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THE STREET RAILWAYS OF WASHINGTON, D. C.

All the principal street railway lines operating in the city of Washington are at present undergoing important changes. Some are extending their present limits, while others are being rebuilt, one for cable traction and another for an underground electric system. In studying the street railway situation of Washington, it must be remembered that all the street railway lines of the District of Columbia are under the direct supervision of Congress, and none of them can effect a change of motive power without a special act, and this has been secured in the case of the Columbia Railroad Company and other roads, which will be noted below. It should also be borne in mind that an act of Congress, passed some years since, prohibits the use of overhead wires for the operation of any of the street railway lines within the city limits.

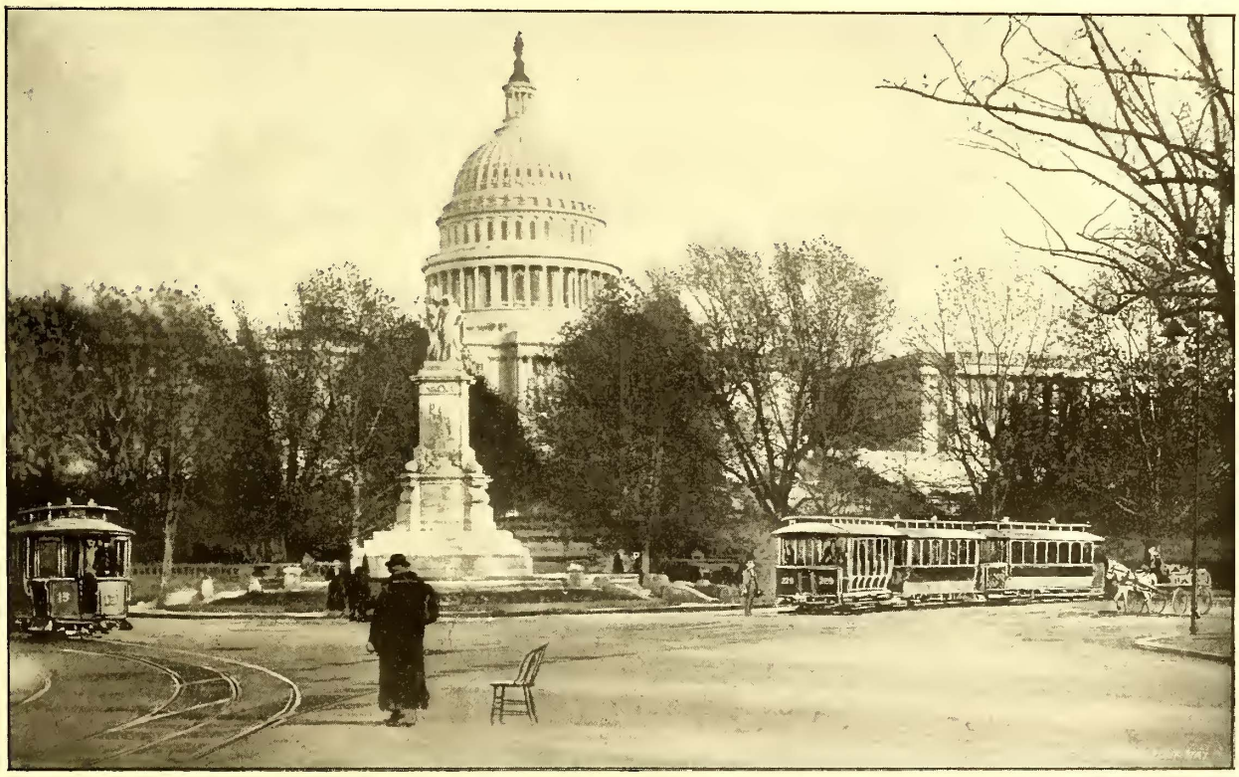


FIG. 1.—CABLE CURVE AT PEACE MONUMENT, FOOT OF PENNSYLVANIA AVENUE—WASHINGTON, D. C.

Washington & Georgetown Railroad Company.

All the lines controlled by this company are now operated by cable, and are run in three divisions known as the Pennsylvania Avenue or Georgetown division, 7th and 14th Streets divisions. The Georgetown terminal of the Pennsylvania Avenue section is to be extended a distance of 1,500 ft. to the Aqueduct Bridge, where a new car house and station will be erected, through which, to the right of the street, the track will make a loop, by means of which the cable trains will be turned. This will be a gravity loop, and the cable will not follow the line of the track, but will encircle a terminal sheave located in the street. The present car house in Georgetown will be abandoned and devoted to other purposes. The present length of rope, which operates the Georgetown division from the central power station, is 2,350 ft., but it will be correspondingly increased to operate the extension. The length of the rope which operates the Navy Yard end of the line is 31,500 ft., that on 14th Street division is 27,700 ft., and on 7th Street division 33,250 ft.

All the ropes now employed on this line are one and ¼ a quarter inches in diameter, are of the Lang lay type, and were manufactured by Roebling and Broderick & Bascom. The lay of these ropes is eight and a half inches, somewhat shorter than the lay usually employed by foreign manufacturers.

On the Georgetown line the average life of the cable is about 120 days or about 20,000 miles, while the 7th Street line being nearly straight, the rope in that division has an unusually long life. The rope which is now run-

ning was put in on July 2, 1893, and is still in fair condition.

During the early history of the Pennsylvania Avenue line, the traffic was interrupted quite frequently by the breaking or stranding of the ropes, but since Peter Moar was engaged as splicer and rope superintendent in February, 1893, there have been very few delays and only one serious one during the present year. Such a record is

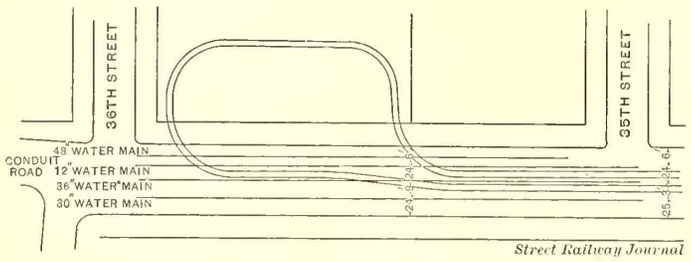


FIG. 2.—LOOP AT 35TH STREET—WASHINGTON.

evidence of the skill of the rope splicer and the care which is given to the ropes. Mr. Moar employs a rope dressing which he has originated, the material in which is known only to himself and to the officials of the company, and this is giving most excellent satisfaction, being very cheap and not liable to drop out in cold or wet weather. We do not know of a cable railway where the expense for rope dressing is maintained at so low a figure as on this system, as the following data will show:

CENTRAL POWER STATION.

3 cables=82,500 ft. of rope.
Material for coating and dressing, cost for nine months ending September 30, 1894, $151.86.
During this six new cables were put in and filled.

SEVENTH STREET POWER HOUSE.

1 cable=33,250 ft.
Material used for dressing, cost for nine months ending September 30, 1894, $11.88.

It will be noted that the expense on one of the ropes is less than five cents a day, and of all the ropes only about sixty cents per day. We are told of roads where a less number of miles of cable are operated, on which the average expense for rope dressing is nearly $15 a day. The proportion of ingredients employed in the rope dressing is varied to suit the conditions of the weather, and great care is exercised in applying it so that it is not too oily or too dry; in other words, a little "brain oil" is employed as one of the ingredients.

As we have before described in detail the equipment of the power stations of this system, it will not be necessary to repeat it in this connection, except to say that the method of rope drive employed in the central power station, in which both winding drums are driven from the same pinion, is giving most excellent satisfaction. The machinery is noiseless in operation, and the manilla ropes are making an excellent record, as well as the engines and boilers. The station, it will be remembered, is a large six story brick building, and the various floors are rented for offices and manufacturing purposes where power is employed, the shafting of the different floors being operated by an independent engine. All the apartments have not yet been leased, but the scheme is proving a paying one. The principal grip repair shop is on the ground floor, and this is equipped with a number of first class iron working tools. To this shop the grips of the entire system are brought every day for inspection, when they are cleaned and nuts and bolts tightened up. A raised iron platform in the middle of the shop is provided, on which the grips are overhauled, so that the oil and dirt are prevented from being scattered about the floor. We noted at the time of our visit that one of the five foot elevating sheaves was being repaired by lining the groove with cast steel segments which are held in place by steel bolts inserted on the inner side of the rim, thus prolonging the life of the sheave indefinitely. In the splicing room adjoining the tension runs, extra ropes are mounted in position on their spools ready to be run in when it becomes necessary to renew the rope.

The machinery in the 7th Street power station is also standing up exceedingly well under the long service, the line having been in operation nearly five years. This station is operated by compound engines, and the drums are operated by means of gear wheels, the main gears having wooden teeth which mesh with iron teeth on the pinion. After these wooden gears had been running about two years, they showed some sign of failing, and a new set was made, but the original teeth, with one or two exceptions, are still running, and seem to be in fair condition. The wooden keys, however, have all been renewed. It is proposed, in case it is found possible to change to the rope drive without interfering with the traffic, to replace the gear with a system of rope drive modeled after that in the central station.

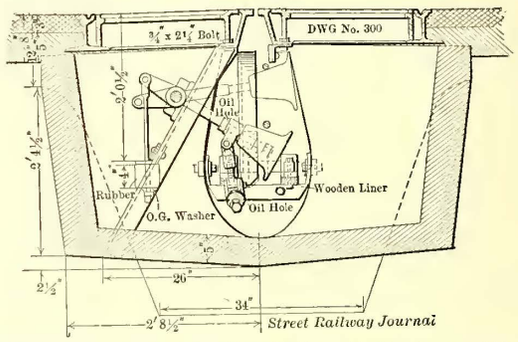


FIG. 4.—CROSS SECTION OF AUTOMATIC PICK-UP—WASHINGTON.

CAR SERVICE.

All the trains on this entire system consist of an open grip car and one or more trailers, open trailers being run in summer and closed cars in winter. The grips are operated by levers, and the gripman is stationed in the middle of the grip car. This method of operating the grip in the center of the car has been criticized somewhat in Washington, but, in our opinion, where the streets are as wide as they are here, and where the conditions are all favorable, there can be no more liability to accident with the gripman in the center of the car than when he is stationed on the front platform. In crowded streets like Broadway and Third Avenue, New York, the conditions are different. With open grip cars and the gripman in the center, accidents to people getting on or off are often prevented by the ability of the gripman to overlook the entire car. It is also claimed for the lever grip that it is more quickly operated, consequently the rope can be released and the car stopped quicker, with less danger of the gripman falling to release the rope in time at let-goes, than with the wheel grip. Should the grip be damaged en route, and require to be taken up out of the conduit, it can be done without disturbing the passengers where an open car is employed, while with a wheel grip operated from the front platform of a closed car, it is necessary to have the passengers leave the car in order to remove the grip. In this connection it may be stated that the prac-

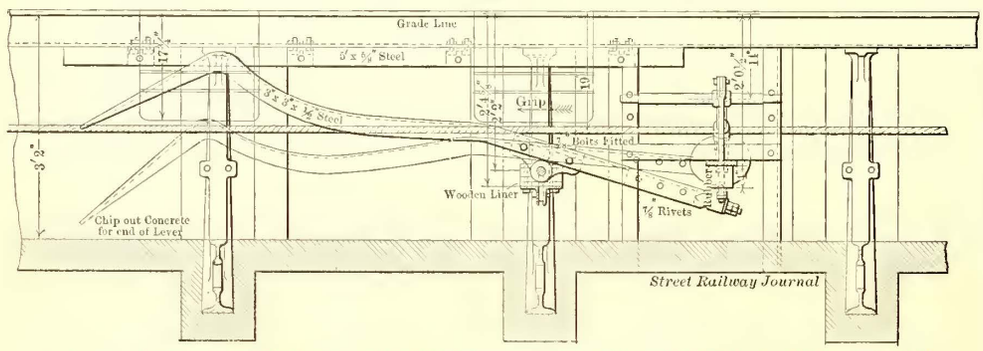


FIG. 3.—SIDE ELEVATION OF AUTOMATIC PICK-UP—WASHINGTON & GEORGETOWN RAILROAD.

tice of these roads sustains the claim that traffic is increased by the employment of open grip cars. Passengers will frequently jump on and ride for a short distance when they would not think of entering a closed car. It is very apparent that the dividends of a company running as many cars as are operated by this system will be materially affected by the gain or loss of only two or three passengers per trip.

Three pick-ups, similar to that shown in Figs. 3 and 4, have been in continuous service for over two years on the Pennsylvania Avenue line, namely, two at the 7th Street cable crossing and one at the Peace Monument junction. They are very satisfactory and reliable, the expense for maintaining being even less than that of elevating wheels. Each pick-up is required to throw the rope into the grip about 800 times per day or nearly 300,000 times per year, which represents nearly 2,000,000 pick-ups, as made by all three since the time they were installed. The operation is very simple and the work is done without any pounding or jerk, no matter what the speed of the car may be. The operation is as follows:

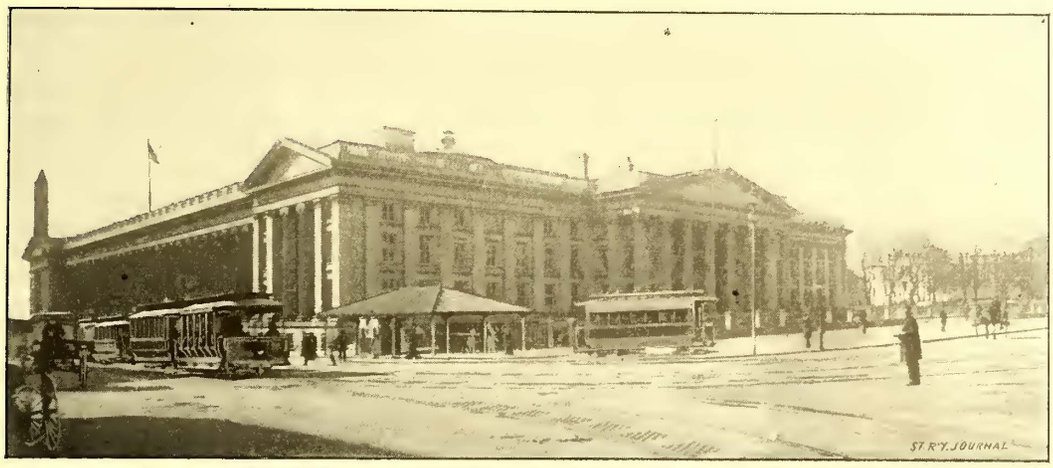


FIG. 5.—TRANSFER STATION NEAR TREASURY BUILDING—WASHINGTON & GEORGETOWN RAILROAD.

The car running by momentum brings the bottom of the grip into contact with the gooseneck or trip lever, which gradually throws the gypsy spool upward and carries the cable into the grip. As will be seen from the engraving, this lever swings on a shaft forming a counter-lever. On the extreme end of the lever is a universal connection provided with adjustment which raises the spool arm and accommodates itself to any position required.

After the grip has passed over the gooseneck lever, the weight of the spool and connections overbalances the trip lever and so automatically the device resets itself. The shape of the trip lever is such that the grip leaves it gradually. The spool arm also has the drop cushioned, as shown, by means of rubber springs attached to a short lever on the opposite side of the supporting shaft. A guide bar is located in the conduit parallel to the trip lever to prevent the grip glancing off to one side. The gypsy was invented by W. B. Upton.

FARES AND TRANSFERS.

The fare on the lines of this system is five cents, with six tickets for twenty-five cents, transfers issued on all the company's connecting lines, and with the Eckington & Soldiers' Home line at G Street. The transfer tickets are issued by agents stationed at the transfer points, the two principal stations being at 15th Street and New York Avenue, near the corner of the Treasury Building, and the other on Pennsylvania Avenue corner of 7th Street. At the 15th Street station (Fig. 5) the company has erected a neat, iron roofed shed for the accommodation of the passengers, extending the entire width of the sidewalk. On the curb line is a small house for the protection of the transfer agent who issues the tickets to the passengers as they alight from one car and pass to the connecting line. In this station a Keller dating machine is employed, by means of which the month, day, hour and minute of issue are printed on the ticket. The machine is arranged for very rapid work and a boy is employed to turn the crank, when the tickets are delivered in the form of a notched ribbon, so that they are easily torn up into proper lengths. The type for printing the dates and time is readily changed, a change being made every fifteen minutes. The company employs two of these machines at each of the principal transfer stations.

Near the 15th Street transfer station is located a switchman's booth, where a man is stationed to throw the switch for the cars that branch to the 14th Street line, as they turn into New York Avenue and run to 14th Street.

During the absence of Henry Hurt, president of this company, who is making a tour of the world, the management of the system is in the hands of G. T. Dunlop, vice-president, who is acting president. The control of the car men is under the supervision of C. C. Sailer, while D. S. Carll is engineer and has a general oversight of all the mechanical affairs.

Columbia Railroad Company.

This company is now engaged in reconstructing its entire system, aggregating three miles of double track for cable traction, and it is expected that the work will be completed and the lines in operation by cable power during the early spring months. The route of this system is principally on H Street, but passes through a portion of Massachusetts and New York Avenues. Wm. B. Upton, of Washington, D. C., is the chief engineer.

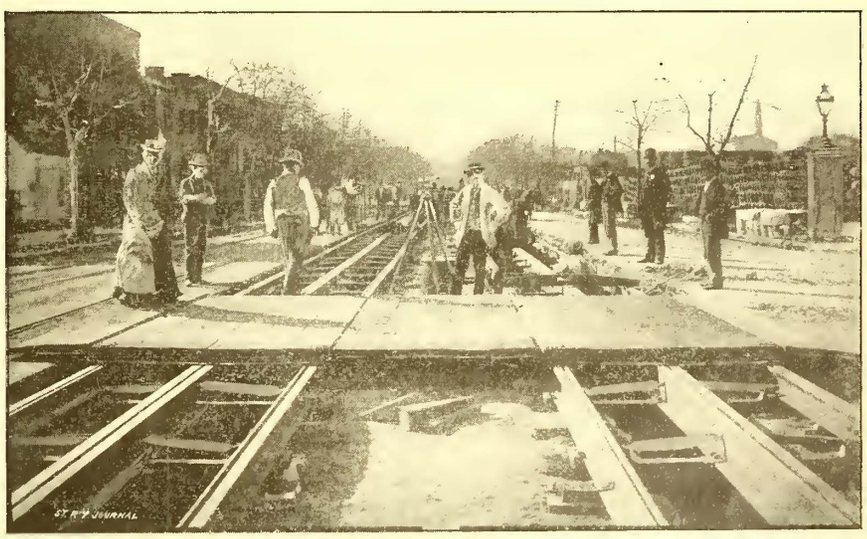


FIG. 6.—CABLE CONSTRUCTION, SHOWING TEMPORARY HIGHWAY BRIDGES—COLUMBIA RAILROAD.

In the new construction the cable conduit is of about the same depth and the yokes of about the same weight as were employed in the Washington & Georgetown lines. The rail is of the grooved girder type, weighing eighty-six pounds per yard, is six inches in depth and has a six inch base or flange. The slot is Z shaped, seven inches in depth, and weighs sixty-seven pounds per yard. The track rails, slot rails, curves and conduit crossings are made by the

Johnson Company, of Johnstown, Pa., the steam crossings by the Weir Frog Company, and the surface crossings by the Indianapolis Switch & Frog Company. The yokes, which support the carrying pulleys, are provided with chambered lugs on their inner faces, to which the journal pulley boxes are fastened by means of T bolts. The city end of the line terminates on New York Avenue near the Treasury Building, beside the tracks of the Fourteenth Street line of the Washington & Georgetown system, where an ordinary crossover switch will be provided for the transfer of the cars from one track to the other. The suburban terminal of the line will be on H Street near 15th Street East, at which point the company's offices and stables are now located, and near which the new power station is being erected.

The new station is to be of brick, 80 × 200 ft. in dimensions, and office and car house building 128 × 200 ft., a portion of it two stories in height. The engine room will occupy the front portion adjoining the street, in rear of which is the boiler room, and alongside will be the tension run. The smokestack is of brick and 100 ft. in height. W. B. Wood, of Washington, D. C., was the architect. The contractors for the power station were Richardson & Burgess, of Washington.

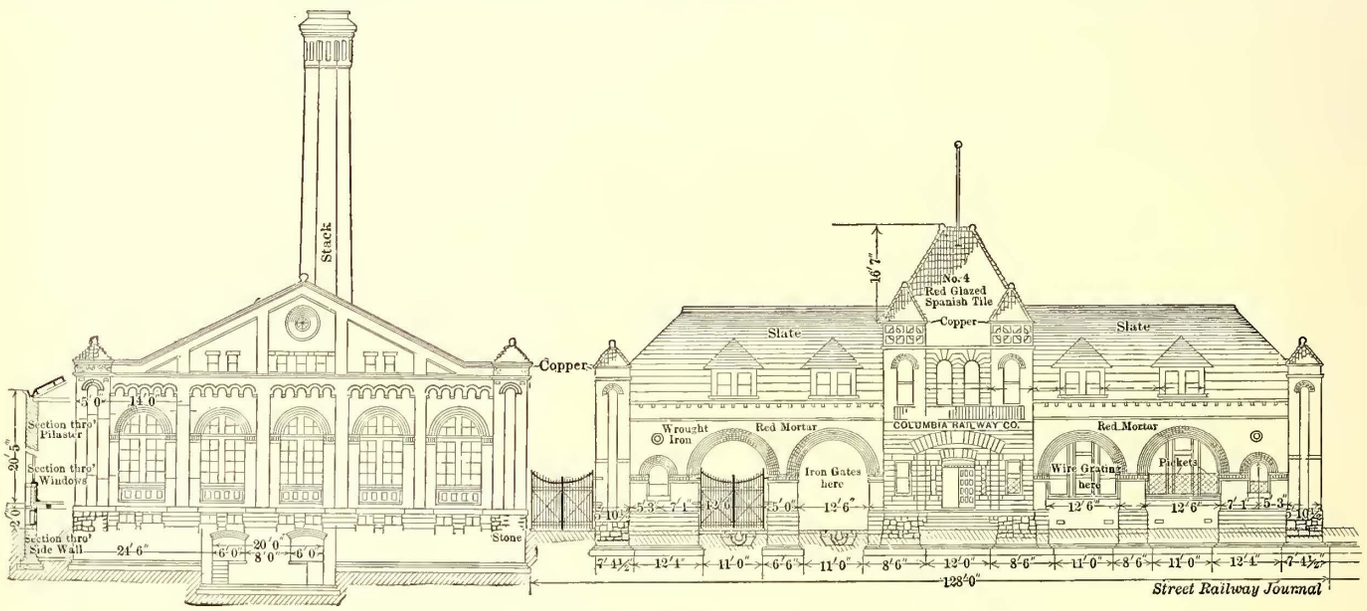


FIG. 7.—EXTERIOR OF NEW POWER STATION AND CAR HOUSE—COLUMBIA RAILROAD.

The power equipment of the station will consist of Campbell & Zell boilers, and engines manufactured by the E. P. Allis Company. The driving machinery will be similar to that employed in the Washington & Georgetown central power station, and will consist of a rope drive, both winding drums being driven from the same pulley, and the Walker differential rings will be employed. The tension carriage will be provided with the automatic weight attachment, designed by the chief engineer of the road, and will be an improvement over this type of carriage, which is already employed on other lines in the city. The cable machinery is being built by the Walker Manufacturing Company, of Cleveland, O.

The street construction, with the exception of the paving, is being done under contract by E. Saxton, the well known railway contractor of Washington, who furnishes all material, special work, etc., and the work is being done rapidly and in a first class manner in every particular. We do not remember to have found an equipment for cable railway construction so complete and perfect in every particular, nor so systematic a method of doing business, down to the minutest details, as is found in the construction plant and organization belonging to Mr. Saxton. In the present work, when material can be had, the organization and equipment are equal to the regular daily completion of 600 ft. of double track ready for paving. The work is assigned to different gangs, which are named and lettered from A to V. One takes up the paving, another does the excavating over the full width of the double track to the depth of ten inches, when the trenching gang follows, and another cuts out the chambers across the trench for the yokes, and then, in order, the other gangs place the rails, concrete, etc. Each gang is provided with a complete set of tools for its particular work, which are kept ready for use in mounted boxes which may run on rails after the track is down. These boxes or chests are lettered to indicate the gang to which they belong, and are painted and kept in a cleanly condition. There are also provided wooden water tanks with a capacity of about eighty gallons each, which are mounted on car wheels and connected with the fire plugs by two lines of rubber hose. The tanks are provided with float valves which automatically close the inlets when the tank is full. Each tank is also provided with two sections of two and a half inch armored or suction hose in ten foot lengths, through which water is quickly run into the concrete mixing boxes. The latter are of wood, mounted on centrally flanged rollers which run on the slot rails, and in front and rear of the mixing boxes are T iron slides covering the slots, which prevent the material from being dropped into the conduit in the operation of putting it in place. "Iron cars" are also provided for holding the bolts, nuts, lock washers, liners, etc., which are provided with chambers having hopper outlets at the base so that the material from each box may be readily removed and conveyed to the workmen.

Vehicle and foot bridges (see Fig. 6) are also provided which are built in interlocking sections, and are readily moved from place to place as the work progresses. At night guard ropes are put up on each side of the work in progress, and at street crossings. These ropes are supported on posts placed about fifty feet apart, and lanterns are hung on all posts along this guard, so that even after the work is stopped the line has an animated appearance. The temporary track, together with the necessary crossings and switches, are also provided by the contractor. The switches employed with the temporary track are of peculiar design, and were invented by Mr. Saxton. Switches, mates and frogs are so arranged that they can work either right or left. In the present case a temporary double track is laid along the work directly on the asphalt paving, the rails being kept to gauge by flat tie bars placed under them at intervals of fifteen feet. The material is stored in a centrally located yard where the contractor has also erected temporary buildings and sheds for the clerical forces, and for the blacksmith shop and storing bins. Here are draughting rooms and time keepers' offices, with all the necessary books and cards for keeping record of the work of the different gangs. A comptometer is provided as

one part of the equipment of the accounting department, by means of which long lines of figures are added and other computations are made. This device was manufactured by Felt & Tarrant, of Chicago. The paving is to be done under a special contract. The material between the rails and on each side is vitrified brick, but between the tracks there will be a strip of asphalt to correspond with the asphalt paving on the remainder of the street. The combination of asphalt and brick paving between the tracks is used to comply with the requirements of the district commissioners.

The closed cars to be placed in service on this line when completed are modeled after those of the Broadway, New York, cable road, except that they will be about two feet shorter. They will be built by the John Stephenson Company, of New York, which company will also build the open cars. The grip will be operated from the front platform.

FARE AND TRANSFERS.

The fare on the Columbia Railroad is at present five cents, with six tickets for twenty-five cents and school tickets thirty-three for $1. Transfers are made with one or two other lines, but school tickets do not allow of transfer. Employes are provided with passes, on which their name and date of issue are placed and each employe is provided with two tickets a day. A very simple and efficient system of bookkeeping is employed by James B. Adams, secretary and treasurer of the company, who has also designed a very complete system of report blanks for use by the different departments.

FIG. 8.—CABLE CONSTRUCTION ON COLUMBIA RAILROAD, SHOWING PORTABLE TOOL BOXES EMPLOYED.

