a trolley line between Doylestown and Willow Grove, and one of 60 h.p. to Greenville, S. C. All these heaters are of this company's water-tube type, and built for a working pressure of 150 lbs.

THE BALL ENGINE COMPANY, of Erie, Pa., has issued an unusually artistically arranged folder describing the more prominent advantages of the Ball automatic governor for engines and the Ball automatic system of lubrication. This automatic governor is attracting considerable attention and it is believed by the manufacturers that it eliminates a number of the weak points often found in engine governors. This company's automatic oil system employs the force of gravity for feeding to the engines.

C. W. HUNT COMPANY, of New York City, is placing upon the market a coal cracker which is designed for breaking the large lumps in run of mine of bituminous coal into small pieces that will feed though the automatic stokers used under the boilers of large steam generator plants. The points on the rolls are made of tool steel with hardened points, especially designed to crack and not to crush the lumps of coal, so that none of the advantages of lump coal are lost. The fine coal passes through the rolls unaltered.

THE GEO. F. BLAKE MANUFACTURING COMPANY, of New York, is receiving a large number of orders for its well-known air pumps, both in the United States and from foreign countries. This company has recently completed an installation of air pumps which particularly shows the high-class of work which it does. This consists of an entire air pumping system for condensing, feed, bilge and fire purposes on the steamer "Kaiser Wilhelm der Grosse." This is one of the largest installation of air pumps ever made.

THE OHIO BRASS COMPANY, of Mansfield, Ohio, will shortly distribute to all those who have previously been supplied with a copy of its supplement to catalogue No. 3, several additional pages illustrating and describing some new articles which have recently been placed on the market by this company. The supplement was issued last fall. These additional pages are for insertion in the supplement by attaching them to the stub leaves, provided for this purpose in the back, by which means the catalogue may be kept complete.

THE NEW YORK ELECTRICAL WORKS have been compelled to change their plant to a larger building, owing to the increase in their business. They have moved from 161 Washington Street, New York, to 515-521 Kent Avenue, Brooklyn. This company reports an exceedingly good business and has several large orders on its books. It has been located at 161 Washington Street for six or seven years, and now cordially invites all its customers and friends made at its old place of business to visit and inspect its new plant.

THE E. T. BURROWES COMPANY, of Portland, Me., has issued a catalogue, giving much interesting information relative to the well-known Burrowes' car curtains. These curtains are all equipped with the pinch handle holding device, are easy to operate, never stick, cannot rattle, do not sway, always hang straight, have no notches, no ratchets, no balancers, no delicate parts, nothing to get out of order, work quickly, and stop exactly where left. These curtains are now used by street railway companies all over the country, and they seem to be giving excellent satisfaction.

SIPE & SIGLER, of Cleveland, Ohio, have issued a calendar of convenient size, giving full information and statistics relating to the Willard storage battery. It is claimed by the manufacturers of this battery that it embodies a number of new and valuable features, which are not usually found in storage batteries. The chief claim for merit is made upon the fact that the Willard plate, including the terminal, is constructed from a single sheet of pure rolled lead, every part of the finished product remaining integral with the original plate, never having been separated therefrom.

THE Q. & C. COMPANY, of Chicago, reports a number of good orders received for the Q. & C.-Stanwood steel car steps, one of the largest being from the U. S. Navy, for the steamship "Atlanta." This company's new supplemental catalogue is now ready for distribution, and will be sent free upon request. This catalogue gives illustrations of the different styles of steps made, details of construction, etc., together with information regarding the new self-feeding rail drill, designed especially for street railway use, and other devices, which it offers to the street railway trade.

THE FOREST CITY ELECTRIC COMPANY, of Cleveland, Ohio, has issued a very neat catalogue, describing the different styles of commutator bars which it carries in stock. These commutators are known as rolled drop and are cast from pure lake copper, and cold forged or pressed to size by hydraulic machinery. This process produces a dense accurate bar, for which it is claimed that it will give entire satisfaction wherever it is used. The Forest City Electric Company manufactures and carries in stock commutator bars for all the different makes of generators and motors in common use, and will make special styles wherever required.