In the superintendent's office an automatic receiving safe is provided, which was invented by the former superintendent of the road. This safe is so arranged that each conductor can deposit his returns in a separate compartment within the safe.

The Columbia Railroad was for a number of years operated under the direction of the late Wm. J. Stephenson, and in his administration and that of President R. F. Baker, the change from animal to mechanical traction has been carried out. Another interesting feature in connection with the operation of this line is the practice adopted a year or two since of splicing together two of the short one horse cars formerly employed, and making a long car. This method of splicing was devised by Theodore J. King, the former superintendent, and differs from the method ordinarily employed, in that instead of placing a new sill beneath the two parts, the body is strengthened by a modified form of a steel bridge truss, which has proved very efficient and safe under heavy loads and a year or more of service. The road is being operated under the immediate supervision of Wm. C. Bateler, superintendent.

Metropolitan Railroad Company.

This company, of which the late Wm. J. Stephenson was president, is about to install an underground electric system on all its lines, which are at present operated by horses. S. L. Phillips, formerly president of the Third Avenue Railway Company, of New York, has been recently elected president of this company, and under his supervision, assisted by A. N. Connett, chief engineer, the change is to be made from horses to electric traction. Mr. Connett, it will be remembered, was formerly chief engineer and superintendent of the Baltimore City Passenger Railway Company, and designed and superintended the construction of the cable and electric lines of this company. He is now engaged in making the designs for conduit and station equipment for the Metropolitan Company's lines. It will be remembered that this company some years since, while George W. Pearson was president, made a thorough and extensive trial of the storage battery system, large stations having been erected and about twenty cars equipped with motors and batteries. The result of the experiment is already familiar to our readers.

By act of Congress, the company is now obliged to install an underground electric system.

The company proposes to construct the 9th Street line as soon as possible, street work to begin as soon as the weather will permit in the early spring. In the meantime, the plans are being prepared and the special work ordered, so that it will be possible to have the 9th Street line running by August 2 next, as is required in the bill. The conduit to be employed is a modified form of cable conduit with yokes and concrete walls, the interior being twenty-five inches deep and eighteen inches wide, with drains at suitable intervals connecting with the sewers. The slot rails will be deep on their inner faces, so as to prevent the drip falling on the current conductors. The conductors are to consist of tee bars four inches deep, set edgewise and about six inches apart. These are to be supported in lengths of thirteen feet six inches, by dependent rods, supported from double porcelain corrugated insulators with lead filling. These are mounted on cast iron boxes, and suitable provision is made to allow for the expansion and contraction of the tee bars.

A plow with a sliding contact is to be used, and is to be supported from the car by shank plates in the customary manner. The motor equipment will be of the General Electric type, and the generators are also to be of the same manufacture. Direct coupled engines and generators are to be employed. The power will be supplied from the 4½ Street station, which was erected when the storage battery experiment was made. This station is a large brick building occupying nearly a square, and stands just back of the 7th Street cable station of the Washington & Georgetown line. The engine and generator equipment of the second power station, which was erected adjoining the company's offices on P Street, will not be used. The engines, which consist of three 200 H. P. machines, manufactured by Wm. Wright, of Newburgh, are to be sold, as it is proposed to purchase condensing engines for the new plant. The type of car has not yet been fully decided, but it is probable the line will be operated by an open motor car with trailer. The contract for the street construction has not yet been let.

The Eckington & Soldiers' Home Railway Company and the Belt Railway Company.

The lines of these companies are virtually under the control of the same persons, the president being D. M. Newbold, and W. K. Schoepf, vice-president and general manager. H. K. Gray, formerly with the Belt line, is secretary and treasurer of both companies. The line known as the Eckington & Soldiers' Home is chiefly operated by electric

power, the overhead system being employed, and terminates at 7th Street. An experiment is being made on North Capitol Street with a closed conduit system which has been in operation about four months, the Electro-Magnetic Company being the promoter.

The car is of the ordinary type used on electric lines,

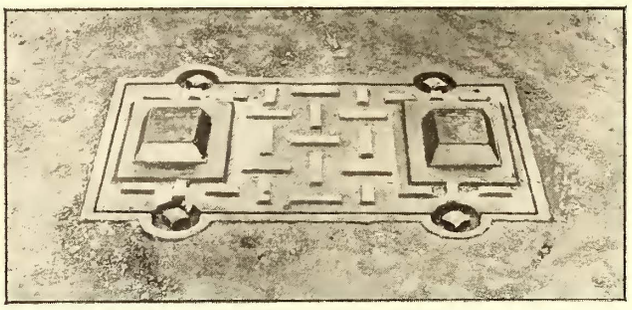


FIG. 9.—SURFACE CONTACT BOX.

except that, in lieu of a trolley stand upon the roof, it has suspended from the under side of its truck, as shown in Fig. 11, two iron bars. These are the same length as the car, are hung upon light springs and adjustable by means of screws, and are known as the energizing and collecting bars respectively. Beneath one of the seats of the car is a small storage battery, consisting of six cells which are arranged to discharge a low potential current at a pressure of about eight volts, and are connected by means of suitable wiring to the energizing bar.

In the center of the track are placed, at intervals of about fifteen feet, hermetically sealed cast iron boxes, upon the lids of which, properly insulated, are two raised surfaces, known as the energizing and collecting plates respectively.

Securely attached to the under side of the lid of each cast iron box is a simple electro-magnet, as shown in Fig. 10, wound with a fine copper wire, one end of which

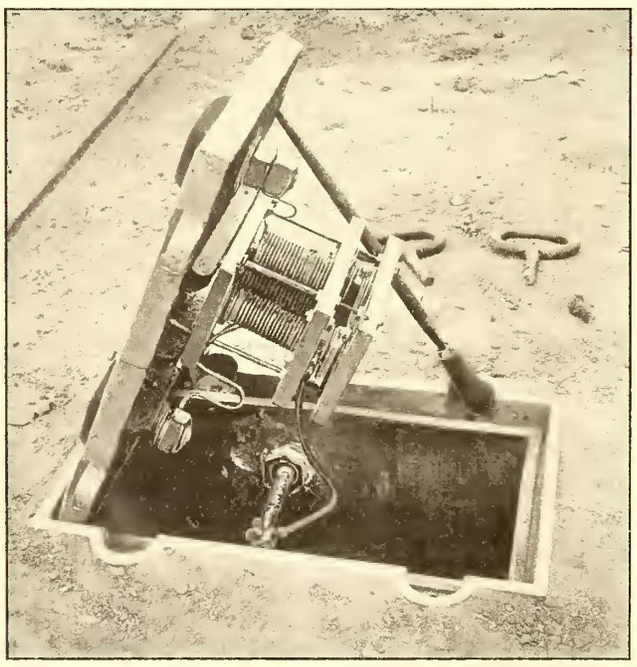


FIG. 10.—CONTACT BOX WITH COVER RAISED.

is connected to the energizing plate. The free poles of the magnet hang down vertically, and work in connection with an armature attached to a bridge piece, upon which are two carbon faces, directly above each of which is a corresponding carbon face fixed to the slate bed of the magnet. One of the fixed carbon faces is directly connected to the main cable which conveys the 500 volt current from the generators at the power house, and which runs in an iron pipe through all the boxes, as shown in Fig. 12. The other carbon face is connected to the collecting plate upon the box lid.

The operation of the car is then as follows: The battery discharges its low pressure current along the energizing bar through the corresponding plate upon the box lid to the electro-magnet which, upon becoming energized, instantly attracts the armature and bridge piece, thus bringing all four carbon faces into close contact and completing the circuit. This allows the current to flow from the main cable up through the collecting plate to its corresponding bar upon the car, whence it is admitted to the motors in the usual manner. Where there is a double track the arrangement is somewhat modified, and in the new roads now under construction a metallic return is introduced by adding a third or return circuit bar to the car, and connecting a third contact plate with a cable laid in the same trench with the main cable.

The difference between the length of the collecting bars and the centers of the boxes insures good contact with the forward plate before the rear one is left. To obtain a shock from the contact plate is impossible, as, should any part of the electro-magnetic switch fail, the pins

FIG. 11.—CAR EQUIPPED WITH ELECTRO-MAGNETIC SYSTEM.

are dead, and the car has to drift by its own momentum to the next box.

During the three months that the current has been on the existing road, the inventors claim that nothing in the shape of trouble has been experienced. They also state that from tests applied by the Wheatstone bridge and tangent galvanometer, after flooding certain boxes with water, with the car keeping the switches closed, the leakage was found to be less than one-half of 1 per cent. of the power required per car. The contact plates stand only about seven-eighths of an inch above the pavement, and offer little or no obstruction to vehicular traffic.

The cost of installing this system is said to be about $35,000 per mile of double track, including the metallic return and all the cables, feeders and conduit.

EXTENSIONS.

The company is now extending its lines within the city, the new construction consisting of four miles of double track. This extension is on 5th Street and Louisiana Avenue, along 6th Street, along B to 7th Street, crossing the Pennsylvania Avenue cable line at 6th Street, where a new substantial crossing is being put in. From this point the line extends past the Pennsylvania Railroad depot and Central Market, insuring a large patronage from these points.

The new construction is being done in a very substantial manner. The street excavation is made to the depth of twenty-one inches, and very heavy ties are being employed, which are placed two and a half feet centers, resting on a concrete or gravel foundation. A ninety-five pound, eight inch, grooved girder rail is employed, having a six inch base, which is laid on tie plates. The joints are connected by means of heavy twelve-bolt fish plates, and the ends are drilled for bond wires, should it ever be necessary to bond the track for electric traction. Thirty new cars have been ordered from the Laclede Car Com-

pany, of St. Louis, and other improvements are being made. A new car home and stable is being erected on the East Washington line.

Rock Creek Railway, of the District of Columbia.

The lines of this system, which embrace about eight miles of double track, lie mostly outside of the city limits, and are operated by electric power. The extension within the city limits is one and five-eighths miles, and this portion is operated by the Love electric conduit system. The trolley wires of the remainder of the line are supported on center iron poles for the most of the distance, wooden poles being employed on the suburban extension. The present suburban terminal of the line is at Chevy Chase, Md., but an extension of two and a half miles is now being constructed to Kingston on the Baltimore & Ohio Railroad. About twenty cars are regularly operated, and these are run on a fifteen minute headway. On Sundays and holidays the headway is reduced to seven minutes. The

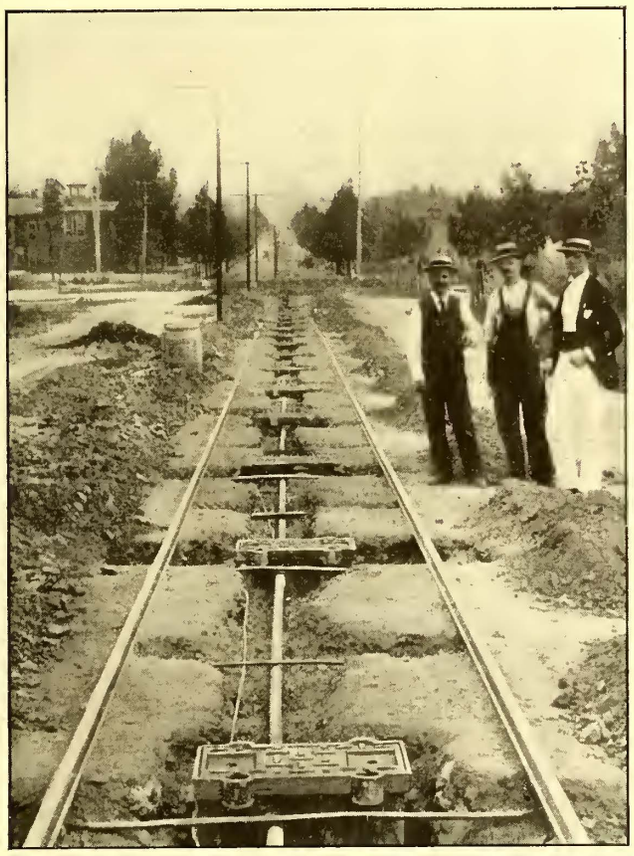


FIG. 12.—SECTION OF TRACK EQUIPPED WITH ELECTRO-MAGNETIC SYSTEM IN COURSE OF CONSTRUCTION.

cars are equipped with trolley poles and are also provided with mechanism for operating over the conduit section. At the junction of the overhead with the underground section pits are provided in each track in which an attendant takes position as the car approaches from either direction. In changing from overhead to underground the trolley pole is pulled down and fastened, and the attendant inserts the underground trolley in a socket provided for it in the truck. This trolley or plow consists of two flat metal plates bolted together. It is half an inch in thickness, four inches wide and two in length, and to its lower portion are two underrunning trolley wheels elastically attached. The conductors in the plow consist of insulated copper ribbons enclosed between the plates and terminating in two copper bars sunk flush with the edges of an insulating cap on the plow at its upper extremity. As the upper end of the plow is inserted in an inverted insulating box with end contacts, suspended under the truck, the contact is made with the motor connections, and the adjustment of a bolt holds the plow in position. The car starts by gravity and carries the trolley into the end of the conduit and in contact with the trolley wires which are supported from the yokes. At the 7th Street terminal of the line, where there is no grade, the trolley wires are extended across the hatch and are under the control of the attendant. The conductors consist of No. 0000 copper wires attached by means of sliding insulated bearings, and are held taut in sections by means of spiral springs. The conduit is about eighteen inches in depth and fourteen inches wide, with drainage pipes provided at suitable intervals. The construction is very thorough, and is standing up exceedingly well under the traffic, the line having been in operation since a year ago last March. On the return trip the plow is removed and the trolley pole is placed in contact with the overhead wire. It is said that the change can be made from the overhead to the underground ordinarily in half a minute, and frequently is done in twelve seconds. The plow is removed from the car on the outgoing trip, and is adjusted to the next car as described above. A tension of 500 volts is employed.

Six of the trucks operated on this system are of the Robinson radial type. The motors were manufactured by the General Electric Company. The fare for the through trip is ten cents; within the District limits, five cents.

One of the cars is equipped with the Palar fender, which consists of large leather cushions covering the front of the dash, and extending for a considerable distance in front of the platform.

The conduit portion is said to be operating with excellent results, giving less trouble, in proportion to the distance, than the overhead section.

The power for operating the system is generated in two stations, one near the city limits, and the other at the terminal of the line, well in the country. C. B. F.

The Annual Meeting of the Connecticut Street Railway Association.

The annual meeting of the Connecticut Street Railway Association occurred in New Haven, Wednesday, November 21. The meeting was held in the offices of the Winchester Avenue Railway Company in West Haven.

The following companies were represented: The Winchester Avenue Railway Company, of New Haven; the New Haven Street Railway Company, of New Haven; the Fair Haven & Westville Street Railway Company, of New Haven; the Hartford Street Railway Company, of Hartford; the Waterbury Traction Company, of Waterbury; the Stamford Street Railway Company, of Stamford; the Norwalk Street Railway Company, of Norwalk, and the Derby Street Railway Company, of Derby.

This was the first annual meeting after the organization of the association, and it was largely devoted to a discussion of future work, and the possibility of interesting other companies of the state in the association and including all as members. At present the association includes ten railway companies. The session lasted two hours and a half.

The officers elected for the following year are: president, H. H. Wood, of Derby; vice-president, H. S. Parmelee, of New Haven; secretary, R. A. Fosdick, of Stamford; treasurer, E. S. Goodrich, of Hartford; executive committee, the officers and I. A. Kelsey, of New Haven; A. M. Young, of Waterbury, and G. A. W. Dodge, of New Haven.

A CONDUCTOR on the Orange Division of the Consolidated Traction Company, of New Jersey, recently sued the company for the amount of the deposit which he had made with the company on entering its employ, and for wages withheld. The company claimed in rebuttal that he had failed to account for $20 in fares collected, as shown by the register, 450 fares having been left out in a single day. The plaintiff was non-suited, the judge holding that he could not recover his deposit until he could account for the missing fares.

The Wyoming Valley Interurban Railway.

The Wyoming Valley, extending from the junction of the Susquehanna and Lackawanna Rivers at Pittston to Nanticoke, a distance of about twenty-two miles, is celebrated for its rich and extensive anthracite coal deposits. The valley has an average width of about five miles, and contains about 160,000 inhabitants. The largest city is Wilkesbarre, located on the east bank of the Susquehanna River, about midway between Pittston and Nanticoke. It has a population of from 45,000 to 50,000 inhabitants. Directly opposite Wilkesbarre, as shown on the map (Fig. 1), is located the borough of Kingston which, with the neighboring villages of Edwardsville, Larksville, Pringleville, Broderick, Luzerne and Fort Fort, has a population of about 17,000. The other principal towns are Plymouth, with a population of 20,000, Nanticoke, 19,000 and Pittston 16,000 inhabitants, including the townships of which these towns are the centers.

There are a number of manufactories in Wilkesbarre, including large iron and steel workers, the largest Nottingham lace factory in the country, and other manufactures. The main industry of the valley, however, is that of coal mining, and during the last year 30 per cent. of all the anthracite coal produced in Pennsylvania was mined here. Most of the mines are located between Pittston and Nanticoke, Wilkesbarre being in the center of the coal field. The region between Wilkesbarre and Nanticoke, which belongs largely to the Delaware, Lackawanna & Western Railroad Company, the Lehigh & Wilkesbarre and Susquehanna Coal Company, is as yet undeveloped, but contains, it is estimated, 50 per cent. of the virgin anthracite coal left in Pennsylvania. The small settlements in the valley are inhabited in large part by Huns, Poles and other foreign laborers; the more wealthy class lives mainly between West Pittston and Kingston on the west side of the river, and in the city of Wilkesbarre.

The valley was seemingly well provided with transportation facilities before the introduction of electric traction, there being six steam railroads extending its entire length, the Delaware, Lackawanna & Western, the Central of New Jersey, the Lehigh Valley, the Pennsylvania, Delaware & Hudson, and the New York, Susquehanna & Western, all of which take coal from this region, but steam railway service has become wholly inadequate in these days of electricity.

The entire electric railway system between Nanticoke and Pittston, consisting of fifty-five miles, is now operated by the Wilkesbarre & Wyoming Valley Traction Company (see map, Fig. 1). This railway company was chartered February 9, 1891, and now controls and operates the lines of nine original companies, the Wilkesbarre & Kingston Railway Company, Wilkesbarre & Suburban Street Railway Company, Coalville Passenger Railway Company, Wilkesbarre & West Side Railway Company, Plymouth Street Railway Company, Pittston Street Car Company, Pittston, Moosic & Pleasant Valley Street Railway Company, West Pittston & Wyoming Street Car Company, and the Nanticoke Street Railway Company. The mileage operated is shown on the map by solid lines, and that proposed by dotted lines.

TRACK.

Of the fifty-five miles of track, all but five is single track with turnouts. Of the mileage under construction, five miles will be built as soon as the girder rails can be secured. The company is using for its new work fifty-six pound T and sixty-six pound girder rails. These are spiked directly to ties which are laid twenty inches between centers. The return circuit is provided for by double bonding the joints with No. o riveted bonds. In addition the company has about one mile of overhead return feeders.

There are about two and a half miles of center pole construction, and three miles of bracket construction. For the rest of the distance span wires are used. Some of the spans are quite long, the roadway for a considerable distance being 100 ft. in width, with the track near the center of the street. The company is using a variety

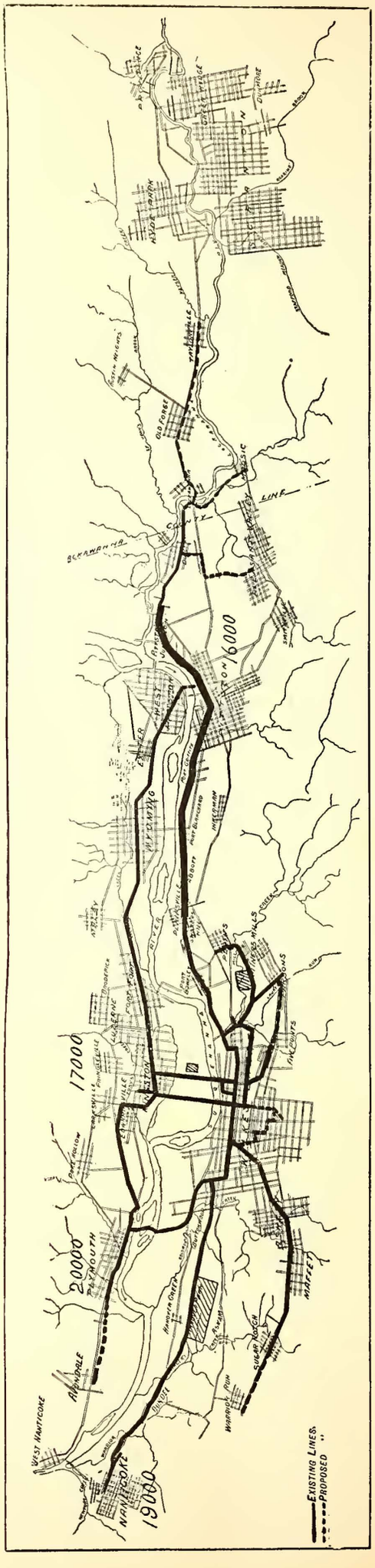


FIG. 1.—MAP SHOWING LINES OF THE WILKESBARRE & WYOMING VALLEY TRACTION CO.—WILKESBARRE, PA.

of overhead material, that provided by the H. W. Johns Manufacturing Company and the Western Electric Company predominating. Roebling wire is used largely, but that of Holmes, Booth & Hayden, and Washburn & Moen is also employed.

A very considerable portion of the company's mileage is through its own right of way.

T RAIL CONSTRUCTION.

The company claims to be the first to use a six inch T rail, its first rails of this dimension having been made especially for use here. In brick paving the rail is laid as shown in the accompanying sketch (Fig. 4), the vitrified brick being laid on sand which is tamped close to the rail. When laid in macadam or dirt a $2\frac{1}{2} \times 6$ in. plank is placed on both sides of the rail, a space being left on the inside for the wheel flange.

POWER HOUSES.

The company has at present two power houses. A view of the main, or South Wilkesbarre station, wtth one of the car houses of the company, is shown in Fig. 3, and an interior view of this station is given in Fig. 2. It is a substantial brick structure located close to a spur of one of the railroads so that coal can be dumped directly in front of the boilers. It is commodious and well lighted, and ventilated by windows on all sides, so that even in the warmest days of summer both boiler and engine room are comfortably cool. It has two iron stacks ninety feet high.

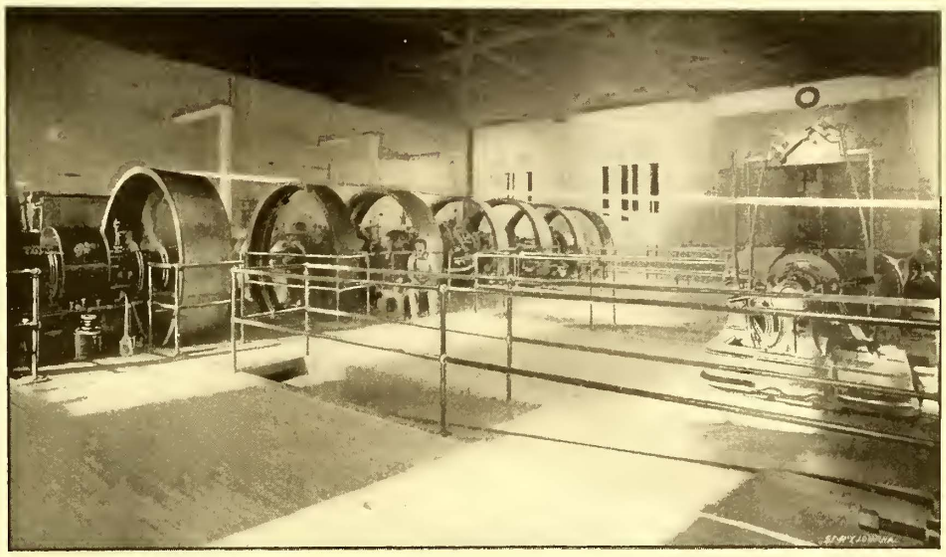


FIG. 2.—INTERIOR OF POWER STATION—WILKESBARRE & WYOMING VALLEY TRACTION CO.

The present engine equipment consists of four Ideal compound engines, cylinder dimensions 17 and 28 × 18 ins. stroke, running at 187 revolutions per minute. These are belted to the same number of 200 K. W., bipolar Gen-

Steam is supplied from six return tubular boilers manufactured by the Harrisburg Foundry & Machine Company, and fitted with the Weitmeyer setting. The draught in this furnace, instead of coming in at the front, is led in at the back of the furnace, the air becoming heated before it passes through the coal. Each boiler is fifteen feet long by seventy-two inches in diameter, and contains 114 three-inch tubes. A Webster feedwater heater supplies water to the boilers at an average temperature of 200 degs. Worthington pumps and a Locke damper regulator are employed. The switchboard is located at the eastern end of the engine room, and is of the General Electric panel type. The company will probably increase its power station capacity in the

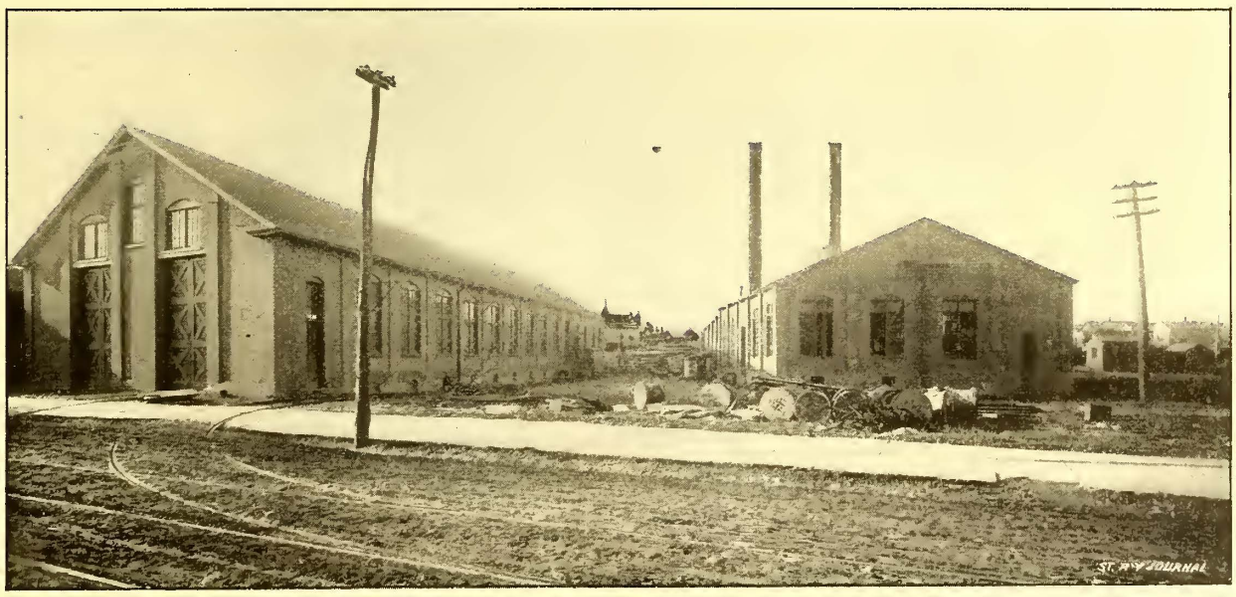


FIG. 3.—MAIN POWER STATION AND CAR HOUSE—WILKESBARRE & WYOMING VALLEY TRACTION CO.

eral Electric generators. Two of the belts were supplied by the Shultz Belting Company and two by the Page Belting Company. The engines run non-condensing.