THE NUERNBERG MACHINE WORKS, of Nuernberg, Germany, is building at present a 6-h.p. Diesel motor which will be put in operation on the street railway in Muenchen, Germany, about May 1st. This will be operated as an independent motor. This company is the licensee of the Diesel patents, which are owned by the Diesel Motor Company, of America, with headquarters at 11 Broadway, New York City. The Diesel Motor Company manufactures motors of all sizes for stationary purposes, for locomotives, and for marine engineering. It will have one of its 20 h.p. motors in operation in April, and invites trade inspection.

THE PIERCE & MILLER ENGINEERING COMPANY, 26 Cortlandt Street, New York, reports increasing demands for export shipments of high grade engines and boilers. During the past month the work of installing a large and unique railway plant has been completed, and the plant is running smoothly and effectively, while orders for the more usual sizes of outfits have kept the company's working staff quite busy. The automatic shaft governor to regulate high and medium speed engines recently adapted to this firm's electric railway and lighting engines is giving the utmost satisfaction, and several repeat orders have already been received as a consequence.

E. P. ROBERTS & COMPANY, of Cleveland, Ohio, are the engineers for the Dayton & Western Traction Company, now building a line between Dayton and Eaton, Ohio. The Osborne Company, of Cleveland, civil engineers, acted as assistant engineers to E. P. Roberts & Company, and also inspected at the mills all the steel used for boilers, structural work and rails. Some particulars of this road were published in our last issue, and the road is now approaching completion. E. P. Roberts & Company have acted as engineers for a number of electric railways, and especially for interurban high speed lines, of which there are a number in Central Ohio.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, of Philadelphia, Pa., has appointed W. R. Garton, 414 Ashland Block, Chicago, Ill., as its Western representative. This change means that the Keystone Electrical Instrument Company is going to make a strong bid for Western business, and there is little doubt but that Mr. Garton's large acquaintance and well-known business energy will result in largely increased sales of this company's instruments in his district. This company reports that since the first of the year its factory has been working day and night to keep pace with its orders, and it is now preparing to largely increase its present facilities.

THE JOSEPH DIXON CRUCIBLE COMPANY, of Jersey City, N. J., supplies a belt dressing which is claimed to be an absolute necessity in every well-regulated factory. Belts that slip not only do not drive properly, but they wear out rapidly; and a

belt that is too tight is over-strained and will also wear out rapidly. The Dixon belt dressing is designed to prevent a belt from slipping, and thoroughly preserves its life and elasticity. As long ago as 1878 it was used on the big driving belt at the Paris Exposition, when every other means had been tried and failed to make the belt take hold of the pulley that was to start the thousands of feet of shafting and the hundreds of machines.

GEORGE T. HANCHETT, of New York City, has removed to 123 Liberty Street, New York, where he will open an office as general electrical and mechanical engineer. Mr. Hanchett announces that he has every facility for preparing engineering drawings and tracings on short notice, and he has associated with him competent draughtsmen and mechanics so that his facilities for preparing engineering work are very complete. Mr. Hanchett also wishes to state that he has every means at hand for the designing and construction of electrical machinery and models, and he makes a specialty of perfecting inventions and apparatus so that they can be manufactured at a minimum cost.

THE WESTERN ELECTRIC COMPANY, of Chicago and New York, reports an excellent business in its different lines of street railway material. Its non-sparking brushes in particular are having a very large sale. The company thinks that the most stubborn case of sparking at the brushes and commutator can be conquered by the use of the Western Electric non-sparking brush. This brush is highly recommended by many of the best dealers in the country. The Western Electric Company is also pushing its swing tree insulator, and thinks that this is the proper time of the year for street railway and electric light plants to carefully examine their outside lines in order to prevent them from coming in contact with trees.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., has secured another contract from the Hartford City Gaslight Company, of Hartford, Conn., for one of its steel roofs lined with its patent anti-condensation fire-proof lining. The new building is to be 30 ft. wide and 70 ft. long, having brick sides and iron roof construction as mentioned above. The Berlin Iron Bridge Company has also secured an order from the Bristol & Plainville Tramway Company, of Bristol, Conn., for building a new steel bridge, having a span of about 90 ft. This bridge will be built at Plainville, Conn. It has been designed with the view of providing a permanent structure, which will be able to take care of the increasing and heavy traffic of this road.