The station is equipped with a lubricating system supplied by a reservoir under the floor, the oil being filtered by an Acme filter. Metallic packing has been used in the engine cylinders for over a year with good satisfaction. A pressure of about 530 volts is maintained at the station, and this has been found sufficient to maintain the potential at the terminals of the divisions, which in some instances are from nine to ten miles from the power station.

spring by the erection of a second station immediately to the north of that just described. Larger units with multipolar generators will be employed. At the same time the present type of generator has given very good satisfaction, and during the two years in which those in use have been in operation they have cost only about $25 for repairs. The general manager is in favor of belted generators in preference to the direct connected type.

The West Side station has at present in operation a Wheelock-Corliss 300 H. P. engine, belted to a 200 K. W.

Short generator, and two Ide simple engines, with cylinder dimensions 20 × 24 ins., belted to two 150 K. W. Short generators. Shultz belts are used throughout this station, and the boiler equipment is similar to that of the South Wilkesbarre station. This station was built to operate the Wilkesbarre & West Side Street Railway before its absorption by the Wilkesbarre & Wyoming Valley Traction Company, and its use as a power station

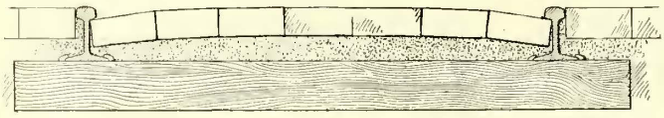


FIG. 4.—METHOD OF PAVING TO T RAIL—WILKESBARRE.

will be discontinued as soon as the necessary power for operating the entire system can be concentrated at one point.

FUEL, COST OF POWER, ETC.

Buckwheat anthracite coal, costing ninety cents per ton, delivered at the boilers, is used as fuel. The low price of coal, combined with the fact that two shifts, of only two men each, are required for operating the main power station of the company, results in the production of power at a very low price. The records of the company show that the cost of a horse power hour delivered to the line, including all power house expenses, was six and two-thirds mills ($.00667) per car mile.

ROLLING STOCK.

The rolling stock of the company consists of 105 passenger cars, two freight cars and two Lewis & Fowler snow sweepers which have just been delivered. Of the passenger cars, fifty-one are closed and all are vestibuled. The cars are from the works of a large number of companies, those of Brill's manufacture predominating. The company has seventy-four double motor equipments. Of these forty-seven are Short, seven Edison, two Baxter, four Westinghouse and fourteen General Electric. Of the latter number, six are of the G. E. 800 type.

occasions. It is handsomely fitted up inside in mahogany, with birdseye maple ceiling. The seats are of rattan covered with damask, and the curtains are of plush. The exterior of the car is painted a Pullman dark green, with gold striping, and presents a very striking appearance.

CAR HOUSES.

The company has three car houses, all of brick. The main car house is located on Northampton Street, and measures, with the machine shop of the company, 252 × 110 ft. A portion of this house is partitioned off by brick walls for a supply department, and another for the steam heating plant. A third room is for oil storage, and measures about 18 × 18 ft. This room has no inside opening into the car house, and its walls, which are of brick, are carried above the roof to reduce the risk of fire.

The company performs all its own repairs, and its machine shop is equipped with a J. T. Schaffer wheel press; two lathes, manufactured by the Sebastian May Company, of Cincinnati, and F. E. Reed & Company, of Worcester, Mass.; a Harrington wheel mill, and a Bickford drill. This machinery is operated by a Short single reduction motor which has been rewound so as to give a constant speed. The wood working department, which is adjoining the machine shop, is operated by an old type of Sprague railway motor shunt wound. This shop contains a J. A. Fay & Egan thirty-six inch band saw, a Universal wood working machine, manufactured by Cordman, Myer & Company, of Cincinnati, and a circular saw. The company employs in its shops two machinists, four painters and four carpenters.

The company has also a car house on Main Street, shown in Fig. 3, adjoining the power station. This car house measures 60 × 200 ft. A third car house, measuring 200 × 54 ft., is located on Pierce Street, adjoining the West Side station of the company.

BRIDGES.

As shown on the map, the tracks of the company at present cross the Susquehanna River at two points near Wilkesbarre. A third line to Plymouth will cross the

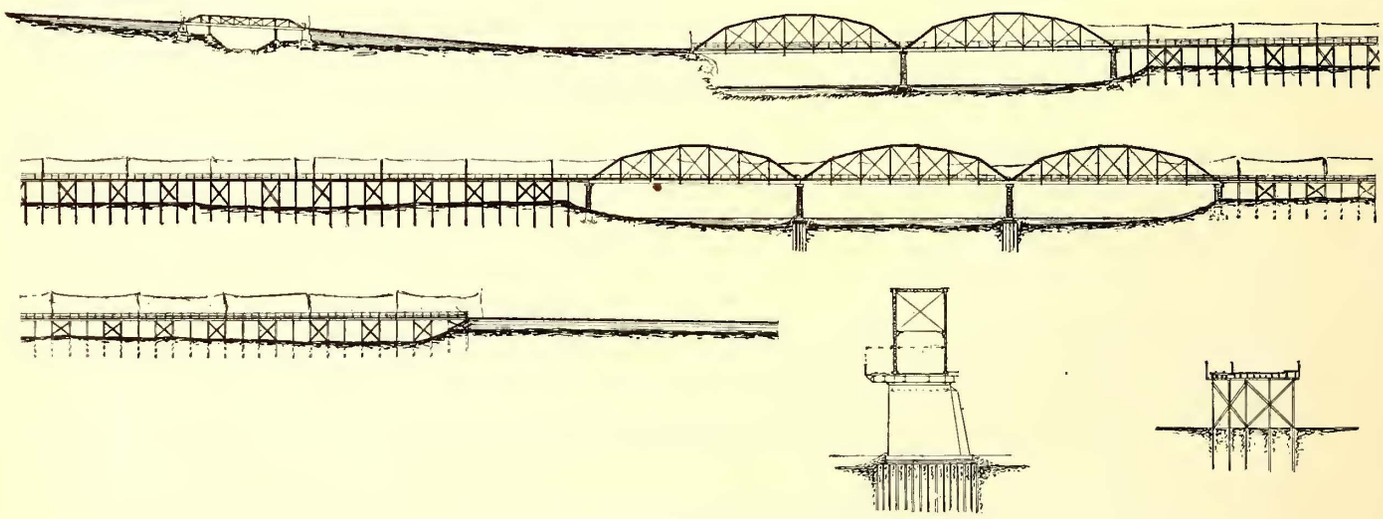


FIG. 5.—SIDE VIEW AND SECTIONS OF BRIDGE AT PLYMOUTH, BEING BUILT FOR THE WILKESBARRE & WYOMING VALLEY TRACTION CO.

The cars are sixteen, eighteen and twenty-five feet in length, and are equipped with Boston, General Electric, Nuttall and Short trolleys. The Lewis & Fowler and New Haven registers and Spear car stoves are employed. Philadelphia car wheels are in use, with a special type of compound brake shoe, shown in Fig. 7. This shoe consists of two parts the wearing portion being cast iron and quickly renewable. It is held in place by pins, as shown in the engraving. This form of shoe was devised by the company's electrical and mechanical engineer, James Fagan.

PARLOR CAR.

The company has also a handsome parlor car, built by the St. Louis Car Company, and used on special

river on a new bridge now being built by the Penn Bridge Company, of Beaver Falls, Pa., and which will reduce the distance from Wilkesbarre to Plymouth by nearly a mile. The new bridge with approaches will be about 6,000 ft. in length and will carry a roadway twenty feet in width, and a sidewalk five feet wide. The electric railway tracks will be carried at the side of the roadway. The bridge being the private property of the company, a toll will be charged for its use as a highway. There are five spans using the ordinary parabolic truss, and measuring each 217 ft. from center to center of end pins, or 220 ft. from center to center of piers. There will be in addition a short lattice bridge 125 ft. in length, where a steam railroad track is crossed and about 1,500 ft. of pile trestling. Fig. 5 gives a side elevation and cross sections of the bridge.

PARKS.

Two parks, owned by the Wilkesbarre & Wyoming Valley Traction Company, are located on its lines; one, entitled the Suburban Park, comprises twenty acres and contains a race track; the other is Hanover Park and contains fifty-three acres. At this latter point are located picnic grounds, ball field, rifle range, running track, dancing pavilion, toboggan slide and an artificial lake, which is used in the summer for boating, and in winter for skating. The company is very enthusiastic on the subject of parks, and believes that the $5,000 or $6,000, which Hanover Park cost, was one of the best investments it ever made. It is the custom of the company to lease this park to the representatives of responsible societies and social clubs at a nominal fee of $20 a day, and as the only entrance to the park is by the cars of the company, to look to its car receipts for returns. Restaurant privileges go with the lease of the park, and at the beginning of summer the company usually has all the dates filled for the season.

HEADWAY, TRAFFIC, ETC.

Most of the business of the company is an interurban one. Forty cars are the regular number in daily service, and of these only three operate entirely within the city limits of Wilkesbarre. On the West Pittston & Wilkesbarre line a twenty minute headway is maintained from 6.20 A. M. to 10.40 P. M. and the schedule time for making the distance, which is 8.66 miles, is forty minutes. Late cars are run at intervals after 11.40 P. M. The same headway is maintained on the Wilkesbarre & Nanticoke line, and the same on the Wilkesbarre & Pittston line on the east side of the river. A fifteen minute service is maintained between Wilkesbarre & Ashley and Wilkesbarre and Plymouth. The fares charged are fifteen cents between Wilkesbarre and West Pittston, ten cents between Wilkesbarre and Nanticoke, Sugar Notch or Plymouth, and five cents for the shorter distances. No transfers are issued, but commutation books, good for 100 rides, are issued for $4. The fifteen cent and ten cent fares are registered on the regular register as three or two fares. The average fare is thought to be about seven cents.

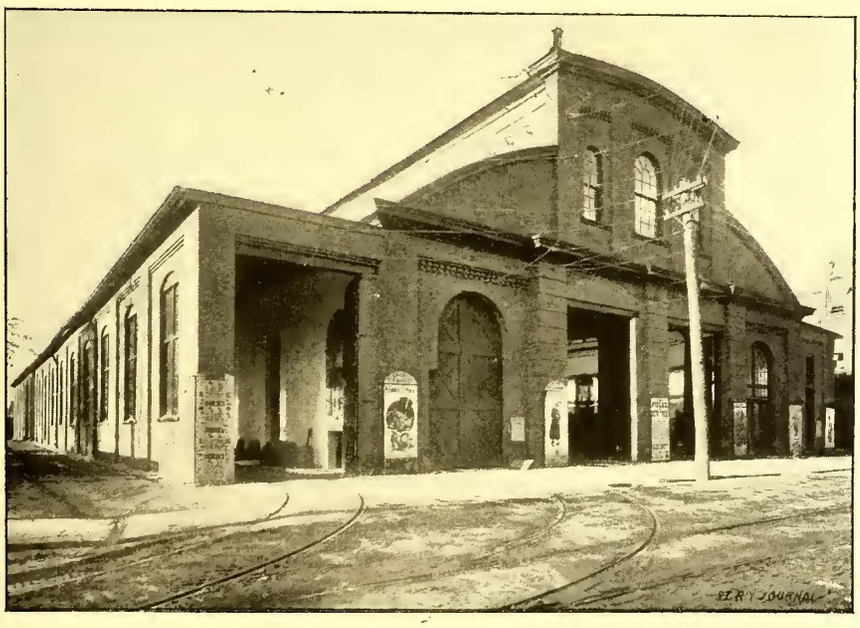


FIG. 6.—NORTHAMPTON STREET CAR HOUSE—WILKESBARRE & WYOMING VALLEY TRACTION CO.

The cars of the company are well patronized, and seem to indicate that an interurban road of this character will attract travel. In fact the service is so much cheaper and more popular than that formerly provided by the steam railway companies that the latter have almost entirely gone out of the local traffic business. In the morning and evening the cars are crowded by miners and others going to and from their work, while in the afternoon they are filled with women and others who go to Wilkesbarre to make their purchases. It is interesting to notice that large numbers of the foreign miners patronize the cars, and are as liberal with their nickels as, if not more so than, the native population. On Sundays, especially, the cars carry many of these people to and from the only Greek church in the valley, while the pleasure traffic is also considerable.

For the nine months ending September 30, 1894, the company's cars averaged 136,399 car miles per month. During this time, the receipts per car mile amounted to 24.57 cents, and the operating expenses, including all disbursements, except insurance, taxes and interest, amounted to 10.521 cents. The gross earnings for the seven months ending January, 1894, were $207,258.83, and operating expenses, $90,287.61. The lines now operated by the company average $22 per mile per day, and about $28 per car per day.

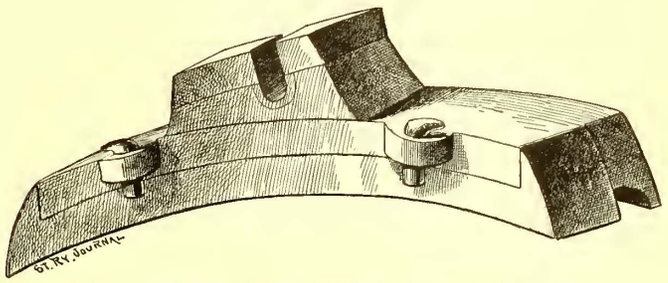


FIG. 7.—COMPOUND BRAKE SHOE—WILKESBARRE.

The company received, during the last year, 6,300,000 nickel fares, equal, as already stated, to about 4,400,000 passengers, and present indications point to a traffic of 8,000,000 five cent fares per year before 1896.

The officers of the Wilkesbarre & Wyoming Valley Traction Company are: President, B. F. Myers, of Harrisburg; secretary, W. G. Eno; treasurer and general manager, John Graham; electrical engineer, James Fagan; superintendents, J. C. Meixell and John Clifford. The success of the road is largely due to the energy and push of the general manager who was one of the incorporators of the company, and has been prominently identified with it since its organization.

SOME interesting observations on road traffic were made recently, according to an English paper, by the London municipal authorities. These observations extended over fifty days of twelve hours each day, namely, from 8 A. M. to 8 P. M., and granite, asphalt, and wood pavements were considered. In one day of twelve hours no fewer than 12,366 horses and vehicles passed along Cheapside, and 5,350 along Cannon Street. During the fifty days upon which observations were taken, 542 accidents took place on wood pavement, 719 on granite, and 1,066 on asphalt. From these figures it was estimated that a horse could travel 330 miles on wood pavement during fifty days without meeting with an accident, 191 on granite, and 132 on asphalt; therefore the great superiority of wood pavement over all others—at least, where horses are concerned—is at once apparent. Altogether, 1,054 falls were recorded, and an analysis of this number affords some curious information. On asphalt, 247 partial and 190 complete falls took place; on wood 326—only 39 complete falls. Roughly, for every fall on wood pavement, four took place on granite and asphalt.

THE Skowhegan & Norridgewock Street Railway & Power Company, of Skowhegan, Me., put its line in operation during October.

Some Details of the Electrical Railway Work of the New Orleans Traction Company.

By W. Nelson Smith.

The accompanying illustrations will give an idea of the electrical railway engineering work that has been in progress in the city of New Orleans during the past six or seven months under the supervision of Ben Willard, electrical engineer of the New Orleans Traction Company. The company rents its power from the Louisiana Electric Company, whose plant is situated about a mile and a half from the business center of the city. These conditions necessitated the construction of a heavy feeder trunk line, some details of which are shown herewith.

Not the least interesting feature of this pole line is the terminal pole in front of the power station. It is built of two sawed yellow pine poles, 15 × 15 in. butts and 12 × 12 in. tops, set in concrete, one pole being seven feet eight inches in rear of the other. The cables terminate in specially designed connectors, to which the strain insulators are fastened; and these in turn are attached to eyebolts in the crossarms (which are 5 × 6 ins.) on the front of the forward pole. On the rear side of each pole, at heights corresponding to the crossarms, are bolted what may be termed strain crossarms of 4 × 4 × ½ in. angle iron, five on each pole. The strains from the wooden arms in front are transmitted directly to these iron arms, by three-quarters inch tie rods, four to each tier of arms. The two poles are also rigidly connected by longitudinal tie beams, 4 × 5 ins., which are bolted to the ends of angle iron arms. The total height of the poles is thirty feet.

The main cables are "dead ended," where they are attached to the pole, and the station connections are tapped to them by inserting the cable ends into sockets cast in the end connectors. The cables turn a square corner and leave the pole at a right angle in order to enter the station. In each tier of arms is a diagonal tie beam, bored for pins, and running diagonally from the street end of the rear arm to the station end of the front arm. The cables are drawn around on the pins in these diagonals, and are supported where they leave the pole by pins set in the longitudinal arms.

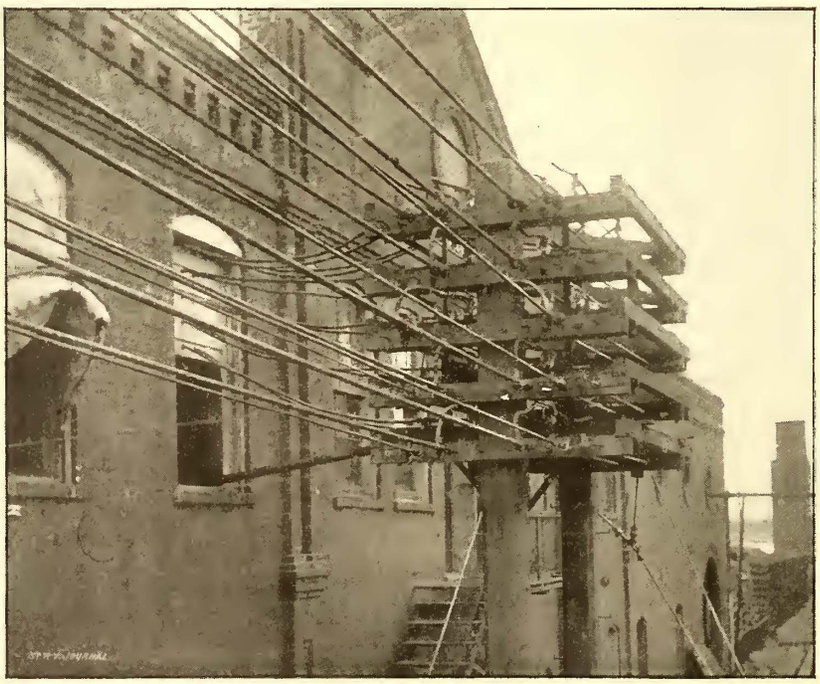


FIG. 1.—TERMINAL POLE IN FRONT OF POWER STATION—NEW ORLEANS.

The guys are fastened to two vertical planks set edgeways between the wooden and iron arms on the rear pole, there being one on each side of the pole. The strain of the whole five arms is thus concentrated on these equalizing braces, and the guys, of one inch galvanized iron cable, are attached to the equalizers by heavy iron clevises. One V guy has its branches attached to the upper ends of these equalizers and the other to the lower ends. The branches of the V's unite about eight feet from the pole.

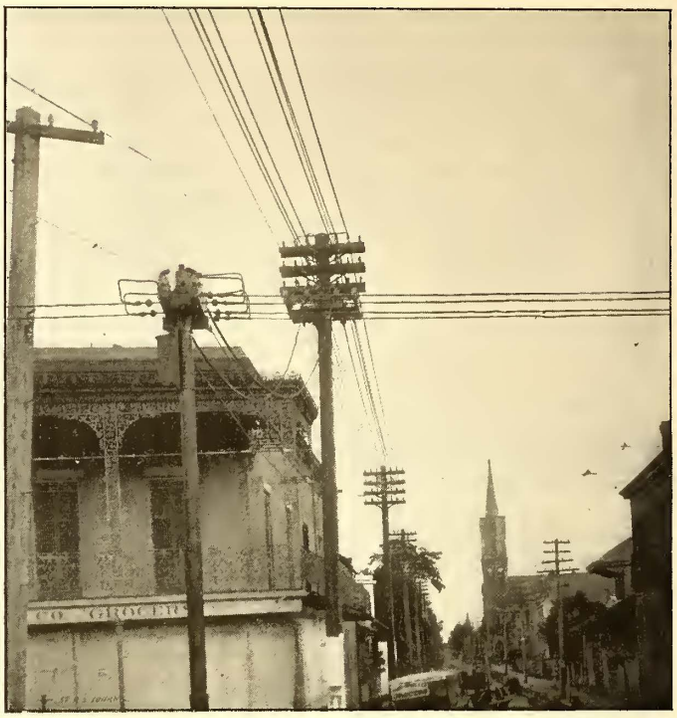


FIG. 2.—MAIN FEEDER POLE LINE AND SECTION FEEDERS—NEW ORLEANS.

There are two guy stubs, each made by cutting in half a thirty foot, 100 lb., center bearing girder rail, placing the halves side by side close together, and setting this fifteen foot stub in eight feet of solid concrete. The rails pull against their bottom flanges, and a pin through the two webs near the top carries the eye of the turnbuckle that tightens the guy. They are also braced backwards at the ground level by one and a half inch anchor rods, as shown in the accompanying engraving. A detailed plan and elevation of the crossarms and iron work of the terminal pole are also given in Figs. 3 and 4.

The poles on Market Street extending from the terminal poles are sawed hard pine, butts 15 × 15 ins., tops 10 × 10 ins., forty-five feet long, with corners chamfered, and with five double crossarms, six pins to each, measuring 3½ × 5 ins. × 6 ft. The heavy cables are supported by Columbia top-groove insulators. This trunk line carries the feeders for the Prytania Street, Canal Street and Peters Avenue lines, and part of the Esplanade feeders. It will also carry feeders for the Magazine and Annunciation lines when those are equipped. There are now carried on this pole line ten 500,000 C. M. cables, two 250,000 C. M. cables, and four No. 0000 wires, the trolley feeders for the different lines. Besides these trolley feeders, the top arm carries four 500,000 C. M. cables, which complete the return circuit from the tracks of the different lines, connection being made at the points where the trunk line crosses the tracks. At these points two or three No. 0000 wires are fastened to each rail by a specially designed connection, and run up the poles, where they are tapped into the return feeders. Two more of these feeders are now being added to those at present on the poles, making six altogether.

At the principal feeding points where the trunk line intersects the trolley lines, the crossarms are replaced by

special frames designed for sustaining the mechanical stresses due to the tremendous tension of the cables, and also for convenience in electrical distribution. The frame is of 4 × 5 in. pine, supported on 4 × 4 in. angle iron, and the stresses are transmitted from the frame to the angles by tie bolts reinforced by gas pipe. The frame is five feet square, and is fastened together by angle irons bolted on at the corners. A seven-eighths inch copper bus rod is carried around the frame on insulators, and the dead ended feeders are tapped on to it, and the railway line feeders led out from it on whichsoever side may be most convenient. The pole shown in Fig. 2 is at the intersection of the trunk line with the Prytania Street line, and in this particular case two heavy cables connect the bus rod with the Prytania Street mains, which run along the railway poles on the opposite side of the street. On this pole is also shown one of the standard section boxes, one of which is placed at the end of each section. Each one of these boxes has its own separate feeder running to it from the principal junction point. At every section box there is a sectional insulator in each trolley wire. The feeder, before it enters the box, is divided into two branches, each of which is connected to the trolley wire on opposite sides of the sectional insulator. The box contains a single pole switch and fuse block for each branch. It is thus evident that every feeder feeds into two adjacent sections, which are thus made continuous

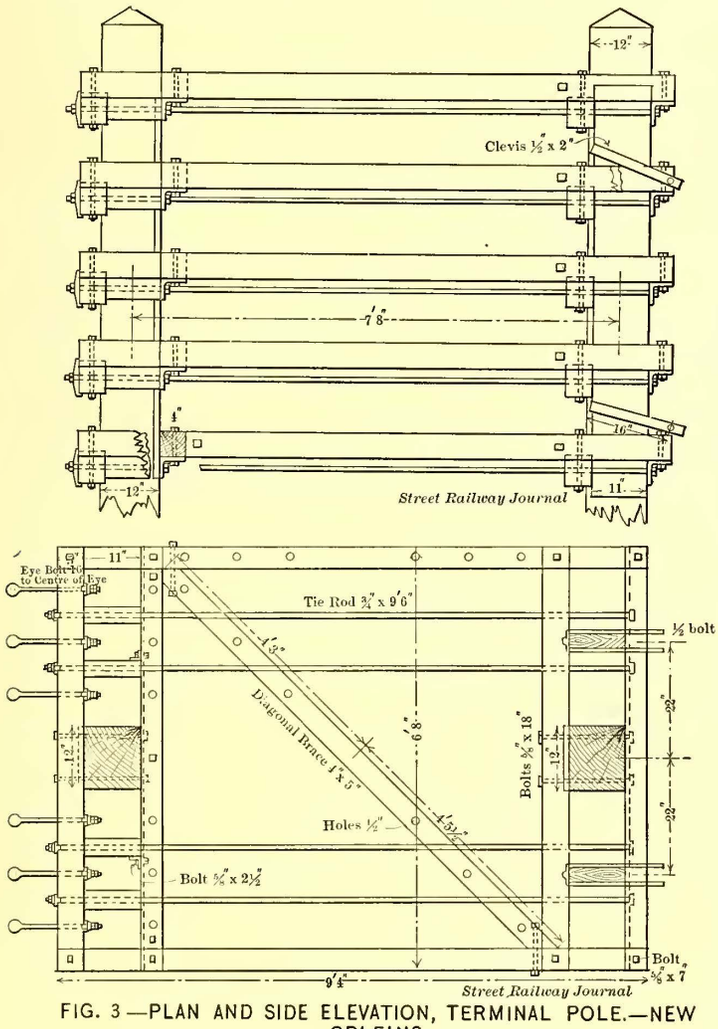


FIG. 3.—PLAN AND SIDE ELEVATION, TERMINAL POLE.—NEW ORLEANS.

unless one of the switches in the box be opened or the fuse blown, so that the conductivity of the trolley wire is added to that of the feeders throughout the entire length of any particular railway line. The illustration of the junction pole shows also quite clearly the relative arrangement of the section box and the trolley insulators.