THE ST. LOUIS IRON & MACHINE WORKS, St. Louis, Mo., have just completed two cross compound condensing "St. Louis Corliss" engines of 200 h.p. each, to be direct-connected to Westinghouse generators for the Dallas Street Railway & Light Company, of Dallas, Tex. They have under construction one cross compound condensing heavy duty "St. Louis Corliss" engine of 1000 h.p. for the Consolidated Electric Light & Power Company, Kansas City, Mo.; also two cross compound condensing heavy duty "St. Louis Corliss" engines of 500 h.p. each, for the Lehigh Portland Cement Company, Allentown, Pa.; also one "St. Louis Corliss" engine of 200 h.p. to be attached to an air compressor for the Anheuser-Busch Brewing Association, St. Louis, to be used for deep well pumping by air pressure.

THE HARRISBURG FOUNDRY & MACHINE WORKS, of Harrisburg, Pa., have engaged W. R. Fleming, formerly of W. R. Fleming & Co., of New York, Boston and Philadelphia, as vice-president and general manager. Mr. Fleming succeeds M. E. Hershey, formerly general manager of the company. This change took effect on Feb. 1st. The Harrisburg Foundry & Machine Works contemplate making a considerable increase in their facilities for manufacturing automatic engines for electric service. It is intended to add several new lines of engines, so as to broadly cover the whole field of steam engine practice. It is also understood that the company will rebuild its entire plant upon a plan and scope which will place it in a superior condition for the manufacturing of its machinery, which is well known throughout the country.

THE BALDWIN LOCOMOTIVE WORKS, of Philadelphia, have recently built one of their steam motor cars for use on the lines of the Cincinnati, Hamilton & Dayton Traction Company. The weight of this motor in working order, not including passengers, is 48,000 lbs., with about 32,000 lbs. on the driving wheels. The cylinders are of the Vaulcain compound type, high pressure, 5½ ins. in diameter; low pressure, 9 ins. in diameter; stroke, 12 ins. The fuel used will be anthracite coal or coke. The boilers are 48 ins. in diameter, centrally fired, and are of the self-feeding type, being supplied with coal from the top of the car roof, around the stack, though a 10-in. pipe in the center of the boiler. The boiler is constructed of steel ½ in. thick and carries a working pressure of 180 lbs. to the square inch. The feed-water is supplied by two injectors.

FRANK M. BLAISDELL, landscape architect and civil engineer of Boston, Mass., makes a specialty of designing and superintending the construction of pleasure parks and resorts for street railway companies. Mr. Blaisdell has had considerable experience in designing special attractions for parks, such as casino buildings, canoe and bicycle houses, band stands, rustic open air theaters, rustic bridges, towers, grottos, gateway entrances, building of ponds, developing of springs, planting of trees, shrubbery, etc. He has successfully carried out work of this kind for a number of street railway companies, including the Portland Railroad Company, of Portland, Maine, Newcastle Traction Company, of Newcastle, Pa., Commonwealth Avenue Railroad Company, of Newton, Mass., and Fitchburg & Leominster Railroad Company, of Fitchburg, Mass.

THE MICA INSULATOR COMPANY, of New York, Chicago and London, announces that it has recently made an addition to its already extensive line of oiled cloth and paper insulations, and is now prepared to furnish M-I-C-compound rope and bond paper. This line of insulation is made from the finest grade of rope and bond paper and treated with two baked coatings of M-I-C compound. The rope paper is furnished in sheets one yard wide, two yards long, and carefully packed between sheets of plain paper. The average break down test is 739 volts per mill; thickness, 4½ mills. The bond paper is furnished in sheets 19 ins. x 24 ins. and 22 ins. x 34 ins., the average break down test being 859 volts per mill; thickness, 5 mills. The company will be pleased to send samples to electrical manufacturers, street railways, or lighting stations upon application.

ELMER P. MORRIS, of New York, reports a large number of shipments of electrical apparatus made by him to street railway companies abroad. Mr. Morris makes a specialty of this kind of business, and acts as purchasing agent in this country for foreign tramway companies. Mr. Morris' experience in electric railway construction well fits him for this business, as he knows all the conditions which are apt to arise in electric railway work, what apparatus is best suited to some of the conditions and what to other conditions. In advancing this line of business he has secured the services of C. H. Leighton, who sailed for Europe March 19 to make a tour of the principal European countries and introduce Mr. Morris' particular line of work to them. Mr. Morris also reports a good American business, and in this direction has secured the services of C. J. Harrington.