Special devices had to be designed for splicing cables and for the various kinds of connections that had to be made to them. Owing to the nature of the soil, which consists largely of water, the setting of poles was attended with unusual difficulty and expense. All the poles are set eight feet in the ground, and in concrete. From one to the other there are some twenty guy stubs at points where there are turns in the line, or where the strain of a branch lead has to be balanced. The entire length of the trunk line up Market to Felicity, thence to Dryades, thence to Canal Street, is about two and a half miles. As one line after another is passed the entire weight of copper is, of course, gradually diminished. The amount of copper

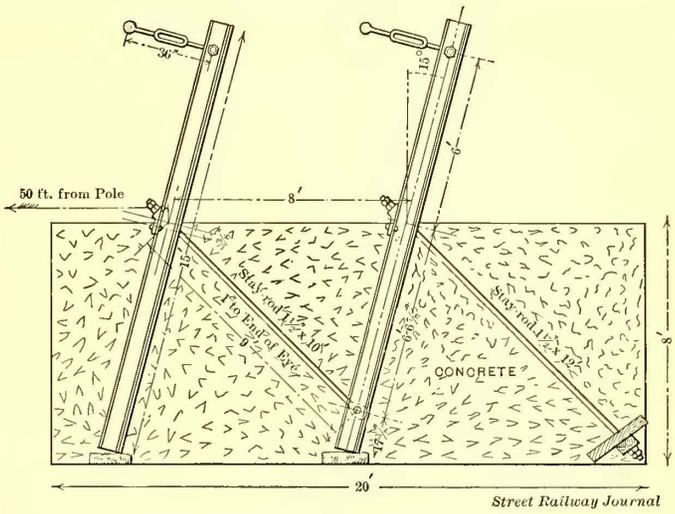


FIG. 4.—GUY STUB, TERMINAL POLE—NEW ORLEANS.

carried through to Canal Street consists of four 500,000 C. M. and two 250,000 C. M. cables. Two of the former go on through to Esplanade Street on a similarly constructed line of forty and forty-five foot poles, this extension being about seven-eighths of a mile long.

The return circuit of any one of the railway lines is entirely through the rails up to the intersection of the trunk line, whence the track feeders, carried on the top of the arms of the trunk line, complete the return to the station. The tracks are all double bonded with No. 0 copper, except in some outlying portions of the lines, where they are single bonded. The Peters Avenue line is treble bonded from Canal Street to its intersection with the feeder trunk line, as it is obliged to carry the return from the Canal Street line as well as its own. All the lines above Canal Street intersect the trunk line at points not greatly distant from the power station, so that all of them will have a first class return connection.

The trolley wire construction has all been done with two tower wagons, built in New Orleans, after the designs of Mr. Willard. When not in use the platform can be lowered, and it then forms the driver's seat, the supports being doubled up something like a jack knife. By means of a windlass, which can be easily operated by one man, the supporting legs are opened out and the platform raised to the proper height at the same time. In order to work on the wire, and at the same time allow cars to pass, an extra platform is provided, which is hinged to the main platform, and when in use projects sideways from it, out over the track, with its outer end supported by chains. When not in use this hinged platform is simply swung over on top of the other. All these changes can be made in a few minutes, and with very little trouble. The wagon is heavy enough for ordinary construction work, and at the same time light enough to be used for emergency purposes. It is probably one of the best all-around trolley wagons that has ever been devised.

The conditions prevailing in New Orleans have made the work considerably more difficult than is usually the case with most large cities. The unstable nature of the soil has already been alluded to. The city is at long distances from the principal markets, which results in delaying the delivery of material. As electric railway construction was a comparatively new business in the city, most of the lighter materials, as well as all the heavier, and all the skilled labor, had to be imported. Notwithstand-

ing these difficulties, there is now standing in New Orleans electrical railway construction which is second to none in the country, both for good appearance and durability.

The lines now in operation are the Canal Street, Prytania Street and the Dryades Street & Peters Avenue. By the time this gets into print, the Esplanade Street and Dauphine Street lines will have been started.

Underground Electric Railways in London.

By Alex. McCallum.

In the early part of this year I gave in the Street Railway Journal a general account of the system of underground electric railways about to be developed in London. Since then some little progress has been made in the matter, but all the parties concerned seem to go on the principle of "hasten slowly." Things are, however, now in such a position that a few details about the various projects, along with a glance at similar proposals on the continent of Europe, may be useful. It will be remembered that all these railways are to be constructed on the Greathead deep tunnel system, a method which presents enormous advantages in crowded cities both as to cost and convenience.

Since writing previously, work has been commenced on the Waterloo & City Railway, and this, therefore, is the first of the group to get under way. In spite of financial depression, the whole of the stock was at once taken up by the stockholders of the London & Southwestern Railway Company, from whose great terminus, Waterloo Station, the new railway is to run underground and across beneath the Thames to the Bank of England, a distance of a mile and a half. The estimated cost is about half a million sterling, say, $2,500,000, while an elevated railway between the same points, on the very lowest estimate, would have cost $15,000,000, owing to the immense value of the property which would have had to be purchased. About midsummer the work of sinking two shafts in the bed of the Thames was begun, and in September—the work having been carried on from a staging erected on piles in the river—this operation was practically completed. In October two of the cutting shields for driving the tunnels were got into position, and the work commenced. Soon afterwards other two shields for driving the tunnels in the opposite direction were set going. In this way the whole of the driving will be done from the river, and all the excavated material will be brought out there and taken away on barges. There will be no street interference and no carting through the busy thoroughfares, two most valuable considerations. The whole work is expected to occupy two years and a half. There will be no intermediate station, and as in the case of the other lines of the kind, electricity is to be the motive power. A through speed of twenty-two miles an hour will be obtained, and as the line will be graded downwards from each end to the center the traction expenses are to be very low. Indeed, the impetus obtained on the down grade will be nearly sufficient to carry the train to the terminus on the up grade. The engineers of the line are Mr. Galbraith and Mr. Greathead.

During the past summer an attempt was made to raise capital for starting another of these lines, the Hampstead, St. Pancras & Charing Cross Railway, but the movement was premature and the subscriptions were not obtained. A better considered attempt is expected shortly, but in the present stagnation of the money market and the widespread distrust caused by such disasters as that of the Liberator Building Society, it is difficult to raise capital for any purpose whatever. The financial prophets, however, think that there will soon be an improvement.

One change of importance has been made since the beginning of the year in the proposals for working this Hampstead & Charing Cross Railway. Owing to the gradients it was intended to work the line by cables, but this has now been abandoned in favor of electricity.

Among the various schemes the line which will probably carry the greatest traffic will be the Central London Railway. This road will start from beneath Liverpool Street Station, the huge terminus of the Great Eastern Railway, and will run past the Bank of England westwards under the great traffic artery formed by Cheapside, Oxford Street and other thoroughfares, to Shepherd's Bush in the western suburbs, a distance of about six miles. Stations will be about half a mile apart. Each train will seat about 340 passengers, and a three minute headway is contemplated. The company is not yet in a position to begin the work of construction, but expects soon to be so.

It is not necessary now to refer again to the other schemes, for none of them are as yet started; though the underground extension of the Great Northern Railway to the city district promises soon to begin under an arrangement with the Great Northern Railway Company. The tunnels here, as in the case of the Walthamstow & Epping Forest line are to be made wide enough to admit the ordinary rolling stock of the steam lines, so that through trains can be run to and from the country. The steam locomotive will, of course, give place to the electric on entering the tunnels. The various railways will be of immense service in relieving congestion on the streets, and in providing rapid transit through crowded districts which are at present served by no railway.

A unique arrangement is to be put into effect at the Bank of England, one of the most congested spots, so far as street traffic is concerned, in the world. The Central London and Waterloo & City Railways are to have stations in the ground beneath all this turmoil overhead, and so will the existing City & South London Railway when its extension northward is carried out. The stations will not be at the same level, but they will be in close proximity, and subways will enable passengers to change from one to another with the greatest ease. Besides this, a subway of an elliptical course just below the street surface will run round the open space in front of the bank, and enable the public, whether using the railways or not, to avoid the street traffic in crossing from one side to the other. Elevators will descend from this subway to the various stations. The usefulness and convenience of this arrangement, which has been designed by Mr. Greathead, can only be thoroughly appreciated by those who have personal experience of the difficulties of the pedestrian in the neighborhood of the bank. At every point in the metropolis where one of the new railways is close to an existing steam railway station, subways will be provided to allow passengers to pass easily from the one line to the other.

The experience gained on the existing City & South London electric underground railway and on the Liverpool elevated electric railway has shown that there will be no difficulty in carrying the traffic on the new lines by electric power. The watchword of the promoters is short trains and a very frequent service. The latter is now practicable without a large number of signal boxes and signal men, as the experience at Liverpool with automatic electric signaling has been thoroughly satisfactory, and enables such railways to be worked in very short block sections with the greatest economy and safety. Economy of working will be further secured by Mr. Greathead's method of grading the lines, so that every station has a down grade in each direction leading from it. As to cost of construction, the work on an average, including stations, land, tunnels and equipment, will run from $1,500,000 to $2,000,000 per double mile, against more than $5,000,000 per mile for shallow tunnel or elevated lines. In the latter case all the land and property along the route have to be bought, while on the deep tunnel system the only land to be purchased is that for the entrance to stations and for the power houses.

In many of the large cities of Europe attention has been directed to the great advantages of the Greathead tunnel. In Berlin a project of the kind is being discussed, and Mr. Greathead has recently been in communication with the authorities there on the subject. This is in spite of the fact that very efficient elevated steam lines already exist. In Brussels there is a proposal for a deep tunnel railway taking a circular route. This will be an

extremely useful line, as the streets of Brussels are characterized by very steep inclines, rendering ordinary vehicular traffic difficult. It is expected that the underground line in Brussels will be very cheap to construct. Antwerp proposes to go forward vigorously with a Greathead tunnel scheme under the River Scheldt, to be used for general traffic. The case of Antwerp is, perhaps, one of the most extraordinary in the annals of nineteenth century civilization. At present the city is confined to one side of the river, which is here about a quarter of a mile broad. The town is surrounded and hemmed in by its semicircle of walls and forts, for, like many European towns, Antwerp has to live armed to the teeth. The diameter of the semicircle is the River Scheldt. A great amount of shipping passes up and down the river, and in consequence no bridge has ever been built across it. The further shore is at present almost wholly unoccupied except by farmers. The scheme of an electric railway in a deep tunnel under the river is accordingly finding immense favor. It is intended that the railway shall serve local requirements in the city, and then pass under the river to the opposite shore, whence it can be continued should occasion require. The immediate effect will be to give a city value to land which now has only agricultural value. The people of Antwerp propose to construct new docks, and at first the idea was that these should be within the present city. This was to involve a cost of about $15,000,000. Mr. Greathead, however, suggested some time ago that the docks might be located on the other side of the river for a mere fraction of that sum, even including the price of the proposed railway under the river. The railway in this case would carry freight as well as passengers. The idea was taken up strongly in the city during the past summer, and very elaborate designs have been made, not only for new docks, but practically another town on the opposite bank of the river. At the Antwerp Exhibition there was an exhibit showing an actual section of the iron lined tunnels proposed for the electric railways at Antwerp and Brussels, and also a large number of drawings giving details of the work. It is expected that a concession will soon be granted, and then the work of construction will begin.

In Paris there is a proposal for an underground electric railway, and this will receive encouragement from the fact that a tunnel has recently been constructed on the Greathead system under the River Seine in connection with drainage works. The French Government is now taking an interest in the question of rapid local transit, and the French Minister recently visited London and Liverpool, where he inspected the City & South London and the Liverpool electric railways. In Vienna there is a prospect of a system of deep tunnel electric railways being carried out.

That people in New York interested in the local transit problem are beginning to appreciate the merits of the deep tunnel scheme is evidenced by the fact that during the past summer the engineer of the Rapid Transit Commissioners, of New York, came to London and investigated both the method of constructing and of operating the existing city & South London Electric Railway. I believe the deep tunnels in New York would have to be cut for the most part through rock, though in part sand would be the medium. There would be very little difference, however, in the cost, as though rock is more expensive to cut than sand or clay the costly iron and concrete lining of the tunnels in the latter media would for the most part not be required in the tunnels through the solid rock. In the latter, also, there would be no necessity for the expensive compressed air working necessary during excavation in water-bearing strata. The Rapid Transit Commissioners' engineer has recently reported in favor of constructing the tunnels as near the surface as possible. In Europe this could not be done without buying immense quantities of land and house property. Whether any special arrangement to avoid this expenditure is possible in New York remains to be seen. If not, deep tunnels seem the only alternative.

Distribution of Elevated Railway Traffic in New York.

In a recent number of the *Railroad Gazette*, J. J. R. Croes presents interesting diagrams showing the distribution of the daily traffic on the lines of the Manhattan Railway Company, of New York. We reproduce these diagrams for the benefit of our readers, with the following brief explanation of their meaning:

The entire city served by the four elevated lines is divided into twenty sections, each one-half mile in length. The shaded portions on each diagram represent the tickets taken at all the stations in the different sections on the down and up trips respectively, each half mile square representing 5,000 trips. The distribution of the traffic between the east and west sides is also indicated on the diagrams.

DIAGRAM SHOWING DAILY TRAFFIC ON THE MANHATTAN ELEVATED RAILWAY, NEW YORK.

By comparison of these two diagrams, the average distance traveled per passenger may be inferred, with some approach to accuracy. We quote from Mr. Croes' article:

"Looking at the traffic on all lines, 59 per cent of the up travel comes from the three sections (a mile and a half) at the lower end, and 59 per cent. of the down traffic comes from the upper ten sections (five miles), so that the mean journey of 59 per cent. of the passengers appears to be six and three-quarters miles. * * * There are two main lines independent of each other, one on the west side of the city, carrying 47 per cent. of all the passengers the other on the east side, carrying 53 per cent."

These diagrams will repay careful study in view of the problems of traffic to be passed upon by the Rapid Transit Commissioners in laying out the new through

system from the Battery to the northern limits of the city. Mr. Croes believes that the present plans of the Commissioners are defective in that they do not sufficiently take into account the necessities of the traffic of the city. He says: "Indeed, the whole study of the Commissioners seems to have been to provide speedy communication, by the most expensive methods, between Whitehall Street and Washington Heights, without considering the fact that from the West Side, above 122 Street, there now comes less than 10 per cent. of the passengers who go down on rapid transit trains, and that for three miles further down the road there are fewer passengers carried than on any other three lines north of Bleecker Street."

Suggestions for an Index of Engineering Literature.*

By Prof. George D. Shepardson.

To save the time of busy people, and to call attention to a mass of material that would otherwise be available to comparatively few, attempts have been made at different times to compile indices of literature. Perhaps the greatest of these is the "Royal Society Catalogue of Scientific Papers," consisting of eight quarto volumes of about 1,000 pages each. This was compiled under the auspices of the Royal Society of England, and was printed by the English Government at public expense. It gives alphabetical lists of titles and authors of scientific papers published in every civilized country, between the years 1800 and 1873, but exclusive of technical and professional papers.

Next to this stands "Poole's Index of Current Literature," published in this country by private enterprise. The first volume, compiled with the co-operation of fifty-two libraries, indexed 6,200 volumes which were published during the period from 1803 to 1882, and contains about 1,000 references to articles on electrical subjects that appeared in popular and scientific journals. The second volume, to which ninety-seven libraries contributed, covers the period from 1882 to 1887, and contains about 600 references to articles on electrical subjects. The third volume, compiled with the co-operation of 122 libraries, covers the period from 1887 to 1892, and gives about 500 references to electrical papers. The volume for 1893 gives about 100 such references. In "Poole's Index" there is some attempt at classification of electrical papers, and there are a few cross references.

The "Descriptive Index of Current Engineering Literature," compiled from the monthly summaries in the *Journal of the Association of Engineering Societies*, gives an excellent résumé of engineering literature between 1884 and 1891. This is devoted principally to civil engineering, but gives about thirty pages, with 700 references, to electrical papers. Most of the references indicate the character of the papers. The cross references are excellent. The index in the *Journal of the Association of Engineering Societies* is commendable in that it prints the indices on only one side of the leaf, so that they may be cut and re-arranged according to the ideas of the individual. The *Journal* for each December contains a summary of the monthly indices of the year.

The American Institute of Electrical Engineers published in its Transactions for about three years, 1886 to 1888, an excellent index of current electrical literature, compiled gratuitously by a gentleman too modest to have his name appear. Volume V of the Transactions contains about 5,100 references, Volume VI about 5,800, and the first few numbers of Volume VII contain about 1,500 references. Some of these are accompanied by descriptive notes.

The first volume of "Galloupe's Engineering Index," compiled and published by private enterprise, gives about twenty-eight pages, with 1,500 references, to articles on electrical subjects appearing in the years 1883 to 1887. The second volume, 1888 to 1892, gives sixty-one pages, with about 3,300 references, titles and authors being given.

Excellent indices have appeared in the *Engineering Magazine* and in *Electrical Engineering*, the figures for which are not at hand. Recently *Electric Power* has launched out into this field. The digest of foreign literature in the *Electrical World* is commendable, but confessedly incomplete. Extended indices are published at intervals by the French and Germans. A universal index, published weekly at Leipzig, aims to give tables of contents of a number of journals arranged in the alphabetical order of their places of publication. Doubtless there are other indices not known to the present writer.

A commendable custom of *La Lumière Électrique*, that might well be imitated by other periodicals, was to publish at intervals complete lists of articles that had previously appeared in the paper bearing upon particular subjects.

To the mind of the writer, the most ideal index yet attempted was that published at first in connection with *Electrical Engineering*, and later as a too short lived publication by itself under the name of *Electrical Literature*. The printing of the indices on separate sheets, perforated and tied together, each sheet being devoted to a single subject, combines the advantage of flexible classification of subjects with ease of arranging the sheets from month to month, so as to make the bibliography of each subject consecutive and up to date. Having the sheets loose and perforated for binding with brass clips or cords, allows each individual to supplement the printed sheet by his own notes or additional references. The publisher is also able to add sheets descriptive of later or earlier memoirs, without impairing the integrity of previous work. It should be, and doubtless is, a matter of sincere regret by the electrical and mechanical engineering professions that this publication was forced to suspend on account of lack of financial support.

* * * * *

In view of the present state of the case, as imperfectly outlined above, what seems to be the best method of securing the publication of an index that shall avoid the failings of those already existent? One of the first considerations is that the compilation of an index which will be an improvement upon all existing ones, must be the result of the co-operation of a large number of people, as "Poole's Index," to which over 122 libraries contributed. It will require the expenditure of a considerable amount of money, and will probably not be self-supporting. Such work could probably be done best under the auspices of some society or societies, as was the "Royal Society Catalogue." Since the index might well include the subjects of interest to electrical, mechanical, hydraulic and civil engineers, it seems reasonable that the various national engineering societies might combine forces to maintain the publication of an index that would be of lasting value to the engineering profession of the entire world. Since the headquarters of four of the national societies are in the same city, two of them being in the same building, such co-operation would not seem difficult. A joint committee might be appointed which would receive the confidence and co-operation of all. They could draw upon a large constituency for co-operation and subscriptions. The committee might outline the plan for the work, and prepare preliminary lists of subjects which might be published and submitted to the members for suggestions. The committee could then call upon different members for contributions from their private index files. The committee should have authority to edit the contributions thus received. Doubtless a number of publishing houses would contribute complete files of their publications for such indexing. Indeed, some of them have already made such offers to a private enterprise for such purpose. Incidentally the material thus received would make a valuable addition to the libraries which are being gathered at the headquarters of the societies. Such a committee would certainly compile an index that would be far in advance of the imperfect ones now published. The vast amount of duplicate labor now expended by the papers and by individuals could then be turned to more efficient work.

In conclusion the writer begs to add some suggestions as to the style of such an index. It should include subjects relating to electrical, mechanical, hydraulic and civil, and perhaps mining engineering. It should index books as well as periodicals. The references should be descriptive so far as practicable. Each subject should have a page by itself. Digests and simple references might be on separate sheets. References and sheets on each subject might be numbered consecutively for convenience in adding later notes from other files or from later publications of the same articles. Abbreviations or other symbols should indicate whether the reference is to the original paper or to a reprint, whether the paper is in full or abstract, whether accompanied by discussion and by plates or illustrations. The separate sheets should be perforated for rearranging and rebinding and should be printed on one side only. It might be preferable to print the whole index on cards similar to those used in the card catalogues of libraries.

In this way it would be practicable to begin publication at an early date and to issue parts at frequent intervals. The indices to current publications could be issued without delay, and those of completed files and historical works could appear as the work proceeded. Publishing the work in sections would allow each engineer or student to purchase or subscribe for only such subjects as were of importance or interest to him. Indeed, the work, if carried out properly, would result in so massive a catalogue that few outside of libraries or other public institutions could afford to obtain the entire work.

* * * * *

After this paper was prepared, the writer learned, in looking over some periodicals that accumulated during the summer, that the Royal Society recognizes the defects of its admirable catalogue, and is taking steps to revise and bring it down to date with the co-operation of learned societies in various parts of the world. (*London Electrician*, xxxiii, 268, July 6, 1894.)

* Abstract of a paper read before the American Institute of Electrical Engineers on November 21.

American Institute of Electrical Engineers: Removal Notice.

The office of the American Institute of Electrical Engineers, which has been at 12 West 31st Street since May, 1890, has been removed to rooms 1009 and 1010 Havemeyer Building, 26 Cortlandt Street (tenth floor), New York City.

This change has been decided upon by Council, after careful consideration during the past three months, by a committee composed of James Hamblet, chairman, Prof. F. B. Crocker and H. A. Foster. The inconvenience of the uptown location has long been apparent to officers and members in the city, as well as visitors from a distance.

The choice of the Havemeyer Building was due to its central location in the electrical district, and its convenience to various lines of travel. It has entrances on Cortlandt, Church and Dey Streets. It is immediately adjacent to the Sixth Avenue Elevated Railroad station, one block from the Ninth Avenue station and the Broadway cable line; two blocks from the Pennsylvania Railroad ferry, and three from that of the Central Railroad of New Jersey.

The Institute meetings will be held at 12 West 31st Street, as heretofore, until further notice.

The office will be open from 9 A. M. to 5 P. M. It is equipped with a long distance telephone, and direct messenger service. Over

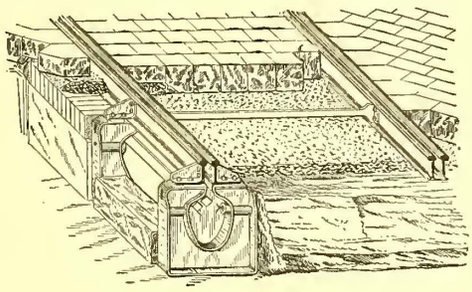
100 electrical, mechanical and engineering periodicals will be found on file. The rooms front west, and command a fine view of the Hudson River. Members visiting New York will find the rooms as convenient for their accommodation as were those at the World's Fair.

Is There a Solution of the Electric Conduit Railway Problem.*

By Joseph Sachs.

It is scarcely a dozen years ago when we did not even have a single inch, I may say, of electric railway in existence. To-day there are hundreds of miles in this country alone; but, strange to say, although its advance has been most phenomenal and the success of the so-called "deadly trolley" has been very great, there has existed a most extensive demand for a substitute for the trolley, which should be free from the various objections which are inherent in the overhead wire. The main objection that exists is the overhead wire, and although we have advanced in the construction and operating of motors and gearing and power house machinery, we still remain at the same point that we did at the very beginning in the method of distributing the power to the motor on the car, namely, by means of an overhead bare wire. Now two substitutes have appeared to solve this problem; one has been the storage battery and the other has been the underground or conduit system. The storage battery car does not need to be explained; you are all familiar with it, and I need only say that although the storage battery has proved a failure in the past, and a severe loss to many of those who have invested money in enterprises of that kind, recent successes in that direction lead us to believe that it is more than a possibility, in fact a very great probability, that we may have a very successful storage battery system in the very near future. But the point that I have under consideration to-night is not to solve the problem in that way, but to solve it by a center of distribution method, or a central station method, and the way to solve the problem in that way is by the conduit system.

Hundreds of conduits have been tried; thousands of them, I may say. And I may also say that perhaps no other branch of electrical engineering can boast of the vast variety of systems and plans that



THE BUDA-PESTH CONDUIT.

have been developed by various promoters as the class of conduit electric railways; in fact, of all the electric railway patents in the Patent Office to-day, over one-half are conduit railway systems; that includes locomotives, storage batteries and everything else that appertains to electric railways. It may seem strange, but perhaps the first thing the novice in electrical engineering goes at is a conduit electric railway. Perhaps that is the very reason why so many have not been successful.

Why is it that success has not been obtained? One reason I have perhaps given you; the other is perhaps on account of some inherent difficulties, and another still is perhaps the extreme large cost of construction and maintenance, although the maintenance would seem to be less than the trolley.

From the fact that there are in operation to-day two electric conduit systems, it would appear that we could build other systems of similar character and somewhat similar construction and have them work successfully; but up to date nothing that has been successful, on a commercial basis, has been forthcoming. I think that in order to bring forth a successful system, we must first study the problem most thoroughly and the real question to be solved.

I have taken up the various systems that have been devised and divided them into six classes, and have selected some which I shall describe to you in their classes, and show you their points of advantage and disadvantage.

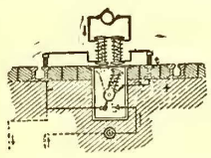
We shall first take up the open slot, continuous wire conduits.

The first system which I shall consider will be the well known Bentley-Knight system, which was, as you all well know, one of the first attempts ever made in this country to solve the rapid transit problem by means of electricity. It consisted of a very small, open slotted conduit with two wires suspended therein. The conduit was exceedingly small and, although this road was operated for some time, it was at last abandoned. The road was opened in 1884, about ten years ago, and, as I say, was the first attempt at electric traction on a commercial operative basis in this country.

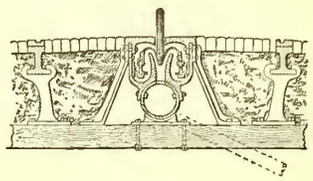
The Bentley-Knight people, however, were not satisfied with that attempt and got out another system. It had also a very small conduit, but instead of placing it in the middle of the track, it was located at the side of the rail. Two wires were located therein, and the plow coming down from the car came in contact with the wires, one on each side.

Another conduit was installed as early as 1885, and although the apparent conditions would be against its successful operation, strange to say it is operating to-day and paying dividends. I have reference to the Blackpool system or Blackpool conduit, which is operated in Blackpool, England, to-day. The conduit is exceedingly small, and the two wires are supported nearly directly below the slot, yet as I say, the conduit is in daily operation.

The next system to be described is the far famed Siemens-Halske system, which is being operated to day at Buda-Pesth. The conduit is a peculiar one. It is located directly beneath the rail. The car wheel is very dissimilar from that used in this country. It is a central flange one, the flange running between the two rails, the object being to keep the slot open at all times. Two wires are used, one each side of the slot, and the whole space around the conduit is filled up and protected by cement. Strange to say, this conduit has been in daily operation, since 1889; dividends are paid by the road, and sixty cars are operating on six miles of double track. But I doubt very much whether a conduit of that size would operate in this country.



SIEMENS SURFACE CONTACT SYSTEM.



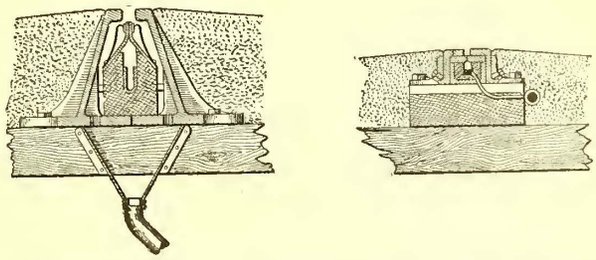
THE ZELL SYSTEM.

Now we come to the latest addition to open slot conduits, which is proving more or less successful. I have reference to what is called the Love conduit. The yoke is a construction adopted at Chicago, where this system was first introduced. You see the promoters of this system had a better idea of the problem to be solved. We have here a large conduit and the wire placed high and dry; and furthermore, about the most important thing of the system is that the wire is accessible by placing above the wire a detachable slot rail or cover which can be raised at any time, so that the wire can be inspected. But apparently it did not prove satisfactory for some reason or other, and when the same system was introduced in Washington, they adopted another form of construction. One reason, no doubt, was that a cheap conduit was wanted, which seemed to be the underlying principle of this whole matter, and for that reason the heavy yoke was replaced by a simple trough located between the tracks. The conduit, I understand, is to-day in operation in Washington; whether fully successful or not I do not know.

Now we come to some of the possibilities and suggestions. One is the Griffin conduit, the only feature of which consists in the fact that the conduit is divided into two compartments, one for the wire and the other for drainage. The advantage of the last form of construction you can readily see for yourself is also borne out in the form of construction which is called the Zell conduit, in which we have a drainage tube in the center beneath the slot, and the wire is supported in two separate compartments, one on each side of the drainage tube. Both of these systems, as I say, are suggestions.

Here are some more suggestions, one of which is very similar to the Bentley-Knight construction. A very complete and well designed conduit is that devised by Elias Ries as far back as 1887. The other is an oddity. The wire is simply loosely supported on insulators, and the trolley wheels pass under the wire and raise it up as it comes along, and after the collector has passed the wire drops back into its support.

Now you will please take notice that most of these various forms of open slot conduit possess several points of disadvantage. In nearly all the forms which have been tried the conduit has been extremely small; the wires have been unprotected and poorly located; they have



TWO FORMS OF VAN DEPOELE'S FLEXIBLE LIP CONDUIT.

been placed low instead of high; the insulators have been poor and inaccessible, and the problem seems to have been attacked from the wrong standpoint, namely, to get a cheap system to compete with the trolley.

We will leave the open slot conduit for a while and take up what we call the movable lip or cover conduit. In this form of construction the aim has been to protect the wire, and in order to do that several inventors have attempted to cover up the slot to keep the slush and mud dirt out, except when the trolley is passing. One of the best known of this kind is the Van Depoele conduit, and the invention of the late well known electrician, Mr. Van Depoele. He devised a form of con-

*Read before the New York Electrical Society, November 1, 1894.

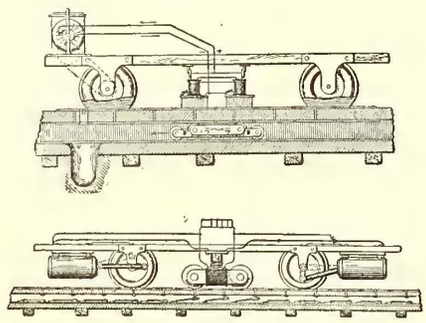
struction having flexible lips, which cover the slot of the conduit containing the wire. The conduit is very small, and there are two lips which press together over the slot and which are pushed aside by the plow of the car as it comes along, but close again after the car has passed.

In another form which Mr. Van Depoele has devised he puts the same construction inside of a somewhat larger conduit, and there the same thing goes on.

In another form the wire is located in a trough within the slotted conduit and covered by two shutters, which are pushed aside by the plow. These shutters are made in short sections, and cover up again after the plow has passed.

Now we come to another system which has recently been exploited in this country, which is called the Peterson system. The conduit is very small and divided into two compartments. The wires are located in one compartment, and there is a cover which is pushed aside by the plow.

The difficulty with these open slot, flexible cover or movable cover conduits is practically the same as the previous class, and possesses

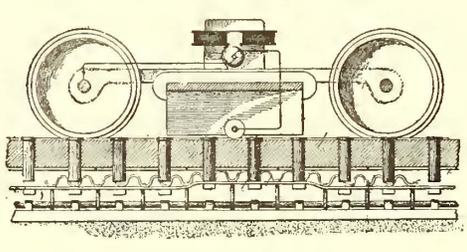


VAN DEPOELE MAGNETIC SURFACE CONTACT SYSTEM.

the additional disadvantage that we have not got the flexible material that will stand the strain of every day railway traffic, and the shutters when made of metal cause a great deal of noise and do not seem to afford a great deal of protection against injury to the wire.

The next class we come to is known as the surface contact system. It holds forth certain alluring attractions in the way of cheap first cost and dispensing with the open slot, and has therefore received a great deal of attention. The Lineff system of this class has been tried experimentally. It contains a sectional iron contact rail which is flush with the street surface. It is made in sections of six to ten feet, placed on top of the conduit, which is entirely closed, and is composed of some insulating material, in which is laid a strip of copper, attached to the bottom of which is a strip of iron, and this composite strip is connected with the source of supply. Upon the car is a magnet having a wheel at each end, and is placed longitudinally with the track. When the magnet is energized the composite strip is attracted up against the rail and naturally connects that section of the rail with the dynamo; and as the car moves along the magnet pulls up the strips in succession, and connects each successive section of the contact rail with the source of supply. I will not dwell any longer on this system, as I have a number of others to describe.

There is another surface contact system devised by Mr. Van Depoele which is practically the same in principle. The contact conductor consists of a number of sections on the surface of the street; the contact device, or collecting plow, consists of a magnet, the poles of which are brushes. The switching device is a small car which runs upon rails in the conduit and directly beneath the sectional con-



LIEUT. F. JARVIS PATTEN'S SURFACE CONTACT SYSTEM.

tacts. The lower rails form the supply conductor, and the car acts as a connection between it and the section above. As the motor car runs along, the magnet beneath pulls the little car through the conduit, and thereby connects each successive section with the supply wire.

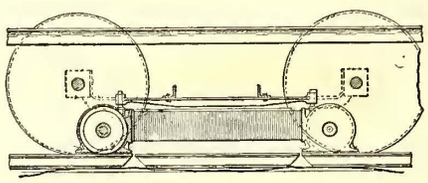
In another system of Mr. Van Depoele's there are a number of levers inside of the conduit beneath the sectional conductor, and as the magnet moves along the switch levers are pulled up against the respective sections, and in that way the contact is made all along the line in each section of surface contact conductor. After the car has passed and the magnet passed the section the lever beneath will drop back and disconnect.

Lieutenant Patten's system is very much the same as the Lineff system. It consists of a band of iron, and upon the car is mounted a magnet, the difference being that this magnet is placed transversely instead of longitudinally to the track. The band is pulled up against the rail by the magnet, which forms the magnetic switching medium, and also against a central contact, which forms the sectional conductor.

Messrs. McElroy, Nicholson and McTighe have devised a system in which, instead of using a sectional rail contact, plates are used which are located between the track on boxes in which the switch mechanism is located. The poles of the magnet are very long and project from the plate on one box to the next. In the box a small lever is pivoted and connected to the supply wire. When a magnet on the car is over the box the lever is attracted up against the contact plate and connects it with the supply wire, and the current is taken off by the long bar which forms the pole of the magnet. As will be understood, the long bar is long enough to span two contact plates.

Another system, in which the boxes are located in the center of the track, was devised by the same inventors. Instead of having a lever, an electro-magnet is used, and the current is sent down through each successive contact head and through the magnet and the connection made between the contact plate and supply wire, just as it would be in the magnetic switch by the magnetic plow. Instead of using a magnet at the bottom of the car a brush or contact bar is used. The current is sent down through the head into the magnet which then pulls up the switching device at the bottom, instead of it being directly operated by the magnet on the car.

There is a system which I have had a little experience with, and which has made me a little doubtful respecting the ultimate success of



THE LINEFF SYSTEM.

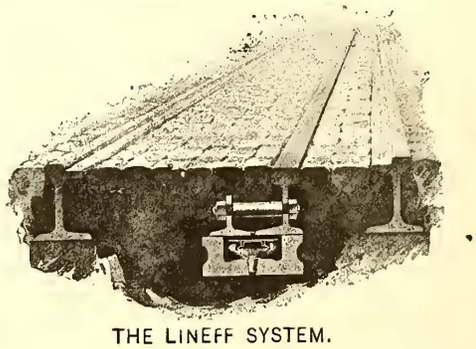
the surface contact system. It is a system in which very much the same methods were adopted as in the McElroy, Nicholson and McTighe system. As in the last system described contact plates are used, but the electro-magnets are not placed under the plates, but in accessible manholes, or placed upon posts along the road. A number of them controlling a section were grouped together. The brush, which is under the car, is always in contact with two or more heads. One head is energized, and when that has been energized, why, the last one is dropped. The conduit really consists merely of a small trough in which the wires were run to the various switching magnets which were all located together. The system was originally an invention of G. T. Woods.

There is another class or system, in fact, it might be called a combination of systems, combining the magnetic arrangement of surface contact with the electro-magnetic. One of these is the Siemens system. Contact plates are used, and the switching mechanism therein consists of a pivoted lever which is first attracted by the magnet on the car, and after the plate has been connected the current passes around a coil of wire on the lever and magnetizes it.

There is another system, devised by Lieutenant Patten, in which practically the same method is adopted. The switching device is so arranged as to improve the magnetic circuit. A separate contact rail is used as the contact conductor.

What is perhaps the latest attempt, in the surface contact system of the Johnson-Lundell type, is very similar to the system in which the magnetic switches are all grouped together. A sectional rail is used instead of contact plates.

The peculiarities of this system are that the car is also equipped



THE LINEFF SYSTEM.

with a storage battery, so that in case the brush under the car loses contact with any section of the contact rail, the car is simply operated by the storage battery. The battery is also used to actuate the magnetic switch if it should be de-energized.

Other surface contact systems have also been devised by Gorden, Pollak and Binswanger, Schuckert and others. In the last named system iron fillings are used as the switching medium in the same way as the levers are used in one of the systems described.

I will not dwell on the advantage or disadvantage of the surface contact systems. The claim put forth by their promoters is that they dispense with the open slot, and can be installed cheaper than any such system. However, on the other side, we have the difficulty of keeping down the leakage of the section that may be alive; the complicated mechanism and the many parts, and the uncertainty of action

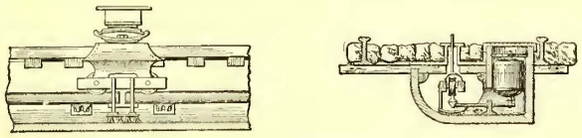
which always attends the operation of a number of small mechanisms, would seem to seriously defer the ultimate success of such systems.

In addition, there is the open conduit class in which, instead of having a continuous wire, a sectional conductor is used: that is, only a section of the contact conductor is connected with the supply wire, and magnetic, electro-magnetic or mechanical switches may be used. We could, for instance, take any of the sectional conductor systems and place the contact rail or plate within a slotted conduit.

The switching of the various sections, plates or contact points can, however, also be accomplished by mechanical devices operated by the moving car.

The Lawrence system has mechanical switch boxes. The contact rail is composed of small T rails supported on a pivoted lever, one end of which is conneeted with the switch piston. The trolley comes down upon the conductor, and by depressing one end of the lever supporting the rail, shoves up the other, and pushes in the switch rod, making connection with the main wire. After the collector has passed the bar springs up again, and connection is broken in the switch box for that section.

The Muncie-Coles system was experimentally tried some time ago at New Haven. Instead of using a continually depressed rail, a number of switch boxes are used and the contact points are depressed. The conduit is very small and simply covers up the boxes.



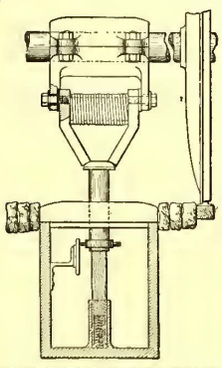
THE LAWRENCE CONDUIT.

A system which was recently exploited at Coney Island is rather a combination of ideas, but as far as I can understand, it is also fundamentally due to the very fertile brain of G. T. Woods; it is practically the same as the Muncie-Coles, but the very great advantage of this is that the switching mechanism, instead of moving up and down, moves on a pivot.

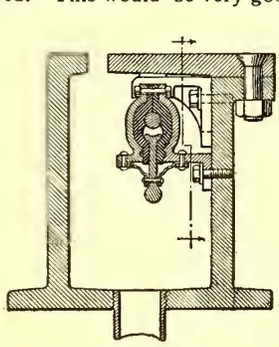
A system devised by Frank M. Ashley, very much the same as the Lawrence or any of the sectional conductor systems operated mechanically, consists of a conduit, a sectional flexible rail and the supply conductor inside of a jacket. As the connector comes along it presses up that section of the conductor and throws it in connection with the supply wire.

Now, these various forms of sectional conductor, open slot conduit systems possess, in my mind, very little advantage over the continuous wire conduit. You have the open conduit, the chance for getting mud, slush and dirt therein, and you have got to have a fairly large conduit.

Now, we come to a very peculiar system. Here the inventor has attempted to bring the conductor, not in the conduit, not on the surface, but he has gone to the other extreme and says, let me bring it above the surface, and I will have it clear and sure. So he constructs a slot parallel to the rail, along the roadbed, and places adjacent to that slot a number of switch boxes, having long arms, the contact points at the end of which run across the slot. On the car is a plow which projects down into the slot, and a similar plow at the other end, and a connection or contact bar between the two plows. The plow goes down in the slot, catches one of the arms and raises it up. While the lever is raised in connection with the bar, current is supplied from that particular switch, and then after the car has passed by the raised contact, why, the contact simply drops back again, but another lever is always raised before the last is dropped. This would be very good if



THE HENRY CONDUIT.



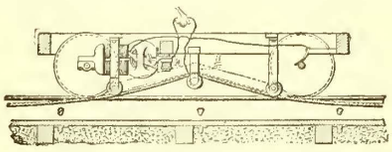
THE ASHLEY CONDUIT.

we always had clean and clear streets, and no mud, slush, dirt or snow; but inasmuch as the system has not yet been tried, I cannot say whether it will be able to operate against these or not.

In another form of raised, sectional contact system, devised by Mr. Henry, the contact device is located in a box in the roadbed, and instead of having a mechanical device, you have an electro-magnetic device. A long magnet under the car attracts a plug in the box to it and makes contact therewith. After the car has passed, the plug drops back and out of connection. The raising and lowering of the plug causes it to be connected and dlsconnected with the supply wire. The same points hold good with this system.

Now we come to another form of raised contact system which is an exceedingly odd thing. This invention has a slotted conduit, and puts therein a flexible cable which is supported on cross-bars. As the car goes along it raises up the flexible cable out of the slot and over rollers under the car, and after the car has passed it drops back.

The last class to be considered is what is called the induction system, in which a number of primary coils are located at regular points along the line, and upon the car is located a secondary coil, brought into such relation to the primary that a current is induced in the secondary from the primary. Although we may have the alternating current motor, the system would be very inefficient and costly. The primaries are wound upon "U" shaped cores, imbedded in the roadbed with the two ends up. The long core on the car is also "U" shaped; each end is a long brush which comes into intimate contact with the ends of the "U" in the street. As you see, the brush makes

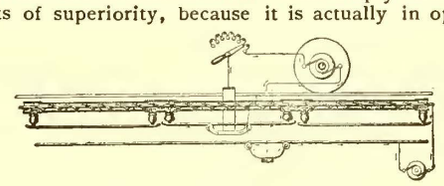


THE FELTROW CONDUIT.

contact with one primary core before it leaves the last, and in that way a continuous alternating current is induced and the car is supposed to move; it has not as yet, though.

What is, perhaps, the first surface contact system installed in the country was put in by the Baltimore Traction Company in 1885. The road was equipped with Daft motors, installed by the Daft Company, but instead of an overhead wire it had a T rail in the center of the track supported by suitable insulators. The car was operated through streets in which there was not much traffic, but there was only 250 to 300 volts. This system is not in operation at present.

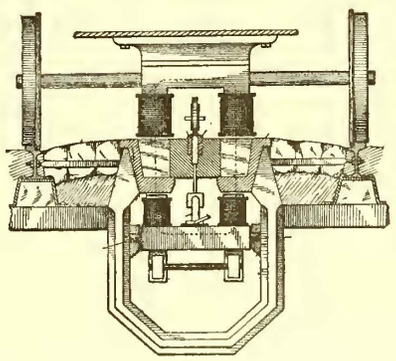
Now, as you see from the variety of possibilities and probabilities that I have shown, the solution of the conduit electric railway problem is not at all limited, and all you have got to do is to pay your money and take your choice; but the peculiar part of it all is that there is not much choice to make, because apparently nothing has ever been evolved—nothing commercially practical—except the plain, everyday open conduit and the continuous wire. That simply means that it has many points of superiority, because it is actually in operation and



THE ASHLEY CONDUIT.

nothing else has ever been operated. We have such a system in operation at Buda-Pesth and at Blackpool, England; but it is doubtful whether either of these systems can be made operative in this country. The climatic conditions are different, and it is doubtful whether our American streets are quite up to some, at least, of the streets in Buda-Pesth, in which one of the systems is in operation.

Various advantages are claimed for the different systems that have been suggested as a substitute for the open slot conduit. They may obviate some of the disadvantages of the open slot conduit with the continuous wire; they may claim to possess certain advantages in the way of costs and other considerations which are even less apparent than that of cost, but they have other objections which, I think, put them far behind any open slot conduit system, although I do not mean

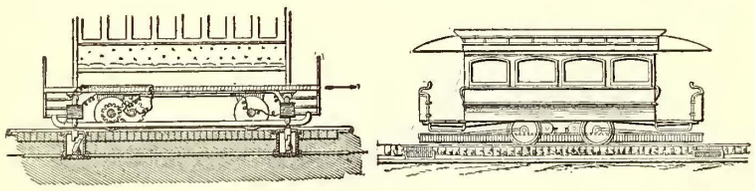


LIEUT. PATTEN'S IMPROVED SIEMENS SURFACE CONTACT SYSTEM.

to say that such systems— that is, those other than the open slot conduit —cannot be made operative.

But let us return to the open slot conduit systems that have been tried and installed. What do we find? We find, in the first place, a very small conduit poorly constructed. The wires are located in very poor positions and badly protected. The drainage is exceedingly poor, and the voltage is exceedingly high. The last state existed when attempts were made that failed, although in others that have succeeded the voltage is low, being about 300 volts. The aim has always been to produce a cheap system, a system which will compete with the trolley. This is a very desirable aim, but not one that is absolutely necessary, and from the fact that cable traction companies will put in cable systems where the track construction alone costs very nearly $100,000 per

mile, single track, as in this city, I think we can afford to spend quite a little on a conduit system which will operate as well as the cable system and certainly has advantages which the cable has not. The problem is, primarily, one of mechanical construction of the conduit. We must get a large conduit, a dry conduit; we must place the wires in such positions as to make them high and dry, and various other conditions must be studied, and it seems to me that it is rather a rebuke to electrical engineers that they have not been able to devise, or have not devised, or that some philanthropic man or corporation has not advanced the interest of the conduit system; but they have not. Let us take the cable conduit, for instance—and those that have recently been built are certainly excellent conduits—and what do we want to do? If we look at the problem thoroughly, we want, in the first place, as previously mentioned, to put the wire high and dry and protect it; the insulators must be far apart and located in manholes or pits; they must be far apart; the contact should be an underbearing one, the voltage should be as low as the first cost of the plant will permit, in fact, below 300 volts if possible, for reasons which I will bring out hereafter; and if possible we should use, at a low voltage, the structure as a return. I believe that those points can be met, and that a system containing them can very readily be devised; in fact, C. H. Warner, an electrical engineer of this city and myself, some time ago, attempted to attack that problem. We were striving for the $50,000 prize, and we have not as yet gotten it. We devised a form of conduit, taking the ordinary Broadway conduit, in this city, with which you are all familiar, and we got up an insulator which consisted of a central core of insulating materials, in which was imbedded a stud or bolt. On the core of



McELROY, NICHOLSON & McTIGHE SYSTEM.

insulating material were placed a number of petticoats of enameled metal, and separated from one another.

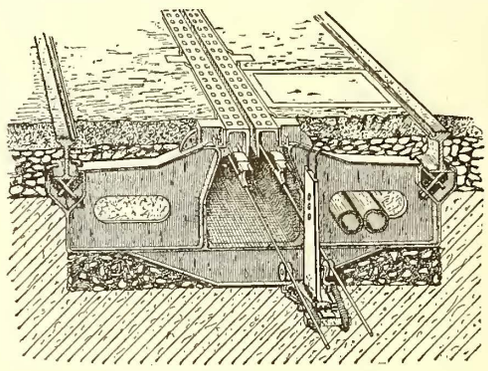
A number of these were placed on the core and clamped by the oil cup at the bottom, through which the bolt passed, and the whole was fastened together by a nut on the bolt coming against the bottom of the cup, the clip being attached to the end of the bolt. The insulator was supported by arms attached to the top petticoat, which came against an enlarged portion of the insulating core. You see by this arrangement a very long surface was presented for surface leakage, namely, the inside and outside of each of the petticoats and the oil in the cups. The insulators were supposed to be in the regular manholes and were located at thirty feet apart, and the wire was supposed to be sustained; the contact was supposed to be an underbearing one.

Now the main electrical point in the system is the voltage. If we can get the voltage low enough, why, we may put the conductor on the surface of the street, as Mr. Edison proposed some time ago. There are various methods of producing low voltage, and one of them is the method which has been adopted by the General Electric Company recently, to supply the ordinary overhead trolley system. It consists in applying the three-wire system to the electric railroad, and it can be very readily applied to conduit construction in this way. We can take an ordinary conduit, such as the Broadway conduit is, or any other, and let the structure itself be the neutral wire. Suppose we use about 300 volts now, we put, as you know, in many conduit systems two wires, an outgoing wire and return wire; now all we employ here are two wires; one forms a negative, one a positive, and the structure the neutral, and by alternately connecting between the neutral on one side and the neutral on the other side, we can balance up our three-wire system fairly well without very many additional devices, because, don't you see, although one car may be stopping and the other could be going at full speed and another up grade, still for all that we can get a fairly even distribution and fairly even balance. We can also have a double track system with one set of three wires; for instance, the plus wire in one conduit of one track and the minus wire in the other, the structure being the neutral. In that way we could really have the voltage about 250 for actual work, while we would have a 500 volt distribution. If the Edison Illuminating Company can afford to spend millions in installing underground three-wire feeders at 220 volts, for furnishing hundreds of horse power in lights, it certainly seems possible that the electric railway companies, whose dividends are just as high, if not higher, could afford to put in a system at the same voltage or perhaps somewhat higher voltage, and perhaps in that way something successful may be done.

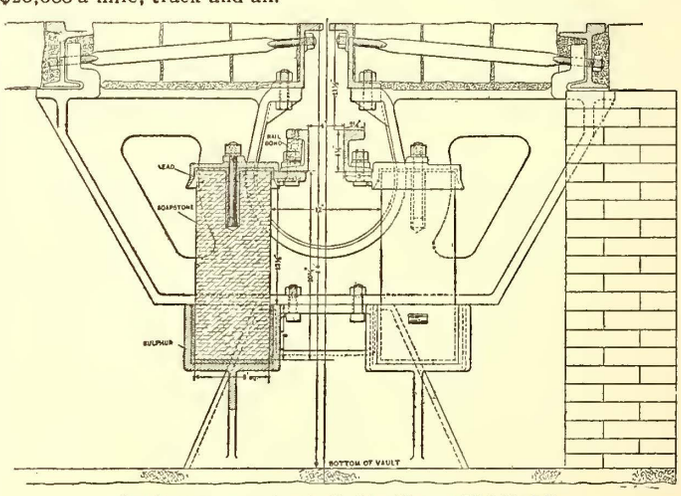
But we have a most promising thing in the alternating system. As you all well know, the voltage possible is unlimited. We can reduce from 10 volts to 1-10th, or from 10,000 volts to 100 volts, but the question again has been the motor, and I want to explain to you this evening various methods, and make suggestions in which the alternating system can be operated, even with the present system of motors through an ordinary open slot conduit, by converters located along the line and taking the current from secondary wires, which would be of perhaps 100 volts or slightly above, anyway not much more than 100. One of the methods is this: We can use a single phase or multiphase system, and we can put upon the car a synchronous motor. This synchronous motor is operated continuously, and when the car is doing no work is practically taking very little current. To connect and disconnect the motor from the axle we can get up some mechanical gear to reduce or connect this kind of motor to the axle. We may also, perhaps, devise a hydraulic gearing. There is a third system which seems to be very promising. It consists in putting in a pneumatic gear between motor and axle. Now, I think we can use one of these gears, either the pneumatic, the hydraulic, or the purely mechanical; but if neither of these should be successful, we may be successful in another way; we can use the tri-phase system and put in induction motors on the car and have two wires as before, the third one being the structure, the induction motor taking the current from the two wires and from the structure, and being connected to the axle of the car through gears, and being regulated and operated by the usual forms of regulating device for such motors.

Now we come to another system devised by H. Ward Leonard, of this city. He proposes to take a synchronous motor with a single or multiphase system, operating the synchronous motor continuously, having the synchronous act as a motor generator, and transforming the alternating current into a constant current, which is used on the motors of the car.

The only point is simply this: I do not think it is so much a question of building a system, but it is one which sounds very like this: What will it cost? The cost, it appears to me, is such that it will only insure adoption in our largest cities; but if we can build a system I feel quite confident that it is wanted. I am borne out in that direction by eminent electrical engineers; in fact, a number of companies who are putting down their good dollars to put in such a system certainly believe that way. The cost, in my mind, will not be less than $30,000 to $40,000 per mile—single track—that is, including perhaps some cheap paving. This estimate, however, is low, and not for the best construction, and assumes that there will be but very little obstruction in the way of pipes, sewers, etc. But we must not compare this with the trolley; the trolley will reign supreme in its own field, and it has certainly been of enormous value in the ten short years of its life; and to say that at the coming of the conduit system the trolley goes out is making a false prophecy, because the trolley has its own field, and will stay. We will never get a conduit system which will be put in for $20,000 a mile, track and all.



THE LOVE CONDUIT.



CONDUIT FOR LENOX AVENUE, NEW YORK.

In conclusion, I would say that I believe we can solve this problem. I have shown you some of the ways in which it has been attempted to solve it, and some of the ways in which it may be solved. Some of you undoubtedly have other ways. We have got to have an underground or conduit system for our large cities, where they will not let us use a trolley, and from the fact that at least three companies, three large corporations, that I know of are trying the ordinary open slot conduit, I think we will shortly see something in actual operation.

But before closing I want to speak about a system, a stretch of which will be installed upon the Lenox Avenue cable road of the Metropolitan Traction Company. It has been devised by the engineers of the General Electric Company, has been approved by their most eminent men and contains various features, some of which I have already described. The ordinary conduit yoke is taken, and at the manholes, thirty feet apart, placed upon suitable supports, insulators which

are of rectangular form are located. They are supported in cups and embedded in sulphur; these insulators are of soapstone, and fastened to the top is an arm of iron. There being two conductors used there is no structural return. To this arm is fastened the contact conductor, which is of channel iron. The contact shoe comes down through the slot and has two arms which press outwardly from the center, supporting the bar against the contact rails, making a continuous rubbing contact. As I said, the insulators are located in the manholes and are easily accessible; they are some distance apart, and the voltage, last of all, is low, it being intended to use about 250 to 300 volts. I want to point out the fact, without criticism, that the conductors are very nearly directly below the slot, which was apparently the objection in some of the first systems, but the peculiar construction and location of the insulators on this system may prevent trouble from this source.