THE GENERAL ELECTRIC COMPANY, of Schnectady, N. Y., has recently issued a small pamphlet entitled "A Modern Gear Plant," which describes the very extensive factory that this company has established at Lynn, Mass., for the exclusive manufacture of steel gears and pinions. This plant is equipped with the best modern machinery and gears and pinions are made in all standard sizes. The General Electric Company reports a number of orders for its electrical apparatus during the past month. One of these comes from the Cincinnati Street Railway Company, and covers the necessary electrical equipment to enable that company to change over its Walnut Hill line from cable to electric traction. This order amounts to over $100,000. The Boston Elevated Railway Company has also placed a large contract with the General Electric Company for electrical apparatus amounting to about the same sum.

THE SARGENT COMPANY, of Chicago, Ill., has found it necessary to considerably increase its present capacity, owing to the number of large orders which it has received. Its business so far this year has increased about 40 per cent over its business for the corresponding period last year. The Sargent Company, in addition to making other improvements, has recently installed a large 20-ton electric traveling crane in its factory, in addition to the cranes now operated. It has also installed an additional saw of the latest and most improved type. The traveling crane was supplied by Manning, Maxwell & Moore, and the saw was made by the Q. & C. Company. The Sargent Company is rearranging its receiving and shipping departments extensively, and is installing new engines, dynamos, etc., in its power house. This company now has a capacity of about 1000 tons a month, which will of course be greatly increased by the changes now in progress.

THE ELECTRICAL EXHIBITION COMPANY, of New York City, reports that the demands for space at the Electrical Exhibition, to be given in Madison Square Garden, in May, are constantly coming in, and the complete success of the exhibition is more than assured. A number of interesting collections of telegraphic instruments, etc., will be made, and will undoubtedly prove strong drawing cards. It is proposed to have on exhibi-

tion, besides other electrical apparatus, a working model of the third-rail system, as applied to the lines of the New York, New Haven & Hartford Railroad Company. N. H. Heft, electrical engineer of this company, has kindly placed at the disposal of the Electrical Exhibition Company blue-prints showing the construction of the track and some of the actual material used. The model will be from 50 ft. to 100 ft. long, and a small car will be in actual operation, showing the method of picking up current and delivering it to the motors.

THE AULTMAN & TAYLOR MACHINERY COMPANY, Mansfield, Ohio, manufacturers of the well-known types of Cahall vertical water tube boiler and Cahall-Babcock & Wilcox water tube boilers, have recently secured valuable additions to their erecting force in the persons of W. E. Bickford and J. C. Cooke. Mr. Cooke has been located in the Philadelphia district for the past six years as superintendent of erection for the Babcock & Wilcox Company of New York City. The Cahall people are to be congratulated on having secured the service of Mr. Cooke, and as he has made the change for his own betterment, no doubt his many friends will be pleased to learn of his having taken charge of the erecting department for the Cahall people in Philadelphia and New York. Mr. Bickford has been superintendent of erection for the National Water Tube Boiler Company, for the past five years, and recently resigned that position to accept a position as erecting superintendent with the Cahall people with headquarters at Mansfield, Ohio.

LANGE, WHARTON & DOWN, LTD., electric light, power and traction engineers, of London and Leeds, England, have issued a catalogue describing track drills, rail saws and jacks which they handle. The jacks are the well-known Pearson jacks, which are now in use on a large number of street railway companies, both in the United States and abroad. The track drill which this company handles is called the Paulus, and is also well-known in the United States. The following advantages are claimed for this drill: Speed, five times that of ratchet brace; feed, equal to full capability of twist drill bit; no adjustments required before using; accuracy of bore equal to shop work; instant clearing of track to allow train to pass; minimum of repairs. This tool is well suited to its work, and is simple in construction. Lange, Wharton & Down also handle the Buda track drill. This company's rail saws are portable and are designed for cutting off rails true to length with square ends with great accuracy on the track. They are best driven by two workmen, who can make a complete cut in from 6 to 20 minutes, dependent on depth and weight of rail.