DISCUSSION.

In the discussion which followed the reading of the paper, C. B. Fairchild referred to the underground system now being placed on the Metropolitan Railway, of Washington, D. C., and described elsewhere in this issue. The cost is estimated to be more than the cost of cable construction. Mr. Fairchild stated that the Siemens-Halske Company, which proposed at one time to put in an underground system, admitted to him that the cost would be more than the ordinary estimates for cable construction. In New York City the cable roads were built for not less than $150,000 per mile, single track, but in Washington the cost is about $30,000 per mile, of single track; ordinarily, however, the cost would be from $60,000 to $75,000 per mile with single track.

Referring to the question of contraction and expansion in conduit conductors, Mr. Fairchild stated that in Washington, where the temperature in the conduit varied from below freezing to 140 degs., a great deal of difficulty has been experienced in this connection. He referred to the extreme dampness and great amount of mud and street sweepings in cable conduits, all of which would necessitate great care in insulation. A heavier construction will also be required to support electric cars than required for cable cars, on account of the motors, and the cost will be correspondingly great.

Electric traction is very much harder on the rails than cable traction where the headway is under three minutes. Even where the rail is from seventy-five to eighty pounds, the cost of maintaining the track where electric cars are used is surprisingly great.

Robert Lundell spoke of the Johnson-Lundell surface contact system now being tried at 59th Street. He stated that his company is now ready to put down the system at $30,000 per car mile double track for the electrical equipment without rails or ties, and the track would cost about $20,000 a mile additional. This system has been described at length in these columns. The voltage is 300.

C. J. Field made the statement that in some cases, the cost of the trolley system was as high as $75,000 per mile for a single track, which included $20,000 per mile for paving the streets from curb to curb. He thought that the Buda-Pesth system, as modified, would fill all the requirements of American conditions.

E. A. Merrill spoke of the use of the three-wire system at Bangor, Me. The trouble seemed to be in balancing, and at Bangor, when going up steep hills, very frequently they would have to take the trolley off one side and put it on the other wire. The same difficulty in balancing was found in Milwaukee. He stated that he knew of one road where the cause of the difficulty was not discovered, but the road was abandoned.

Annual Report of the West End Street Railway Company, of Boston.

The following is an abstract of the seventh annual report for the year ending September 30, 1894, and is one which will, on the whole, please the shareholders. The usual 8 per cent. dividends on the preferred stock were paid, together with a regular 6 per cent. and an extra 1½ per cent. dividend on the common stock:

REPORT OF EARNINGS.

Year ending Sept. 30,	1893.	1894.	Inc. in 1894.
Earnings	$6,692,578	$6,823,879	$131,301
Expenses	4,550,734	4,807,083	256,348
Net	$2,141,843	$2,016,795	*$125,047
Interest, taxes and rent.	689,778	725.064	35,286
Balance	$1,452,064	$1,291,731	*$160,333
Dividends	1,329,650	1,193,375	*136,275
Surplus	$122,414	$98,356	*$24 058

*Decrease.

Of the total revenue, $6,734,311 was from passengers. Advertising yielded $34,158, an increase of $2,832 from the previous year.

CLASSIFIED OPERATING EXPENSES.

		Increase.
General expenses	$418,874	$17,681
Maintenance of track	**536,177	255,161
Maintenance buildings	41,796	*24,644
Maintenance cars and vehicles	48,701	110,632
Maintenance horse equipment	130,225	79,124
Maintenance electric equipment	356,833	13,760
Road and snow expense	164,458	*33,788
Transportation expenses	2,510,016	*181,257
Injuries and damages	240,000	19,677

*Decrease.

**Includes the charge to track improvement account last year of $192,190.22, and similar work performed during this year, amounting to $80,617.64, or a total of $272,807.86.

GENERAL BALANCE SHEET.

Assets.

September 30,	1894.	1893.
Construction	$6,135,484	$6,076,760
Real estate	4,667,552	7,315,153
Power stations	3,203,271	1,845,853
Electric car houses and shops	1,563,087	166,811
Electric line equipment	1,480,717	1,276,417
Cars, 2,115 in '94 and 2,172 in '93	5,119,973	5,009,436
Horses, 1,223 in '94 and 2,123 in '93	163,882	284,484
General equipment	548,464	512,614
Malden & Melrose Railroad	214,520	214,520
Somerville Horse Railroad	294,482	82,353
Furniture and fixtures	15,178	19,978
Stock and bonds	75,100	75,100
Track improvement	82,320	192,190
Cash	1,313,100	738,654
Cash for October dividends	136,275	.....
Materials and supplie	365,008	472,639
Accounts receivable	185,915	255,822
Insurance	15,523	31,114
Total	$25,579,850	$24,569,898

Liabilities.

Common stock	$9,085,000	$9,085,000
Preferred stock	6,400,000	6,400,000
Funded debt	9,175,000	6,690,000
Notes payable	.....	1,219,700
Current liabilities	492,783	770,443
Sundry items	397,712	224,866
Profit and loss, surplus	29,356	179,861
Total	$25,579,850	$24,563,871

The surplus account gives a debit of $68,861 written off for old track removed and not replaced, and $180,000 discount on bonds, presumably the $2,000,000 4½s which must have been sold at 91. An interesting feature of the report is an analysis of the stock holdings, preferred and common, on September 30, 1894:

	Pref.	Com.
No. shares	128,000	181,700
No. shareholders	3,611	3,399
Average holding	35	53
Trust shareholders	471	81
Trust stock	23,256	5,797
Women stockholders	1,677	1,164
Stock held by women	38,364	24,727

The company added 10.477 miles of track, and took up 3.482 miles, making a net addition of 6.995 miles. The mileage owned September 30, 1894, was 261.334; the mileage operated, 272.894. The completed overhead mileage is 212.466. The revenue passengers carried numbered 137,028,449. Of the mileage run, 87.29 per cent. was electric and 12.71 per cent. horse cars. Of the passenger receipts, 90.17 per cent. was from electric, and 9.83 per cent. from horse cars. The reconstruction account for the year was $210,352, of which $47,415 was charged to construction, $80,617 to operating expenses, and $82,320 to track improvement account, to be written off against earnings. Other and new construction cost $172,586, which was offset by a credit of $113,861, book value of track taken up, etc., leaving the net addition $58,724. There was a reduction of 900 horses during the year. The company had 606 horse and 1,507 electric cars on September 30, also 1,223 horses and 1,842 electric motors.

President Samuel Little, reporting for the directors, says:

"Owing to the general business depression, only a comparatively small increase in the gross earnings is shown, while the operating expenses show an increase of $256,348.42. This is more than accounted for by having included the track improvement account of last year, amounting to $192,190.22, and similar work performed during this year, amounting to $80,617.64, or a total increase on this account alone of $272,807.86. It has been thought best by the directors to change the dates of paying the common stock dividends from January 1 and July 1 to April 1 and October 1, in order that the dividend year may agree with the fiscal year of the company; and three months' dividend was declared payable October 1, as shown on the previous page.

"At the close of the year, 93 per cent. of the mileage, namely, 1,770,000 miles per month, was run by the electric system, and the equipment of the larger part of the balance is rapidly progressing. * * * * The company sold during the year $2,000,000 4½ per cent., twenty year bonds, with the proceeds of which the entire floating debt has been retired, and at present there is cash enough on hand to cover the expense of finishing the electric equipment now under way and contemplated."

THE STREET RAILWAY JOURNAL

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H. W. Pool, Advertising Department.
C. B. Fairchild, Henry W. Blake, } Editors.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

There Are No Signs of Disintegration in the American Street Railway Association. On the contrary, there has never been a more enthusiastic and thoroughly harmonious meeting than that at Atlanta this year. It is a work of exceptional difficulty to guide a great organization of this character so wisely and carefully that conflicting interests shall have no power to interfere with fundamental aims, and that personal disappointments and hard feeling shall not lead to schisms, parties and cliques, eventually destroying the prestige of the Association. That this has been so far accomplished in the American Street Railway Association is absolutely true. Its presidents have been, without exception, "men of affairs"—broad in their views, strong in character and full of resource in the many difficult situations arising in their several administrations. From the very first a single secretary has been in the service of the Association, and his genial personality and untiring efforts in behalf of its members have contributed not a little to the unusual success of the great organization which looks to him for the details of its life. The various executive committees, who have held office from year to year, have cheerfully given their time and brain power to the best interests of their fellow members. Altogether, the industry has great reason to be, and is, indeed, proud of its fine representative Association and grateful to those who have given it a standing second to no similar organization in the world.

* * * * *

The Association has gained great strength in the South during the past year, and a far larger number of Southern delegates were present at Atlanta than have ever before been seen at a convention. This is, no doubt, largely due to the selection of a Southern city for the Convention of this year, but we can hardly help believing that a portion of the credit, at least, must be given to the Street Railway Journal for the efforts which it has made during the past year to bring the Southern street railway properties prominently into view, and to impress upon their managers in private interviews the fact that the Association is conferring upon its members benefits enormously in excess of the insignificant membership fees and expenses of attending the conventions—however far away. We are confirmed in our belief by the many kind and cordial greetings and congratulations received from our Southern friends attending the Convention, and by their free expression of satisfaction and pleasure at finding themselves in line with the great street railway interests in other sections of the country. We hope and believe that the time will come when the American Street Railway Association will welcome delegates to its conventions from North, East, South and West, from Canada, Alaska, Mexico and South America—all joining in one united and not unkind effort to absolutely overrun whatever city may be fortunate enough to be selected for the meetings.

* * * * *

The letter from Mr. Bowen, read at the Convention and referred to a new Committee, expresses a real need in street railway practice, and one which it should not be difficult to meet. The question of patent valuations is so complex, and is involved in so much uncertainty, that we do not wonder that large companies prefer to avoid constant litigation by buying off those who claim to own "rock bottom patents" on various desirable appliances. Nevertheless, these claimants, while generally entirely honest in believing themselves to be the first in the field, are oftentimes, in reality, thrashing over old straw on principles laid down many years ago, and there is every probability that those who have real rights in the premises will appear in due time, and require a second compensation. The work of sifting out conflicting claims is one which could easily be undertaken by a board of skilled patent lawyers, designated by the Association as its official legal advisers in patent cases. Members of the Association should be privileged to write to the secretary, or directly to the official head of such a board, for an opinion on any particular device, and this should be given for a moderate fee—perhaps $10 for each case passed upon—if the work of the board can be properly classified and continually kept up to date. It is even possible that the Association can derive an actual revenue from such a system, if it chooses to definitely engage one or more patent lawyers for this class of work. We strongly recommend that the committee appointed by the chair to consider the subject matter of Mr. Bowen's letter do not allow the subject to drop until some definite and valuable action be taken by the Association.

Our Financial Supplement has opened the eyes of Eastern capitalists to the wonderful growth and solid business prosperity of the street railway interests of this country. The financial dailies, weeklies and annuals of the East have for so many years almost ignored the growing importance of street railways that the publication of so large a mass of statistical matter has come upon them in the nature of a shock, from which they have hardly yet recovered. We have remarked with some amusement that a hoary headed "Manual," which has for several years published its street railway statistics in a small volume devoted chiefly to a buyers' directory of steam railroad officials, decided this year—immediately after the pub-

lication of our Supplement—to incorporate the statistics of some fifty of the larger systems of the country in its principal publication. Another financial contemporary proposes this month "to take up the matter of street railways somewhat gradually," and in the current issue of its investors' supplement devotes 11 pages out of 165 to this important department. This is, however, an excellent beginning and we heartily welcome the co-operation of our financial friends, in our efforts to popularize street railway investments. We trust that street railway companies will cordially help us in making the 1895 edition of our Supplement—the blanks for which will go out this month—a more complete presentation of the street railway interests than was the case even with our first issue.

A Characteristic Interurban Electric Railway connecting a city of about 45,000 inhabitants with smaller cities and towns and operating about sixty miles of track, is described elsewhere in this issue. While the conditions for economical operation, owing to the location of the railway in the anthracite region of Pennsylvania, are particularly favorable, the extent of the traffic carried shows that the road would be profitable even if fuel were considerably more expensive. Interurban traffic is something which can be developed by care and good service, and there seems to be no reason why this branch of the electric railway business should not undergo as rapid a development and extension during the next few years as strictly urban electric railways have experienced during those which have recently passed. Just where the point lies where the present electric railway becomes less economical in operation than the steam railway has not yet been determined. In fact, its position varies with the different conditions presented, and the field for electric power is constantly widening with the improvements made in electrical apparatus. But the decreased receipts from local traffic on many steam lines, and the complaints of electric railway competition from the managers of such lines show that interurban business is being profitably carried on by electric cars. It takes considerable courage to extend an electric railway through several miles of uninhabited or sparsely settled territory with the hope of serving a town beyond or building up an undeveloped business. But while such a line may not pay for some years, it is usually possible to secure, at small expense, the right of way for a long term, so that until roads of this character become more common and competition for franchises becomes greater, really valuable property of this character can often be secured for a small outlay.

Street Railway Consolidations are more often advantageous to the public than otherwise, and we are glad to see that the daily press is beginning to appreciate this fact. In steam railway circles, consolidations usually mean higher freight rates, and, occasionally at least, poorer passenger accommodations. With street railways, however, rates are never raised above the five cent fare, now of such universal application, while consolidations usually bring about improved transfer arrangements which are an immediate and direct benefit to the public. Moreover, it is the almost universal experience that the larger companies take a broader view of the necessities of the public, and more clearly recognize the fact that the public cannot be induced to ride in poorly kept cars, than do the smaller companies. In another column we point out a notable illustration of the benefit which New York is receiving from the consolidation of seven formerly independent companies into one, by virtue of which the issue of transfer tickets has in three years' time grown from nothing to 1,000,000 per month.

The Internal Transportation Facilities of the Greater New York will probably be, as a whole, superior to those of any other of the first class cities of the world. Manhattan Island—the heart of the immense new city of 3,000,000 inhabitants, which will soon be created as one of the results of the last election—will be tunneled from its lower to its upper end, and through the annexed district on the mainland to the northern limits of the present New York. A four track railway system will probably be decided upon for this tunnel, and express trains will cover the sixteen miles to be traversed in one-third the time now required. The four elevated lines which now furnish the most rapid transit on the island, extensions of which reach up into the annexed district, already carry 600,000 passengers a day, and their capacity will be somewhat increased by the recent building of a third track on one of the lines and by probable improvements in terminal facilities. The surface railway lines running north and south are being rapidly cabled and will carry an enormous local traffic. The steam railroads terminating at 42d Street handle a heavy suburban traffic, and their capacity will be increased by the new high bridge across the Harlem River, which will prevent a great many of the delays now experienced in getting past this highly congested point. A great bridge is to span the North River and another the East River at Blackwell's Island, intended primarily to connect the great railway systems centering at Jersey City with those of Long Island, but also providing for greatly increased passenger traffic between the different parts of the greater New York, as well as the populous towns of the New Jersey mainland. The tunnel under the North River will soon be completed, and numerous ferry lines ply to and fro between all population centers tributary to Manhattan Island. In Brooklyn and Long Island City the entire surface lines are now operated by electricity, and the service rendered is so far superior to the old that it has already induced a great amount of new traffic, as well as that "stolen" from the elevated system. The latter is extensive and is still well patronized. On Staten Island important plans for the improvement of transportation facilities are in contemplation, and in eastern New Jersey, which is really a residence district of New York City, though it cannot be incorporated in the Greater New York, a complete network of electric lines is building to carry a part of the enormous traffic now given exclusively to the steam railroads. It is believed by some who do not fully realize the forces which are at work in our great cities in the line of development and increase in population, that some of these transportation systems will gain materially at the expense of others. Manhattan Elevated Railway stockholders particularly seem to have become timid over the competition of the Metropolitan Traction Company's cable lines and over the expected competition with the new underground line to be built by the city. Experience tells us, however, and there is no reason to doubt that it will be in this case a true criterion, that although a temporary decrease of earnings may be expected with added competi-

tion, this decrease will be very quickly made up by the growth in population, due to the new facilities offered for country residence and city business, and the stockholders of none of the great urban transportation systems need fear that their properties will not be permanently profitable.

The Wear of Wheels in Electric Railway Service is discussed in several articles this month, and is a subject which is worth the serious attention of street railway managers. The conditions to which street car wheels are subjected have undergone a complete change since the general introduction of electric power, and the experience acquired in horse railway service is of little value in determining the results to be expected under electric cars. The size of the cars has been increased to such an extent that the weight on each wheel of a fully loaded twenty foot car now equals, and frequently exceeds that to which freight and passenger car wheels are subjected in ordinary steam railway traffic. These weights are occasionally as great also as the limiting weight allowed upon the steam roads. At the same time the unfavorable conditions of sand and dirt, which formerly prevailed in horse service, still exist with an increased injurious effect, because the stops made are quite as frequent as formerly. Under these circumstances the wear and breakage of wheels has increased, and that more costly accidents have not occurred from breaking of wheels, speaks well for the care exercised by managers. Motor equipments have, by very force of circumstances, been arranged so as to facilitate the removal of wheels and axles, but with the force and apparatus required, frequent removals are of necessity inconvenient and expensive, and the cost greatly exceeds that of the wheels themselves. It is perhaps no wonder, therefore, that complaints have been frequent that wheels are not wearing as they should, or as they formerly did. Manufacturers are handicapped by the fact that the pressure of other problems requiring immediate solution in electric railway operation, has prevented many managers from giving the attention to the wheel question which they otherwise would. In consequence, one wheel has often been considered as good as another, and but little attention has been paid to any requisite but price. As shown in the paper on "Brakes and Brake Shoes," at the Atlanta Convention, comparatively few roads keep records of their wheel wear, and on a still less number have these records been accurately maintained for any considerable length of time.

It is our intention to devote considerable space in the next few issues of the Street Railway Journal to this department of operation, and we earnestly solicit managers who have kept records of their wheel wear to give others, through our columns, the benefit of their experience. It will be our effort to educe from these records the necessary qualities of a perfect electric car wheel, and to treat the question not only from the standpoint of the life of the wheel itself, but also to describe the proper section of wheel, methods of casting and the effect of different sections on the rails and other portions of the equipment. The relations between the wheel and the track, especially at curves, switches and crossings, are exceedingly intimate, and the life of the wheel and permanent way at these points in largely dependent upon the proper shaping of these parts to the other. A badly designed wheel, or one which has lost its proper shape through excessive wear, will often produce an extensive depreciation at such points, where repairs are most difficult and expensive.

As the teachings of horse traction throw but little light on the behavior of wheels in electric service, neither should we expect to apply without qualification the knowledge gained of wheels in steam railway service, since the average electric car wheel is performing a more severe service than any steam railway wheels in use. While its total load is not as great as that on the driving wheels of heavy locomotives, from imperfect figures now at hand, in regard to the wear of the trolley car wheels, it appears that, though of far harder material than locomotive wheel tires, electric wheels wear out much more rapidly. Judging from figures published in the December number of the Street Railway Journal, a locomotive driver tire may run 12,000 miles for the removal by wear of one-sixteenth of an inch in depth. A motor wheel of half the diameter would probably wear nearly three times as deep for the same mileage, though the locomotive wheel would probably have 100 per cent. more weight upon it than the latter. Upon the Central Iowa Railway an engine with 10,750 lbs. on each driving wheel ran 11,918 miles for each one-sixteenth of an inch worn from its tires. Its service was one where there were many curves and grades, and much sand was needed. It was what would be called hard service on a steam road. With such conditions facing the managers of electric roads in the matter of the wear of wheels, it should be evident that the sooner a systematic record of the performances of wheels is begun, the better it will be for the economy of operation. Much might be said in this connection in regard to the effect which a careless motorman may have upon the life of the wheels. He is certainly as much a factor in their wear as is the careless engineer upon a locomotive. The superintendent usually finds his careless grinding out of wheels somewhat expensive at first. But as worn out flat wheels make themselves apparent to the most careless, retribution follows swiftly, though at some cost to the company. Fortunately, this element in the destruction of the wheel is more under the control of railway managers, than is the quality of the iron in the manufacture of the wheels.

The Street Railway Postal Service.

In the report of the Second Assistant Postmaster General, it is stated that electric cars are becoming more and more important factors in mail transportation from year to year. Forty-seven special lines of this kind have been arranged for by the post office department, at the rates fixed by law for the carrying of mail on steam roads. The routes thus far established are comparatively short, the longest being but eighteen miles, and they are principally laid out through suburban towns, naturally giving a more expeditious and satisfactory service than could be obtained by the use of the star or mail messenger service. The report continues: "Consideration is now being given to the feasibility of utilizing electric and other rapid motor street car lines, to facilitate the transportation of mails in the important cities between the main post offices and branch offices, and to and from the railway stations. A plan of this kind would probably include the running of a special car over the several street lines for the exclusive use of the mail service, not only for carrying locked pouches, but in which a certain amount of distribution would be possible. This office hopes to accomplish some substantial results in the direction indicated within the next year."

STREET RAILWAY WHEELS.

Sharp Flanges.

A sharp flange may be technically defined as one in which the part of the flange next the rail has become vertical. The extent of this vertical surface or its depth may be said to determine the degree of sharpness, which does not, as might be supposed, necessitate a razor edge upon the flange. Another definition of a sharp flange would be a wheel in which the flange is so worn as to be without flare.

Wheels having the so-called sharp flanges are rightly considered by railway men as most dangerous. No other defect is more likely to produce accidents. A sharp flange mounts the rail with extreme ease, regardless of the actual depth of the flange itself, and hence is always likely to produce a derailment from the most trifling cause.

The reason for this is not at once evident. With a vertical side the five-eighths flange of an ordinary thirty inch wheel will touch the rail for four and a half inches in advance of the point of contact between wheel tread and the rail. The whole of this surface is in actual grinding contact with a rail of ordinary section. The result is a powerful lifting action, greatly aggravated by any side motion, by dirt or other obstruction. In this way, the forward revolution of the wheel is constantly tending to throw the car from the track. A very similar case, which all who are familiar with steam engines will call to mind, illustrates the point; it is the ease with which a governor belt jumps off from the double flanged pulleys on which it runs. These pulleys have vertical flanges, often of considerable depth.

THE CAUSES OF SHARP FLANGES.

In the early days of railroading in the United States, every superintendent and car builder had his own ideas on the subject of sharp flanges and their causes. As the sharp flange was early recognized as a most dangerous defect, a variety of opinions resulted. The steam railroad men had no data on this subject, and consequently no one could prove that any other theory was wrong or his own was right. Every man, therefore, went on his own belief, and argument had very little force.

It is only within a comparatively few years that wheels on steam roads have been made truly round and of equal size. The former practice was to put them on to their axles as they came from the foundry, regardless of size or truth. At that time, the idea of a difference in the hardness between the two wheels as a cause for sharp flanges was very prevalent. In proof that this was the reason, it was very common to test the two wheels with a file, and as it was usually found that the sharp flanged wheel was much softer than its mate, it was assumed that the proof was sufficient. This was not altogether conclusive, however, because the hardness of the tread on a considerably worn wheel was tested against one on which the wear had been light.

Some master car builders experimented on the effect which a difference of diameters in wheels on the same axle had upon the wear of the flanges. It was quite commonly believed that in consequence of the unequal sizes of wheels on the same axles, there is a tendency for one wheel to run forward, and consequently force the opposite wheel against the rail. Long continuance of this action would, of course, result in sharp flanges. While this was perhaps a very common cause of flange wear at that time, it seems now to be of little importance. It is now a usual, if not a universal practice with manufacturers, to size their wheels with extreme accuracy by means of gauges. The diameters of two wheels on the same axle are practically obtained to within the thirtieth of an inch. A variation to this extent is altogether too small to determine which wheel of a pair shall have a sharp flange. There are many other circumstances of far greater importance which influence the wear in this direction.

"Trucks out of square," or a want of parallelism between the two axles of a truck, is now considered one of the most frequent causes for sharp flanges. At least, recent experiments point to this as the case. If squaring gauges are not carefully used, this is often an unsuspected cause. Even by the employment of gauges it is not always easy to determine the absolute parallelism of the axles, nor can it always be established that they are also at right angles to the rails. It may also happen that, while the axles are at right angles to the track, and parallel to each other, the wheels do not "track" properly. In other words, while the axles form with the side bars of the truck the four sides of a parallelogram, it is not rectangular. In such a case the diagonal distances from tread to tread will not be equal. In trucks without attached bodies, gauges from center to center of brasses can be used for the purpose of testing this point.

Trucks that start square in the world not infrequently become distorted by severe usage, in accidents, etc. On steam roads such distortion was not uncommon. But as the gauging was by no means as difficult as on the street railways, there was little excuse for such a condition. On street cars, the difficulty of tracing this want of parallelism in the axles becomes very great, and much of the trouble of sharp flanges undoubtedly might be avoided could this one cause be more carefully controlled.

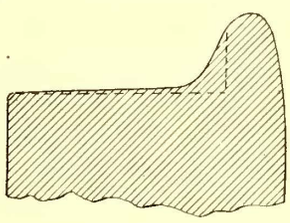


FIG. 1.—OUTLINE OF FULL AND OF SHARP FLANGES

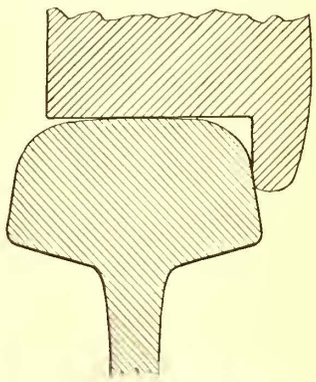


FIG. 2.—SHARP FLANGE ON IMPROVED RAIL SECTION.

We have heretofore referred, in the pages of the STREET RAILWAY JOURNAL, to a case of sharp flanges, which does not appear to be accounted for by any of the theories which have been hitherto presented. The case is that of the cable line of the Third Avenue Railroad, on 125th Street and Amsterdam Avenue, in New York City. On this line, both the wheels on one side of each car wear their flanges sharp. Turning an axle end for end stops the cutting where it had begun, but it begins on the wheel before untouched. In other words, the flange wear is constant upon one side of the car. It is thus independent of the hardness or softness of the wheel, the squareness of the truck or the diameters of the two wheels on the same axle. It is also independent of the curves and the elevation of one rail, etc., because the cars are turned end for end every morning, and make their runs during the day without turning. So far, no rational theory has been offered for this action, and it is probably due to some undiscovered element connected with the car, the wheels, truck or hauling mechanism.

However, it is hardly necessary to consider the question of the primary reasons causing one wheel to hug the rail so as to be worn into the form shown in Fig. 1. The space has in some way been excavated or worn away from what was the original outline of the wheel, as shown by the solid line. In other words, some kind of a tool has been at work to cut out this metal. It will be evident, therefore, to anyone, that if we could in any way prevent

the cutting or grinding from taking place at this point and in this form, it would not matter much whether the truck was square, one wheel softer than the other or whether there was a tendency to hug the rail, brought about by any unknown cause. If we can manage to prevent the grinding from producing this objectionable form, we shall be independent of the causes.

THE REMEDY FOR SHARP FLANGES.

Some years ago, several steam roads in this country, in investigating this subject, came to the conclusion that if the corner of the rail was not sharp enough to cut such a groove in the wheel, sharp flanges would not result. In other words, they believed that the wheel wearing against the rail finally took the form of the rail head. Acting upon this, a rail head was designed, which should more nearly fit the ordinary form of wheel when new. An outline of this head is shown in Fig. 2. The dotted outline shows how the sharp flanged wheel, in Fig. 1, would ride upon such a rail, and it also clearly proves that such a rail is incapable of wearing a wheel into any such form as that shown in our first figure. In a word, the theory was that though there might be numberless reasons to determine the cutting, yet if the cutting member is so shaped or formed as to make an effectual barrier against the production of the undesirable form of wheel, the trouble will be avoided, and sharp flanges become a thing of the past. Several roads adopted the form of rails shown, and with the most satisfactory results.

About ten years ago several engineers undertook to demonstrate by figures whether this change in rail heads produced anything like the results expected theoretically. They found the figures quite as satisfactory as could be desired. The number of wheels from the steam roads of the Eastern states which were condemned for sharp flanges amounted to from 25 to 40 per cent. of the wheels worn out. The general average of the scrap heaps was found to be 25 per cent. Some of the roads reported as high as 40 per cent. Acting upon these figures, which showed the immense importance of the matter, several roads adopted a modified rail head for the purpose of doing away with this excessive wear. This head, which is shown in Fig. 2, had a curve between the side and the tread with a half inch radius. The angles of the sides of the head with the vertical were 18 degs. This form made the head of the rail practically identical with that of the standard flange. Perhaps it would be more correct to say that they were parallel. After several years of use a census of the scrap heaps of the roads which had adopted this form of head showed that the proportion of wheels condemned with sharp flanges had been reduced to 5 per cent. Two roads which adopted this form of rail head were the Lehigh Valley and the Delaware & Hudson Canal Company. On both these roads the figures given were verified very carefully. Ten years having passed, a request for information in regard to wheel wear brought the information that no change had taken place in the extremely low figures that had been previously found. R. G. Blackwell, the superintendent of machinery on the Delaware & Hudson Canal Company's roads, says, under date of October, 1894, that "the showing still holds good."

Through the kindness of John S. Lentz, superintendent of the car department of the Lehigh Valley Railroad, who also investigated the subject of sharp flanges, the following information was obtained from Robert H. Sayre, second vice-president of the road. Mr. Sayre says, under date of October, 23, 1894:

"No changes have been made in the radius of the corners of the head of rails. It was, and is, half an inch. The angle of the side of the head has been changed, however, reducing the angle from 10 to 5 degs. This was done in a way of compromise to the Committee of Mechanical Engineers, who had in hand the uniformity of shape of head of rails. The matter came to naught, however. No records have been kept since the lease of the Lehigh Valley Railroad to the Reading, but my opinion is that we have fewer wheels from sharp flanges than any other road in the country."

A more conclusive proof could hardly be desired in regard to the effect of a rational form of head in preserving the shape of the wheel tread and flange. In a word, we find that when the shape of the tool which cuts out the wheel is changed, the destruction and dangerous cutting ceases, and the wheels retain their natural form until worn out.

THE SAFETY OF FLARING FLANGES.

A question often arises in this connection as to the safety of a wheel and rail with an exceeding flare in the tread. Contrary to the general belief in regard to such matters, the very flaring section is safer and is not as easily derailed as any other. One of the leading founders in the United States had an order at one time to provide wheels for an elevated structure on which derailment had to be most carefully guarded against, since guard rails were not provided. The form of rail used was one having a deep flange at an angle of 45 degs. This extreme flare of the flange was found efficient, and such wheels could be made to leave the rails only with the greatest difficulty. How this can be, can perhaps be best understood by considering the fact that a sharp flange, which is technically one having a perfectly vertical side, is derailed with very little difficulty. A sharp flange on a rail head with a nearly rectangular section, and only a small fillet at the corners, can be made to mount the rail by very slight sidewise pressure. It follows that the use of rails of the flaring section reduces the number of broken flanges, because the relative thicknesses of the different parts of the flange are not disturbed and though wear may go on, still there is no diminution of strength at the root. When extreme wear takes place, the flange has less depth, but the strength is not diminished.

The Wear on Wheels and Brake Shoes.

The question of whether the wheel would wear if relieved from the brake shoe is one which has been very considerably discussed. It is sometimes stated by railway men that 40 or 50 per cent. of the wear is due to the action of the brake on the wheel. This is perhaps true, but it is also true that a loaded wheel running on a rail wears rapidly, even though it has nothing to do with the brake and brake power. A plain cast iron bearing wheel under a transfer table in a New England car shop is a case in point. It had a four and a half inch face, and ran on an ordinary straight track. In eighteen months of service it had a groove worn in it two and a half inches wide and one and three-sixteenths inches deep. There was no wear whatever on it beyond that given by the weight during its revolution. There was no brake shoe or slip, and apparently no reason for wear. The wheel undoubtedly had a considerable load, though how much could not be ascertained, but it was so situated as to carry most of the weight of the small engine and boiler by which the table was driven. In this case, the wear was determined by the mere running of the wheel on a clean rail without side motion, carrying a load and on an axle by itself. We may conclude from this extreme case that there will be wear of wheels whenever they are called upon to carry a load. Dust, dirt and sand or gravel will increase the wear. The application of the brake will also add to the wear due to the rail. It may be assumed as certain, therefore, that the life of the wheel will be prolonged by doing the work of braking elsewhere than on the tread of the wheel.

There are no figures available on this point at the present time, but there are some interesting facts from which it seems safe to draw conclusions. For some time past the Third Avenue Railroad, in the city of New York, has employed a brake drum on the cars of its 125th Street line. The stops made on the cars thus fitted are, upon occasions, remarkably short. The line being driven by cable and having a high speed, the brake power required is very great. The brake drum, however, shows little or no wear, after having worn out one or two pairs of wheels. Indeed, in many instances, the marks of the turning tools are not removed. The brake blocks are of rock maple.

It is fair to conclude from this experience that the wear due to the friction of the brake is largely reduced by removing from the brake shoes the mud, dust and grit

found upon the rail and wheel. The brake under such conditions appears to be more effective than when applied to the wheel. This is probably partly due to the more effective form of the Robertson brake mechanism which is used on these cars, and partly to the fact that the rubbing surfaces are in more intimate contact than is possible between the brake shoe and the wheel. The coefficient of friction is higher between surfaces moving at slow speeds than at high speeds, as shown in the table published on pages 690 and 691 of our November issue. This accounts for the greater efficiency in spite of the shorter leverage employed.

The introduction of new power brakes and the radical changes which the road is making in its equipment prevent any very accurate and fair estimate of the mileage of wheels being made. Upon the face of the returns, however, the wheels appear to be making 38,000 miles under these heavy cars in this hard service. The soil along the line of the road is sandy and gritty, and for a mile or more the road has a macadam surface. There has been also a stretch from 160th Street to about 190th Street, or a mile and a half unpaved. In this portion of the street the natural soil covers the whole roadway. Here sharp sand, coarse gravel and broken country rock compose the street materials. A worse soil could not easily be found, and as the rails are not raised above the level of the dirt the wheels are well supplied with cutting and grinding material.

Experiments are now in progress which will give some figures upon which the questions of drum braking on this particular road may be settled and its economy determined.

Trolley Car Wheel Service.

The electric motor car wheels are performing a much heavier service, and are subjected to more severe strains than is usually thought possible. Motor cars weigh, as a rule, from 16,000 to 18,000 lbs. The latter figures are by no means unusual, and the former quite common. Passenger coaches on steam roads are usually considered light at 50,000 lbs., and their weight increases with the class, until the heaviest sleepers go up to 70,000 or even 80,000 lbs. Of course, comparing the total weight, the motor cars are very light, and would not test a bridge or permanent way like a passenger coach.

But when we come to the actual load upon each individual wheel the question becomes entirely different. The motor car which, with all on, weighs 18,000 lbs., will frequently carry, at the busy hours of the day, 100 passengers. A fair average weight for these will be 130 lbs. In many instances it will be more, for a large proportion will be men. We should, under these conditions, have 13,000 lbs. of load, making a total weight resting upon the wheels of 31,000, or 7,750 lbs. per wheel. A passenger coach of the ordinary type, weighing 64,000 lbs., would carry, on eight wheels, 8,000 lbs. per wheel. Usually, the very heavy cars are carried on twelve instead of eight wheels. The 72,000 lb. cars, therefore, would have, when loaded, only a fraction over 6,000 lbs. per wheel. In fact, an ordinary twelve wheel passenger car, weighing 96,000 lbs., would bring little more weight upon its individual wheels than a loaded motor car under the conditions stated. It must be remembered that the wheels under the motor car weigh from 300 to 350 lbs., according to the size, a few going higher. When cast iron wheels are used for the passenger service on steam roads, the weights will be from 550 to 600 lbs. The steel wheels may go as high as 700 or 800 lbs.

The light motor wheel is lightly proportioned in all respects except the tread itself, which though only two inches wide is very much thicker and should be more heavily chilled than that of a steam road wheel.

The service of the two classes of wheels is as different as possible. The steam road wheel has runs of considerable length at rather high rates of speed. Its work is done on a clean rail. The use of the brake is infrequent. On the other hand the motor wheel does not run at a speed above twenty-five miles per hour. Its rails are always dirty or so rarely clean that such a condition may be neglected in the consideration. The application of brakes will average from five to ten times per mile. One railway manager estimates that there is an application of brakes for each passenger. For roads in cities this is probably a fair estimate. When the line is hilly, as it is apt to be in the Eastern states, the use of the brakes will extend over a large portion of the running time.

From an examination of these facts when compared with the steam road served, it will be seen that the motor wheel has a much more severe work to do than even the heaviest wheel on steam roads.

The rapid wear of motor wheels is thus rationally accounted for by the fact that they are actually doing more work and work of a more severe character than that of the steam road wheels. Only the heaviest of the modern freight cars when loaded to their fullest capacity impose so heavy a load upon their wheels as do the motor cars loaded. There is an additional duty upon a motor wheel from which the steam road car wheel is free, and which has not been mentioned because of the difficulty of estimating its influence. This is the fact that motor wheels are used for driving. That this entails much slipping and wear is well known. Up to the present time no accurate data have been obtained bearing on this subject. Many engineers of experience hold that it is needlessly large. Under some conditions on curves our own experiments seem to show that it may not be far from 25 per cent. with the inside wheel. The outer wheel slipped less in the experiments, but still there was much grinding that was not necessary.

That slipping will be reduced and that the life of motor wheels greatly increased, are results which are to be hoped for. In nearly every instance where a study of the subjects has been taken up, conditions unfavorable to the wheels have been found, which might be changed. The outlook for increased mileage is therefore good.

The following tables showing the weights of modern freight cars of various types illustrate the points made above. The cars are from some of the leading steam roads of the country and may be taken as representative of three different classes. The tables show total weight when loaded and the weight per wheel under this condition, as well as the weight of the car and the capacity.

KIND OF CAR.	NAME OF ROAD.	Weight.	Capacity.	No. of Wheels.	Total weight of car loaded.	Weight per wheel.
Box (local)....	B. & A.	25,600	50,000	8	75,600	9,450
"	C. H. & D.	19,400	32,000	8	51,400	6,425
Grain car.....	N. Y. C. & H. R. R.	{26,800 / 30 650}	60,000	8	{86,800 / 90.650}	10 550 / 11,331
Refrigerator..	Merchants' Dispatch.	36 550	40,000	8	76,550	9,568
Carriage car..	N. Y. Central.	{28,900 / 27,600}	30,000	8	{58,900 / 57.600}	7,362 / 7,200
Flat "	" "	20,200	50 000	8	70,200	8,775
Box "	Mich. Central.	21.200	40,000	8	61,200	7 650
" "	Erie.	26,200	50,000	8	76,200	9,525
" "	Pennsylvania.	29,350	60,000	8	89,350	11,170
Flat "	N. Y. & New England.	19.000	40,000	8	59,000	7,375
Box "	Lehigh Valley.	28,400	60,000	8	88 400	11,050
" "	C., C., C. & St. L.	26,200	50,000	8	76,200	9,550
" "	West Shore.	24.100	40,000	8	64,100	8.012
Refrigerator..	Merchants' Dispatch.	{35,250 / 35.200 / 35,450}	40,000	8	{75,250 / 75.200 / 75,450}	9,406 / 9.400 / 9.431
Box car.....	L. S. & M. S.	23.650	45.000	8	68,650	8,581
Furniture.....	" " "	32,050	60.000	8	92,050	11.506
Large coal car	Pennsylvania.	20,000	60,000	8	80,000	10.000
" " "	"	19,100	50,000	8	69,100	8.637

The following figures in regard to a few passenger coaches on steam roads show the weight per wheel, etc.

NAME OF ROAD.	KIND OF CAR.	No. Wheels.	No. Passengers.	Weight of car.	Weight Loaded.	Weight per wheel.
Ft. Wayne, Pitts. & Chicago.	Passenger.	12	50	47,850	53,850	4 490
N. Y., New H. & Hartford...	Drawing-Room.	12	..	68,850	.....	5,740
Boston & Albany.....	61-ft. Day Coach.	12	..	66,930	.....	5,580
" "	55 " " "	8	..	45,310	.....	5,663

Weights of street cars, weight per wheel, and dead weight per passenger—from various sources :

Kind of Car.	Road.	Weight of Car, lbs.	No. Passengers.	Dead Weight per Passenger, lbs.	Weight Loaded.	Weight per Wheel.
Horse Car.....	3d Ave., N. Y.	5,600	50	112	12,100	3,025
Trail "	" " "	5,600				
Open Grip.....	" " "	.....	...	180	.....	.....
Cable Car.....	" " "	12,000	32	375	16,160	4,040
Electric Motor....	Butte Traction Co.	17,249	...	.....	.....	4,312
Cable Grip	" " "	4,800	...	.....	.....	1,200
Trailers, 16 ft.....	" " "	4,500	...	.....	.....	1,125
8-wheel Cable	125th St., N. Y. City.	26,000	80	180	.....	3,250
Train, Trailer, 5,600 lbs. and Open Car.	" " "	36,640	160	250	.....	.....
Open Car, as above	" " "	8,000	...	.....	.....	2,000
Electric Motor.....	....	18,000	100	13 000	31,000	7,752
" "	.....	18,000	50	6,500	26,000	6,125

The Wear of Wheels in Electric, Cable and Horse Car Service.

A representative of the Street Railway Journal recently interviewed a number of gentlemen on the subject of the relative wear of wheels in electric, cable and horse car service. Below will be found some of the opinions expressed:

Edward C. White, proprietor of the Globe Iron Works, of New York, said:

I have been in the car wheel business for many years. During that time I have seen several important and radical changes made. It is unfortunate that every change has been in the direction of reducing the selling price. Almost every step in this direction has been taken at the expense of quality. The system of purchasing is to some extent blamable for this unfortunate condition. A wheel is a wheel, regardless of quality, in the eyes of most men who make purchases for street railways. The question in buying is, usually, the absolute price regardless of quality. As a result, wheels are sold about as cheaply as sash weights, and in a great many cases appear to be of but little better metal or of more value.

No class of men are more alive to this condition of affairs than the wheel makers themselves. They appear to be helpless. No appeals which can be made in regard to the advantages of a better wheel for more money receives any attention from the roads. Makers are therefore compelled to make guarantees and trust to luck and their own skill in wheel making to make the average life come up to the agreement. If they fail, not only they suffer but the roads also.

In the matter of mileage, the wheel maker is in a peculiarly unfortunate position. I do not think that the roads generally are keeping a sufficiently accurate record of mileage to be of any use in determining how far a wheel has run or how long it has been in service. It is upon these imperfect records that the wheel maker has to rely to establish his guarantee. When the subject of mileage of wheels was taken up on steam roads about the year 1873 the same trouble was encountered. At that time the records of the mileage made by cars and wheels was most imperfectly kept. As the steam roads were seeking better wheels, and as the quality was determined by the miles run, they were forced to keep more perfect records in regard to the life of wheels. As soon as wheel makers found that a better article was appreciated a change was made. The roads put themselves in position to know when they received a good article. As a result, the average guarantee rose from about 25,000 to 30,000 miles, which was the actual life in 1872 or 1873, to 40,000, and in some cases to 60,000 miles. The actual life of many wheels under the improved conditions ran far beyond the guarantee, often passing 100,000 miles. This was an enormous gain for the roads.

At the present time the average guarantee of street car wheels is, say, 35,000 miles. This is about as much as can be got out of a wheel at the present price, which is not far from 1.5 cents per pound. I would not hesitate to guarantee 45,000 miles, if the price were made right. The economy to the company could be easily demonstrated.

The introduction of trolley and cable cars has changed the conditions entirely. The wheels, which answered very well for street cars drawn by horses, are not suitable for the work of heavy trolley and grip cars. They are not sufficiently strong. They wear too rapidly. The cost of replacing wheels has materially increased with the complicated machinery on motor and grip cars. The cost of taking out and replacing a pair of wheels is variously estimated by different roads at from $3, on those having the best facilities, to $6, and even more, on roads not so well equipped in the repair departments. Adding the cost of replacing to the original price of the wheel, it will be found that a $5 wheel guaranteed for 60,000 miles, if it runs only 15,000, might cost from $14 to $22, according to the cost of replacing.

The point which I wish to urge is the necessity for facts. Until the street railways keep accurate and complete accounts of the mileage made by both wheels and axles of all cars, the wheel maker will have little opportunity to improve the quality of his product. The time when each pair of wheels goes under a car should be put on record, as well as the number of miles it runs to the time it is taken out. The cause for removal should be also stated in the record. When such records become general, it will be possible to give more serviceable wheels which will be safer, and in the end cheaper. Until such facts are collected, each superintendent will say, "the wheels on our road are giving good satisfaction," and "as we get them for the lowest market price, there is no reason in purchasing a more expensive wheel."

Wm. Robertson, general manager Robinson Electric Truck & Supply Co., said:

There does not appear to be a general comprehension, or actual recognition, among street railway men, of the radical mechanical differences between the horse and the electric cars as a means for transportation. To this cause may be traced many of the costly mistakes which have been made, and which are now going on.

The driving wheels on electric cars are, as a rule, subjected to an excessive wear never encountered on horse cars. These wheels are constantly slipping and sliding, even on straight track. Take an ordinary car, with two motors It will have a wheel base of six feet or six feet six inches long, with a twenty foot body. When in operation, and especially if loaded at the two ends, the overhanging weight causes "teetering" or galloping, as the expressions go. This motion alternately imposes extra weight on one wheel, while the load upon the other is diminished. As the load is lightened, the traction of the wheel diminishes, and, since the motive power remains constant, there is a certain amount of slipping, while the other wheel does more than its share in driving the car. The next instant the motion reverses the conditions, and the other wheel slips. This slipping, due to teetering, seems to be almost constant on some roads. In addition to this, the conditions of the track may be such that the wheels frequently slip, without moving the car. This may result from a variety of causes, such as bad track, insufficient weight, mud or dirt on the rails. This slipping is sufficient, I think, to account for a large proportion of the unusual wear of the driving wheels under trolley cars. Slipping between the wheel and the rail is necessarily much more destructive than it is between the brake shoe and the wheel. This is evident, because the pressure of the wheel upon the rail is usually greater than that of the shoe on the wheel, and because of the constant presence of sand and dirt on the rail in quantities much larger than ever reach the shoe. The wonder is not at the amount and rapidity of the wear; on the contrary, it would be more natural to expect wear to go forward with far greater rapidity than is actually the case. While such conditions are constantly met, it is by no means necessary to accept them as unavoidable. They ought, however, to have attention. It will not be long before the rapid wear of wheels, and the constant expense of replacing them, will compel a change in method.

Engineer Barr, of the General Electric Company, said:

The results of several careful sets of tests made in the West may be summed up as follows: The friction of chilled cast iron upon a steel rail is considerably less than that of steel upon steel. The friction of steel upon steel under the conditions of dirt, dust and sand found in street railway service is substantially greater than when clean. But the friction of the cast iron wheel is also increased in such a ratio under the same conditions that practically there is little difference to be found between them; certainly not enough to make it worth the extra cost of using steel. The two kinds of wheels are, therefore, practically equal on this count. The hardness of the two metals was the next point. Here the advantage is all in favor of the cast iron, the hardest steel not at all approaching that of the chilled cast iron. In this respect the cast iron wheel has a great advantage, one of the disadvantages of the steel wheel being that it easily becomes flat. A flat wheel on a street railway car is much more of a nuisance than on steam roads. It will produce a greater amount of noise, and, owing to the fact that the street cars are not as well provided with springs as those on steam roads, the discomfort to passengers is proportionally greater. This noise is a great cause of complaint from residents along the line of the streets, especially where they are narrow, making the flat wheel practically unendurable on this account alone. So far as can be ascertained, the wear of the steel wheel is much greater than that of the cast iron wheel. Rapid wear calls for frequent removal and turning off. Counting the cost of the removal and replacing and the machine work, and adding the high first cost of a steel wheel (solid), it is easily seen that there is a great money difference between the cost of running a given number of miles with steel and cast iron. This difference is considerably increased by the good price realized for the cast iron scrap.

When we come to the question of a steel tired wheel as compared with the cast iron, the danger from breakage becomes an important feature, as it is greater with steel than with iron. The reason for this does not at first seem apparent. But the steel wheel, as commonly used, consists of a cast center and a steel tire held on by bolts or rings, etc. These are all liable to give out and allow the wheel to separate. The worn tire is also liable to be broken, and thus cause a destructive accident. This result is all the more probable because in order to attain any measure of success on street roads it becomes necessary to make the metal exceedingly hard, and consequently it is more brittle. In this consideration of the subject I have not noticed the solid steel wheel because on account of its softer body it appears to be entirely inapplicable to use upon street roads. While these wheels may be had of sufficient strength to be removed from all danger of breakage from strain, they cannot compare in life and relative economy with cast iron.

The cast iron wheel when well made is strong, wears well, is not easily flattened, and is cheap. Comparing the cost of running 300,000 miles on steel and on cast iron the figures are greatly in favor of the cast iron.

One of the largest makers of car wheels in the United States, in answer to a question, said that he thought a great increase in the wearing powers of wheels for street cars was possible, and he believed it could come from manufacturers. Better wheels could be made, and

the increased cost would be more than made up by a longer life of the wheel. The general direction of the work would be in the use of better metal with greater care in moulding and foundry work generally. "At present," he said, "we are making just as good a wheel as we know how to, and are taking as much care with the details as we possibly can at the figures which we get for our product. We fit and grind very accurately, in fact to a needlessly close limit, but, of course, if the price were better, improvements would be possible, which are out of the question now. There is no question in my mind that such a wheel as we might make would pay the railroads."

ONE of the officials of the Broadway road (New York City) said that the work on his road was too recent for him to be able to draw intelligent conclusions in regard to the wear and mileage of wheels under grip cars and heavy trailer cars. Comparison with the life and wear of wheels on the old horse car system could only be made when sufficient time had elapsed to find the average under the new systems. New rails, heavier cars, new wheels and a very large increase in speed were all factors in the question. Time only can give the true answer, and at least a year will be needed before figures will be available from which valuable results can be obtained. In the meantime we must collect facts, make observations and note results.

SPECIAL CORRESPONDENCE.

Influence of Soil on Wheels.

EDITORS STREET RAILWAY JOURNAL:

The question of how and why a wheel wears is one which is discussed, generally, with very little reference to the important condition of what kind of soil forms the foundation of the street. If you could get at the figures relating to the life of wheels down along the Jersey coast and in some parts of Florida, and then compare them with those which had run through a clay region, I think you would find some things which would be most surprising. On the New York & New England Railway, steel driver tires wear at the rate of one-sixteenth of an inch for every 12,000 miles. Down in Florida, they wear one-sixteenth of an inch in going about 3,000 miles, and the railroad companies think they have done wonders if they get 5,000 miles with that amount of wear. It seems to me that such figures as these ought to be somewhat encouraging, and look toward the use of steel tired wheels on street roads.

The heaviest of our street cars carried on four wheels is probably not much over 20,000 lbs., or, say, 5,000 lbs. per wheel, while the lightest locomotives will carry at least double that weight per wheel, and so on upward until the maximum reaches 16,000 and perhaps 18,000 lbs. These wheels, too, it must be remembered, are frequently fitted with brakes of the most powerful kind, and since, on many roads, the use of sand is constant, their conditions cannot differ, so much as has been heretofore supposed, from those occurring in street traffic. Under heavy passenger cars where, of course, the sand is not used, thirty-three inch wheels, with steel tires, have records of as high as 300,000 miles, and some of the wheel makers talk of wheels that have done a good deal better than that.

W. O. T.

Electric Arcing and Wheel Wear.

NEW YORK, November 10, 1894.

EDITORS STREET RAILWAY JOURNAL:

The statement that the arcing between the wheels and the rails of an electric car materially shortens the life of the former is often made, but so far as the evidence goes there is nothing to show that this is the case. The facts are about as follows: Under an electric car running at a high rate of speed, say fifteen and, perhaps, twenty miles per hour, the wheels give out quicker than on the old horse road which the trolley line has replaced. Investigation shows that the mileage is less. Upon looking at the wheel a good many spots or pits are seen. Combining these facts with another that now and then a flash has been seen under the wheels, some conclude that the pits are produced by the arc.

Looking at the enlarged photograph of a portion of the tread of a trolley wheel, which I send you herewith, you will see that there are certainly several thousand pits for each square inch of the tread. Now, unless a car is running in an exceedingly sandy country, and with an excessively dirty rail, the flash due to arcing will not be seen once in a minute. It does not occur, ordinarily, once in 1,000 ft. on roads of the best construction. We can, however, get some idea of the probability of the matter by considering the wear of the wheel and the number of pits.

I think no one will examine the tread of a trolley wheel without admitting that an arcing effect sufficient to produce such an excavation of the metal would be plainly seen at night by one watching the wheels of the car. In round numbers, the tread of a thirty inch car wheel has 180 sq. ins. One of these wheels will run about 3,000 miles for each sixteenth of an inch worn off from the tread. As none of these pits is a sixteenth of an inch in depth, we may safely assume that all of them that can be seen have been made within 3,000 miles of wear. If there are 1,000 of these pits per square inch of tread, which I think a fair estimate, we shall have 18,000 on the whole tread, which must have been made in running a distance of 3,000 miles. Dividing, we find there must be made about sixty arcs per mile, or one on every eighty-eight feet during the whole life of the wheel. There may be some roads doing as well as this, but I have not seen more than one that would come anywhere near this figure.

PITS ON WHEEL TREAD.

Now, what about another side of the question? The treads of these trolley wheels look just like the worn treads of horse car wheels or those of any other street car wheels. I question whether there are any men who will assert that arcing produces pits in the treads of horse car wheels. In looking over a pile of old wheels, it will be a very sharp man who can tell, from the tread alone, one street car wheel from another. They are all rough as compared with the treads of worn steam road wheels.

As for the reason for this rough appearance, I have little to offer. The heat generated by the application of the brake shoe and the sudden cooling of the metal by the rail, may have something to do with it. The numerous repetitions, amounting on an average to ten or fifteen per mile may make up by number what they lack in intensity. The brake power on a street railway car is child's play beside that of the air brake. Some railway men say they think the rough condition of the tread of the wheels is due to the grinding of the dirt and sand into the metal. This appears to be more reasonable. The concentrated pressure brought on the metal by a grain of sand upon the rail is far greater than the crushing strength of steel or iron. A grain of sand one-tenth of an inch square would have to bear so large a portion of the weight of an ordinary grip car, as to produce a pressure on the tread of the wheel at the rate of about 600,000 lbs. per square inch. Naturally, we find the tread of the wheel pitted and a dent or dimple in the solid steel rail. This load is nearly double the crushing load of the hardest tempered steel, while car wheel iron is supposed to be crushed by about 180,000 lbs. per square inch, and steel like the ordinary steel rail crushes with a little more than 100,000 lbs.