THE PENNSYLVANIA STEEL COMPANY has moved its Boston office to Mason Building, 70 Kilby Street, corner Milk Street. This branch reports that its street railway business has increased so in the past few years that it has entirely out-grown its present accommodations. Among its recent rail contracts is one of 5000 tons for the Boston Elevated Railway Company, 1500 tons for the Fall River & Newport Street Railway Company, 1800 tons for the Fall River & Providence Street Railway Company, besides many small orders for other roads. Its bridge and construction department business has grown equally fast. Besides its contract for the Southern Terminal station now rapidly nearing completion and involving nearly 10,000 tons of steel, it has recently completed the baseball cage for Harvard University, Memorial Chapel for Wellesley College, steel structure of an apartment house at the corner of Brookline Avenue and Beacon Street, Boston, and is erecting the new power station for the Boston Electric Light Company, which is to be one of the largest and finest in the country. It is a noteworthy fact that the first three sections of the Boston Subway were furnished by this company and it has recently taken a contract for the last section; and it is equally noteworthy that the Northern Union station was built by this company, and it is now completing the Southern Union station. A list of all the street railway and steam railroad customers of the company in New England would include almost everyone of the different systems.

THE ROBINSON RADIAL CAR TRUCK COMPANY, of Boston, Mass., has recently served the following infringement notice on a number of car and truck builders: "We beg to call your attention to the fact that the Robinson Radial Car Truck Company has entered suit, which is now pending, against the West End Street Railway Company, of Boston, for infringement of the Robinson brake system patent, owned by this company. The said infringed patent is No. 554,956, dated Feb. 18, 1896, application filed in 1891. For your information we would state that it is estimated that the West End Railway Company (now leased by the Boston Elevated Railway Company), has at the present time about 2000 cars provided with a brake system infringing the above-named patent. These infringing cars include all of the eight-wheel equipment lately put in operation and provided with the so-called 'Baker Truck,' also various four-wheel cars, including nearly all of those provided with trucks designed by one of the West End master mechanics. It is our purpose to prosecute this suit vigorously and to take such legal action as may be necessary for the protection of our rights in the premises, against all builders, sellers and users of trucks provided with the aforesaid infringing brake system. Please take note of the above facts and refrain from applying this brake system to any trucks which you may be called upon to build or furnish for the Boston Elevated Railway Company, or any other parties, and thus avoid legal complications and responsibility for the same."

THE WALKER COMPANY, of Cleveland, Ohio, will shortly install two 6-pole 100 kw. lighting generators in the Metropolitan Museum of Art, in New York. This company has also received an order from the Presbyterian Hospital, of New York, for a 100 kw. generator and switchboard for lighting purposes. Among the other orders for apparatus for lighting purposes may be mentioned a Walker alternator 3-phase, 60 cycle, which has been purchased by G. Burkhart, of Hudson, Wis. Among the electric railway equipments recently ordered may be mentioned a 500 kw. railway generator of the belted type, and a general panel for the switchboard for the Los Angeles Traction Company, of Los Angeles, Cal., 10 double 3-S equipments with type S controllers sold to the Erie Construction Company for the Buffalo Traction Company, 3 double 40 h.p. equipments with S controllers sold to Isaac Walker & Son, for the Quakertown (Pa.) Traction Company, and 2 double 3 S equipments for storage battery motor cars sold to S. M. Fisher, for the Patton Motor Company. The Walker Company reports that its type S solenoid blow-out controller is the most popular one the company has ever placed on the market. The controller departments of its factories are turning out very large numbers of the type S apparatus. As this issue is going to press it is announced that the Walker Company has just received a contract from the U. S. Government for the building of some very large gun carriages, weighing many tons. The Government desires to make use of the company's large foundries in order that the work may be quickly done.

THE METROPOLITAN ELECTRIC CONSTRUCTION COMPANY, of New York, is now doing all of the installation work of the Sprague Electric Company, an arrangement to that effect having been recently closed. The announcement was made in a striking two-color circular by the Sprague Company, in which circular it was pointed out that the Construction Company would not only contract for installation and maintenance of Sprague machinery, but of any other machinery as well. The offices of the Construction Company, as well as those of the Sprague Company, are in the Commercial Cable Building, New York. The officers are W. D. MacQuesten, president and general manager, and Wallace E. Carver, treasurer. The organization of the Sprague Electric Company, which was formed by the consolidation of the Interior Conduit & Insulation Company, and the Sprague Electric Elevator Company, is being rapidly perfected. The offices of the company now occupy practically the whole of three floors in the Commercial Cable Building. The company recently secured a suite of rooms in the Marquette Building, Chicago, which will be in charge of Millard B. Kitt and E. B. Kittle, long identified with the company. Well-known electrical men and houses are being rapidly secured to represent the Sprague Company in various sections of the country, and the organization bids fair to be a remarkably strong one in every way. An advertising and press bureau is one of the new departments of the Sprague Company, and it has been installed in a suite of rooms on the nineteenth floor of the Commercial Cable Building.

New Publications

The Composite and Its Field. By C. Peter Clark. 16 pages.

This is a copy of a paper read before the New England Railroad Club, at Pierce Hall, Boston, December 14, 1897. This paper discusses the advantages and disadvantages of the use of the composite car, and contains a number of suggestions whereby this type of car can be made to fill all the conditions encountered in railway practice.

Thirteenth Annual Report of the Board of Gas and Electric Light Commissioners of the Commonwealth of Massachusetts. Published by Wright & Potter Printing Co., State Printers, Boston, Mass. 366 pages.

The Board of Gas and Electric Light Commissioners of the

Commonwealth of Massachusetts has under its supervision 134 companies, and the gas or electric light plants of thirteen towns and two cities, all in the State of Massachusetts. This report contains full information regarding the operation of these plants, including the annual reports for the last year.

Trade Catalogues

A Modern Gear Plant. Published by the General Electric Company. 14 pages. Illustrated.

Commutator Bars. Published by the Forest City Electric Company, of Cleveland, Ohio. 24 pages. Illustrated.

Car Shades and Curtains. Published by the E. T. Burrowes Company, of Portland, Me. 22 pages. Illustrated.

Catalogue. Published by the Q. & C. Company, of Chicago, Ill. Illustrated.

A Modern Engine. Published by the Ball Engine Company, of Erie, Pa. 5 pages. Illustrated.

Willard Storage Batteries. Published by Sipe & Sigler, of Cleveland, Ohio. 32 pages. Illustrated.

List of Street Railway Patents Issued

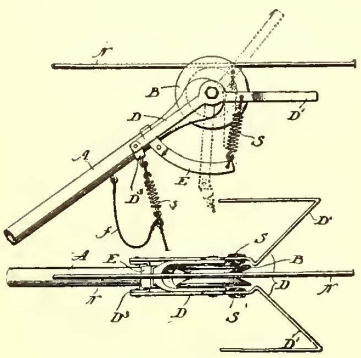
U. S. Patents Issued February 22 to March 15, inclusive.

February 22.

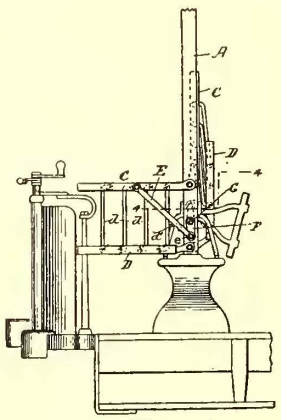
Electric Railway System.—John M. Murphy, Torrington, Conn. No. 599,344.

Trolley for Electric Railways.—Edward K. Landis, Philadelphia, Pa. No. 599,393.

The combination with a current-collector adapted to engage a conducting wire, of a pivoted device having a wing on each side of said current-collector, each wing extending backwardly from its pivotal attachment to a point adjacent to the extremity of said current-collector, thence backwardly and obliquely, and thence forwardly toward its free end.



PAT. NO. 599,393



PAT. NO. 600,261

Street Car Air Brake.—Charles A. Gray, Kansas City, Kan. No. 599,421.

This invention, as its name implies, is a brake operated by compressed air carried in a tank on a street car, provided with means for admitting the air to the brake cylinder for operating the piston therein, which sets the brakes.

Car Fender.—Inozens J. Neracher, Cleveland, Ohio. No. 599,470.

Automatic Car Stopper.—Inozens J. Neracher, Cleveland, Ohio. No. 599,471.

Switch Operating Mechanism.—Charles W. Yerbury, Newark, N. J. No. 599,580.

This invention relates to an electric railway switch comprising electromagnets for moving the switch and means carried by a car for operating the circuit closers.

Electric Railway System.—James D. Gibbs, Chicago, Ill. No. 529,604.

Safety Guard and Truck for Cars.—Abel M. Phelps, New York, N. Y. No. 599,629.

Safety Guard for Railway Cars.—Abel M. Phelps, New York, N. Y. No. 599,630.

March 1.

Car Fender.—Francis S. Davidge, Washington, D. C. No. 599,770.

Automatic Switch.—Marion N. Shufflebarger, Bristol, Tenn. No. 599,808.

Electric Railway.—William M. Brown, Johnstown, Pa. No. 599,828.

The combination with the traveling magnet, energizing-coils therefor connected to opposite sides of the main circuit, and a second set of energizing-coils therefor, of an independent source of current-supply and a switch interposed in a circuit between the independent source of supply and the said second set of energizing-coils and arranged to close whenever the voltage of the main circuit falls below a predetermined figure.

Electric Car Trolley.—Wm. H. Russell, Newcastle, Canada. No. 599,868.

Fender for Trolley Cars.—Otto Spechenbach, New York, N. Y. No. 599,920.

Electrically Controlled Vehicle.—Philip R. Salberg, Pittsburgh, Pa. No. 599,947.

Tramway Switch.—Adam E. Shannon, Findlay, Ohio. No. 600,091.

The switch in this invention is operated by means carried by a car.

Car Fender.—Jokul W. Sussman, New York, N. Y. No. 600,099.

March 8.

Automatic Car Fender.—Oliver E. Stahl, Baltimore, Md. No. 600,183.

Safety Fender for Street Cars.—Wm. B. Heywood, Gualala, Cal. No. 600,224.

Gate for Railway Cars.—Paul Gruhn and Wilhelm Stolpner, Boston, Mass. No. 600,261.

The gate in this patent is collapsible, and is operated by the movement of a folding seat, with which it is connected.

Automatic Switch for Railways.—Howard F. Eaton, Quincy, Mass. No. 600,278.

This invention relates to an electric switch operated by the car

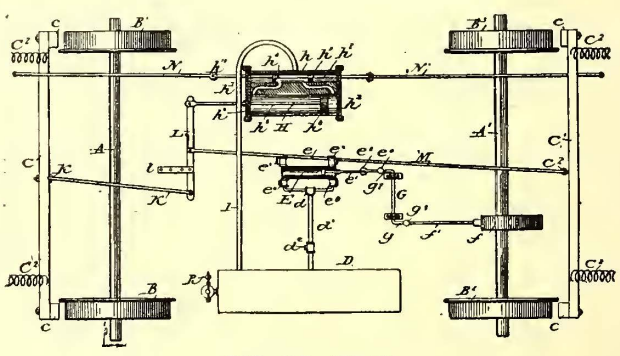
Car Fender and Brake.—Emery E. Rice, Charleroi, Pa. No. 600,378.

Electric Railway.—Louise Scherpe, St. Louis, Mo., administratrix of John F. Scherpe, deceased. No. 600,381.

Switch for Street Railways.—George E. Crane and Victor H. Esch, Washington, D. C. No. 600,407.

March 15.

Controller for Electrically Propelled Vehicles.—R. T. D. Broughham and W. C. Bersey, London, Eng. No. 600,509.



PAT. NO. 599,421

The combination of a switch-lever, a brake-lever, a foot-lever, a connection between the foot and switch levers such that the first movement of the former causes a rapid and wide separation of the contacts, and a connection between the foot-lever and brake-lever such that the movement of the former gradually operates the latter.

Car Fender.—George F. Radcliffe and John C. Sentz, Kansas City, Kan. No. 600,596.

Car Fender.—Wm. F. Young, Philadelphia, Pa. No. 600,601.

Trolley.—John Clayton, Cuyahoga Falls, Ohio. No. 600,633.

This invention relates to means for lubricating the trolley wheel.

Automatic Railway Switch.—Walter C. Humphreys, Salisbury, Md. No. 600,674.

The switch is operated by a device carried by a car.

Protector for Motormen.—John Bowen, Newark, N. J. No. 600,709.

This invention consists in a water-proof strip provided with a sheet of glass, and hangs down in front of the motorman, and is connected with a roller so that it may be wound up when not in use.

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