As there seems to be ample reason for the pitted and worn treads of street car wheels in the ordinary conditions of service, it does not appear necessary to suppose that arcing or any other electrical cause is at work.

JOHN JONES.

Steel Tired Wheels, Wrought Iron Centers.

New York, November 24, 1894.

Editors Street Railway Journal:

Since the adoption of electricity as a motive power great improvements have been made in every department of the street railway business, with one exception, and this is rather surprising, when we consider the important function it performs on every car. I refer to the wheels. Manufacturers of wheels have done considerable experimenting, but very little definite data can be obtained, as the subject is one which has had but little encouragement or consideration from street railway men.

As a matter of fact, standard cast iron wheels in this country to-day will probably not average more than 35,000 miles. There have been few improvements made in the cast wheel, and to-day, by the most approved methods, it is impossible to get any number of cast wheels which are absolutely true and free from various defects. Combination wheels of various kinds have been put on the market, but as yet with no great success. Steel tired wheels have been tried, but we have no reliable data as regards their mileage records made here. In Europe (admitting, it is true, the conditions are very different) the steel tired wheel has been in use for years, and we have records of where the same wheels have been used in constant service for five and six years. Some years ago considerable doubt existed among steam railway men as to the question which was the better wheel to adopt, the cast iron wheel or a combination center with steel tire. After several years of experimenting, the steam roads almost universally adopted the steel tired wheel. In locomotive service they have been adopted exclusively, and records of 500,000 and 600,000 miles have been obtained. True, the service required on steam roads is diametrically opposite to what is required on surface roads in our cities; however, as electricity will probably be the standard motive power for the next hundred years for street railway service, and since its adoption, we have followed very closely the best engineering work done by steam railroad engineers, it seems reasonable to assume that if a steel tired wheel has made in active service 500,000 miles in steam railway service, a wheel built on similar lines should make a record of 150,000 miles in street railway service. If a steel tired wheel will make 150,000 miles it should certainly command attention and consideration from street railway owners. Steel tire manufacturers in this country are unwilling to make any absolute guarantee as to the life of their tires, as they have no mileage record or data whereby they can form any approximate estimate as to the mileage they should make when employed on electric or cable roads. Wheel centers, equally important with the tires, can be obtained guaranteed to give five years' service in commercial operation, or, if found defective, replaced free of cost. If any wheel made will make 150,000 miles, it will obviously be cheaper for the street railway owner to buy it, even at three times the price which is paid to-day for cast iron wheels.

The writer is just placing on the Electric Traction Company's road, of Philadelphia, two sets of wheels for test purposes. The centers of these wheels are manufactured by the Arbel establishments in France, four of them being equipped with steel tires made in France and four of them being equipped with steel tires made by the Midvale Steel Company, of Philadelphia. These two cars will be operated over the same route, and kept in constant service; just what results can be obtained as to mileage of these steel tires, is at this time unknown.

The wheels above referred to are thirty inches outside diameter, the center weighing 105 lbs., steel tire 150 lbs., making a total of 255 lbs. This is a much lighter wheel than the standard thirty inch cast iron wheel. The centers of the wheels are made in separate parts, and are then forged, this process making a much stronger wheel than can be obtained by casting. The centers are turned true on the lathe, the tires are adjusted, turned true, and the result is all wheels under the car are exactly the same diameter.

The cost of such a combination wheel is necessarily much greater than that of the cast iron wheel, but should its adoption be favorably considered, it is reasonable to suppose that its manufacture in large quantities would decrease the price, although it would never reach the present low price of cast iron wheels.

I have been told that a mileage of 120,000 miles has been made with steel tired wheels in an American city, but I have no positive or absolute data to substantiate the statement. Increased speed acquired and now permitted in our various cities on electric railways, makes it the more necessary that the element of safety receive consideration.

Considering the fact that when operating roads by horses, the average speed was but five miles an hour, and to-day, with electricity, an average of from eight or ten miles to twenty-five miles an hour is made, it is strange that the question of stronger and better wheels has not received more consideration. If one is desirous of driving a shaft in a mill at double its former rate of speed, would he not increase the size of his hangers and bearings, or would he simply increase the speed and take chances? It is not my purpose to predict or assume that the standard cast iron wheel will ever be universally discarded, but with increased speeds, heavier cars, the additional weight of the motors, etc., a better wheel is wanted, one which is stronger, the spokes and hubs of which will not crack or split, one which is lighter in weight, thereby decreasing the hammer blow on the rail joints, one which will give increased traction, and above all, one which will give increased mileage. Radical improvements must be made. In the meantime, is not the wheel question worthy of more than the "let well enough alone" attention?

Yours truly,

Wm. Hazelton, 3rd.

Repair Shops of the Metropolitan Street Railway Company..

The consolidation of seven New York City roads into the Metropolitan Street Railway Company has brought about a concentration of the repair work formerly carried on by the independent companies. The smaller repair shops have been closed and the company's work is now done at two points, the cable power station on 50th Street, and in a new building on 53d Street between Tenth and Eleventh Avenues, directly in the rear of the Belt Line division's car house.

The 50th Street cable station contains a very complete machine shop devoted to the repair and manufacture of the cable apparatus. The shop is operated by a Wetherill-Corliss 32 × 42 in. engine, which also runs the dynamos, the mills for grinding feed, the fans serving the adjacent buildings andan Otis elevator. Friction clutches are provided, so that the main shaft of any department can be cut out without interfering with the operation of any other portion of the works. The machine shop contains the following tools:

One cable shear cutter, manufactared by the Cockburn Barrow & Machine Company, Jersey City, N. J., a machine capable of cutting a bar of iron 4 × 1 in.

One planer 10 ft. × 42 ins. × 63 ins., made by the Pond Machine Company, of Plainfield, N. J.

One radial drill, 10 × 5 ft., also by the Pond Machine Company.

Two Pond lathes, one 36 ins. × 14 ft., the other 24 ins. × 14 ft.

One 20 in. × 10 ft. F. E. Reed lathe.

One 16 in. × 8 ft. Reed lathe.

One 2 in. Acme bolt cutter.

One 3 in. cutting-off machine manufactured by the Herbert Rogers Machine Company, of South Sudbury, Mass.

One 3 ft. Springfield tool grinder.

One special "F" Springfield grinder.

One Brown & Sharp No. 1 Universal milling machine.

One Sellers twist drill grinder.

One Gould & Eberhardt 26 in. shaper.

One Gould & Eberhardt 25 in. upright drill.

One 32 in. upright drill, manufactured by Prentiss Bros., of Worcester, Mass.

One Cincinnati Universal reamer and cutter grinder.

One Dwight Slate sensitive drill.

The smithy is equipped with a 600 ton Bement & Miles steam hammer.

Directly above the machine shop is a pattern shop in which are the following tools;

One 25 in. × 10 ft. pattern maker's lathe, manufactured by the New Haven Machine Company.

One 8 × 8 in. draw stroke trimmer, manufactured by Perkins & Company, of Grand Rapids, Mich.

One Baker Bros. Toledo combination rip and cross cut circular saw.

One 3 in. band saw.

Necessary auxiliary tools.

One portion of the pattern shop is partitioned off for a stock and tool room.

Sixteen men are employed in the machine shop, four blacksmiths in the smithy, and several carpenters and pattern makers in the pattern shops. The company makes its own grips, and uses cold rolled steel for pins and bolts.

The 53d Street repair shops take care of all the repairs of the horse and cable car bodies of the company's system, About fifty-five men are employed here, half of whom are in the paint and varnishing department, which occupies nearly all of the second floor and all of the third. A freight elevator handles the cars from floor to floor, and the rooms are brilliantly lighted by incandescent lamps, so that night work is possible. The power for operating and lighting the shops, and for the auxiliary work of the station and the adjoining car house of the Belt Line Division is supplied by a Watts-Compbell and an Ideal engine, located on the ground floor. The shops contain the following machinery: One band saw and one upright drill and mortiser, manufactured by C. D. Rogers & Company, of Norwich, Conn., one circular saw, one planer, one buffing wheel. There are two blacksmith shops in the building, one on the ground floor and one on the second floor near the paint and varnishing department.

Motor Repairs.

Turning Commutators—Testing.

By James F. Hobart.

Frequent re-surfacing of the commutator is necessary, both for economy and for good service. No motor can be operated at the least possible cost, which carries a commutator badly out of round to waste current by sparking. Schemes have been proposed for dressing commutators without removing the armature from the motor, but this has not yet been made to pay, and putting the armature in the lathe is practically the only good way of doing at present.

In turning commutators, it is of vital importance that the tool cuts cleanly, and does not leave fragments of metal clinging to the side of each segment on which the turning tool issues from the cut. For this reason, the ordinary tool used for turning brass, will not answer. To begin with, commutators are not made of brass, but of copper, therefore the tool shown at *a*, Fig. 1, although

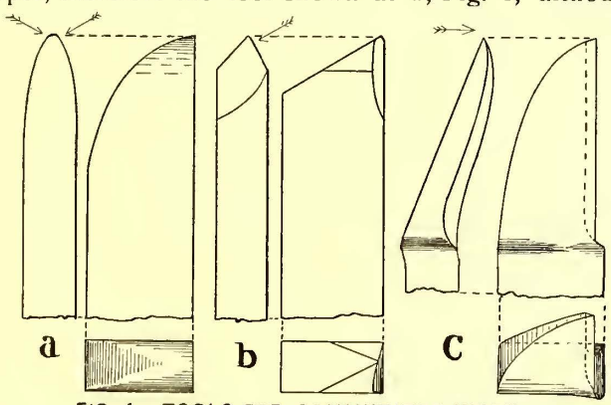


FIG. 1.—TOOLS FOR COMMUTATOR WORK.

much used for cutting brass, is useless on commutator work.

Fig. 1, *b*, shows a good tool for commutator work. This tool will also work wrought iron well, provided the rake and clearance are not too great. The ordinary diamond point tool works very well if it be ground on top so as to cut only in one direction, right or left, but not both. Tool, *b*, is also ground in this way. It will be noted that the point of *b* is ground off slightly. This is necessary in order to make the tool stand up to its work. If the tool be left pointed, the sharp end will soon wear off, then the tool cannot be kept up to its work without a great deal of pressure being put upon it. It will also jam the metal, instead of cutting it, and the metal will be forced into the mica insulation, instead of being cut cleanly off. The consequence will be the short circuiting of several of the segments.

No matter what tool is used for dressing the commutator, a finishing cut should be run over it with a tool something like that shown at *c*. This is commonly known as a "side tool," and if set so the ground-off point is exactly parallel with the axis of the commutator, this tool will cut cleanly and well. The arrows show the direction of cut for each tool; that is, the work must be fed up in the direction indicated by the arrow, or, the tool must be fed up in an opposite direction. In the case of *a*, where two arrows are shown, the tool may be used to cut in either direction.

After turning up a commutator, it should be gone carefully over, and each insulation strip of mica carefully examined. Every bit of imbedded copper must be picked out with a sharp awl. Furthermore, the commutator

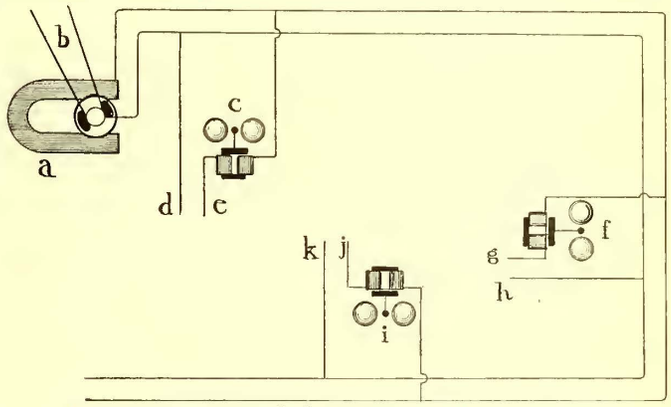


FIG. 2.—POWER MAGNETO FOR TESTING CIRCUITS.

must be carefully tested to see that no undiscovered fragment of copper has formed a hidden short circuit. The testing should be done with a Wheatstone bridge, but in general shop practice, nothing but a magneto is available. However, a good magneto, so wound that it will ring a bell through 30,000 ohms resistance, makes a fairly good testing instrument, and one which is far ahead of no instrument at all.

Magneto testing, in the average car shop, is a costly operation, as managed at present, and is susceptible of great improvement. As now employed, the magneto must have two men to use it, one to turn the crank, the other to apply the terminal wires to the parts to be tested. Sometimes the man (or boy usually) will turn with all his might, sending out a very high voltage which will work through a very high resistance. At other times, he goes so slow on the crank, that the low voltage generated can scarcely ring the bell through considerable of a short circuit.

The remedy for such trouble is to drive the magneto by power, and dispense altogether with the man or boy who does the turning. Frequently there is but one magneto in the shop, and it is sure to be wanted in half a dozen different places during the day. It would be a saving to set up the magneto permanently, drive it by belt or by a small electric motor (from the street current) and then establish half a dozen testing stations where the work may all be done from the single magneto. Fig. 2, shows such an arrangement. The magneto, *a*, is driven by belt, *b*, and forces its high tension, alternating current through the line wires shown in the engraving.

As many magneto bells, *c*, *f*, *i*, etc., must be provided as there are stations to be served. These bells are connected in as shown, bringing one terminal, *e*, *h*, of each bell, down within reach of the workman who is to do the testing. Another terminal, *d*, *h* or *k*, etc., is connected to the other magneto lead and the testing apparatus is all ready for use. Should a workman at the first station re-

quire to use the testing apparatus, he simply connects terminals, *d* and *e*, with the commutator, or other part to be tested, using flexible cord for that purpose. Just before using, the wires should be touched together, and if the bell responds, the apparatus is all right. If the bell does not ring, somebody is probably using one of the other testing stations, in which case, a few moments' wait will set the apparatus at liberty.

This method of magneto testing is much better than the old way of carrying the magneto around the shop, and taking along a man to "do the circular work," *i. e.*, turn the crank. By this method, the magneto is always in order. It is also always in place, as nobody borrows and forgets to return it. For work around the barns, a portable bell may be rigged up, with terminals at binding posts upon its box. Then, connect the box with the magneto leads by means of a double wire (telephone or incandescent lamp cord, and then test from the box, using short wires attached thereto, precisely as were used the wires, *d e*, *g h*, *j k*, etc.

Sometimes it is not possible to get hold of a magneto bell, *i. e.*, one with a polarized armature, and magneto impulses must be made to ring an ordinary bell. This is

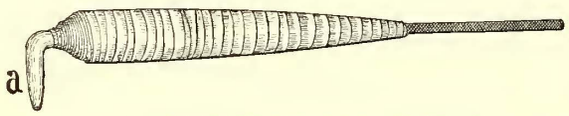


FIG. 3.—CONTACT PIECE FOR TESTING.

easily done by screwing down the spring, practically making a single stroke bell of it. When the spring remains in contact with the adjusting screw, while the hammer is in contact with the gong, there is nothing to interrupt or cut off current from the bell, when the spring is thus screwed down, and the bell will answer nicely to the alternating current, provided its frequency is not so great that the coils cannot have time to act between impulses.

Another method of testing, which is much used in some repair shops, for testing T. H. starting rheostats, is to arrange five car lamps in series and connect them through the parts to be tested. If the lamps don't glow, it is taken as evidence that the insulation is O. K. This seems like a rough and very crude method of testing for insulation, but it works well for some purpose—controllers and rhostlats particularly. The street current (500 volts) is used in making this test, and it is usually applied by making contact with the turned-up ends of wire, one of which is shown at *a*, Fig. 3.

To keep the terminals of the testing wires out of mischief, they should be placed carefully in holes drilled for

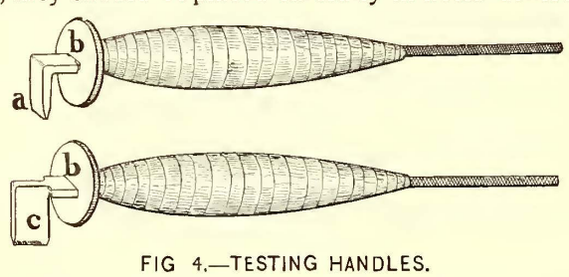


FIG 4.—TESTING HANDLES.

them in a piece of slate which in turn is fastened to the wall in a place not likely to be interfered with accidentally. The danger of shock to the person, and of fire to the building is thereby reduced to a minimum. Do not, as once I saw, place the testing terminals of a 500 volt circuit in holes three-eighths of an inch apart, *in a piece of pine wood.* A nice little tinder box, and nice dry pine for tinder!

The handle of test wire shown by Fig. 3, is made by winding on insulating tape until the size and desired shape has been made up. A much better set of "testing handles" is shown in Fig. 4. These are made of steel, with hard rubber guards, *b*, *b*, fitted on to prevent the hand from slipping against the live metal. Back of these rings, tape is applied to make up the size wanted. It will be seen that the end of the wire at *a*, takes the form of a scraper, and with it a road to bright metal can easily be made through grease or dirt. The other terminal, *c*, is forged to a different shape. It is more like a section of knife blade, and when rubbed back and forth on a piece of metal, it will dig for itself a little channel leading down to solid metal. To assist it, the edge of the tool is cut with file teeth, so that metal covered with rust, or hard oxide can be made bright.

Notes on Power Station Economy.

By Geo. H. Davis.

Economies of engineering have become so universally studied and applied that the idea has almost become synonymous with engineering itself. The first questions to arise are: Will it pay? How much will it pay? What will pay better? We are not looking for the artistic as a primary consideration, neither do we put serious thought on some complicated machine merely for the amusement of the masses. Economy, durability and simplicity are the principal elements of good design, and after these a reasonable amount of ornamentation is desirable. Simplicity, however, when not gained at the expense of the highest efficiency and utility of the machine is the cornerstone of success both in men and mechanisms.

It is probably true that, in the 6,000,000 H. P. being constantly consumed in the United States in the railway, lighting, factory and mill interests, the coal consumption per horse power per hour might be reduced one-third in amount by careful, close calculation and originality in design. The interest on the extra cost of the best will never exceed or even approach the operating expenses resulting from cheap equipments, and it is obviously bad economy that continues to operate an old and wasteful plant when the extra operating expenses over those of the new and modern design will pay more than the interest and depreciation on the cost of the new.

Studying carefully the tests which have been made of power during the past four years, it is found first in the smaller electric light plants that 45 per cent. of the number which have been tested run at such a fearful waste of fuel, labor and repairs, that extra operating expenses would much more than pay the interest and depreciation on the cost of a new equipment. The causes for this are many and distributed over almost every part of the plant. The older equipments are almost universally non-condensing, having exceedingly small units, high speed, countershafts, inefficient boilers, engines and generators. The piping system consists merely of a main extending from boiler to engine poorly placed and poorly covered; the drips, if taken account of, are discharged into the atmosphere. The arrangements for coal handling and discharge of ashes are, in many, of the most primitive sort.

However, these plants were built when the business was new and many of the installments were made as an experiment by manufacturers, capitalists and engineers. Small generators were the only ones that could be purchased. They were wound for exceedingly high speeds and low voltages, the magnetic leakage in some types being as high as 50 per cent. Armature reactions, eddy currents, narrow limits for neutral points, excessive sparking, hot armatures and hot bearings are some of the disagreeable things that engineers in such stations have to contend with. Next to the generator is the narrow, thin belt running at high speeds between short centers, with a slip of from 2 to 5 per cent. from actual tests. The countershafting alone is a considerable source of loss even if the best designed bearings on the best of foundations are used. In a recent test of one of the most carefully managed lighting plants of the old type, using a countershaft and small units, it was found that the total efficiency from engine cylinders to generator brushes was 62.2 per cent., and that the loss due to countershafting and belts was 14.8 per cent.

Some lighting franchises would not pay however economical the power plant might be, and, therefore, the owners seek to close up the business with the least possible loss, which they consider would be best effected by

wearing out such machinery as they may have on hand. The majority of railway and lighting plants are profitable, and with better economy the dividends might be correspondingly increased, and it is with these that we have to deal.

The following simple arithmetical calculation will show the gain in operating expenses, by reducing the coal consumption one-quarter pound per horse power per hour: In a plant using 2,500 H. P., driving twenty-one hours of the day, on a coal consumption of two pounds per horse power per hour, we have a total of 105,000 lbs. per day. With a coal consumption of 1.75 lbs. per horse power hour, we have a total of 91,875 lbs., or a difference of 6.5 tons. At $2.50 per ton, an annual saving of nearly $6,000 would be effected, which would pay the interest at 6 per cent. on an investment of nearly $100,000. At a coal consumption of 2.75 lbs. per horse power per hour, which is often the actual figure, we have an annual expenditure of nearly $24,000 more than is necessary, or the interest at 6 per cent. on a plant costing nearly $400,000.

No account is here taken of the extra water consumption which is often taken from city mains at considerable cost. Then, too, a plant arranged in large units in minimum space requires from 25 to 40 per cent. less in the cost of labor in attendance.

Generally, in operating mills and power plants, we know the cost of production of power by daily records kept, but this is only a test of the plant as a whole. If it be uneconomical in the consumption of fuel and water, there may be a hundred small and more or less obscure parts that might unitedly or individually cause the waste. Of course, the boilers and engines are the principal considerations, but assuming that these are in perfect condition, so far as their peculiar design will permit, then there are details in steam fitting and auxiliary parts, which if not in place or in bad order, may entirely destroy the economy which might otherwise be attained.

There are certain parts in steam fitting which cannot with economy be left out. In an experiment extending over a considerable period of time, while a large plant was being completed, it was observed that the addition of live steam coils in the receivers, complete pipe covering, an auxiliary heater, and return of all drips to the boilers, reduced the coal consumption from seven to five pounds per car mile.

Again the change of valve setting in engines, after a careful study of cards taken, resulted in a saving of 10 per cent. of the usual coal consumption. The most economical points of cut-off and compression can never be determined by mere inspection. Calculations based on a thorough knowledge of the particular design of engine in question are always most satisfactory.

The many things that can be determined from indicator cards alone give one the best clue to the internal workings and faults of an engine. It is no great trouble to take a set of cards, and a few hours' study of the same will often result in a saving equal to the engineer's wages. The outside mechanical operations are usually well cared for because defects there are apparent to any unskilled assistant. Pipe covering is frequently defective when put in place, and an afternoon's work with two calorimeters will serve to show just what the loss is, and it may be found that the extra condensation, if saved, would more than pay the interest on a perfect piece of work. It is well known, with a given pressure of steam, what the condensation should be in the bare pipe and also that perfectly covered.

No station equipment is complete without a full set of testing instruments. Their cost is but a trifle as compared with the resulting saving due to their intelligent use. Among the instruments that are most valuable are a full set of the best indicators; cheap ones, like cheap watches, are worse than useless; a set of well calibrated thermometers reading from 0 to 600 degs., also a pyrometer, two calorimeters, preferably one separating and one throttling watermeter, a tank with condensing coil for measuring hot water, a standard pressure and vacuum gauge.

A frequent analysis of the flue gases is a source of economy. Different grades of fuel require different quantities of air for complete combustion, and no one can tell by the mere inspection of a furnace whether combustible gases are disappearing through the chimney or whether an unnecessary amount of air is being drawn into the furnace to help in condensation. The apparatus necessary for a complete test of flue gases need not cost $5, and if used will save hundreds of dollars.

Boiler incrustation often causes great heat loss, and in using bad water it is a great worry with the managing engineer to know what to do. Compounds, as a rule, are valueless, and often produce chemical reactions with every kind of metal in the piping system. Generally speaking, frequent mechanical cleaning of boilers outside and inside is the only reliable process. Refined kerosene will assist in the work by preventing scale from clinging to the water contact surfaces, and much of the sediment is thus taken to the mud drums automatically.

Every station should also have a simple oil testing outfit, because consignments of oil vary greatly among themselves and are very different from samples submitted, and it is a very bad practice to "try" oil on a costly engine. One may by this means detect poor lubricants, but the machine is often badly injured in the process.

A chief engineer of a power plant should be a busy man. It is a small part of his duty to see that assistants are attending to their ordinary work, that the floor is clean, the polished work bright, all steam leaks repaired and that the engines don't pound; anyone can do this. There is a standard of economy which is remarkably high in the best designed modern plants, and no one can reach it either in the design or operation unless he really knows his business and is a constant student of the situation.

No operating engineer can make a poorly designed plant economical, but if a plant has in its design and construction the best that is known and used at present, there should be an electrical horse power delivered at the switchboard on the consumption of two pounds of combustible per hour.

Engineering problems of to-day are solved neither by the learned scientists who have devoted their entire lives to laboratory and mathematical research, nor by practical men without scientific knowledge, but by men who have served as apprentices in engineering work, later becoming educated in their chosen branches, either in the technical schools or through private study, and finally entering the profession with the best that scientific research can give and much that experience can teach. It is, therefore, no easy thing to make startling improvements on the best that is known and used. However, in the multitude of details which enter into all engineering questions and usually governed by local conditions, there is always great opportunity for betterment, and through the improvement of these we bring a plant to a standard of economy otherwise impossible.

Transfers in New York City.

The consolidation of seven of the largest street railway corporations in New York City into the Metropolitan Street Railway Company, and the close affiliation of this company with others through the agency of the Metropolitan Traction Company, have brought about substantial benefits to the citizens of New York. The company has introduced such a complete system of transfers that a person boarding its cars at any point can be transferred, with one or two exceptions, to any point on its lines, and can ride for a distance of ten miles—all for the sum of five cents. In other words, the consolidation has accomplished the following striking results:

First. Three main through routes from the lower end of the city to Harlem have been established, one of these three routes being already equipped for cable operation.

Second. It is proposed to extend certain of these lines to the extreme northern limits of the city and to thus make it possible for a passenger to ride from the Battery to Kingsbridge, a distance of sixteen miles for the one five cent fare.

Third. Another through cable line is building on Lexington Avenue on the East Side, to connect with the

Broadway system at 23d Street, and with the Union Railway Company's electric lines in the annexed district.

Fourth. The "Belt Line" and numerous crosstown lines running from the Brooklyn Bridge and various ferries on the East and West Sides below 59th Street are operated as feeders to the north and south lines, and transfers are granted at the one fare.

In the words of the New York *Sun*: "It is impossible to overestimate the importance to the traveling public, particularly in a city of the shape of New York, of such an economic factor as exists in a five cent fare as opposed to a ten cent fare. There are 300 days of travel in every year for a vast majority of our people, and 300 days means $30 of economy."

The Metropolitan Street Railway Company operates seventeen distinct lines, and transfers passengers at thirty-one points on its system. It prints thirty-seven Stedman transfer tickets, all of which are given out by conductors, while on the Broadway line transfer agents are stationed at several points, provided with small cards instead of the Stedman ticket. The transfer tickets are not registered, but are turned in on each trip, and a complicated but highly efficient system of checking up the transfers at the office prevents their misuse.

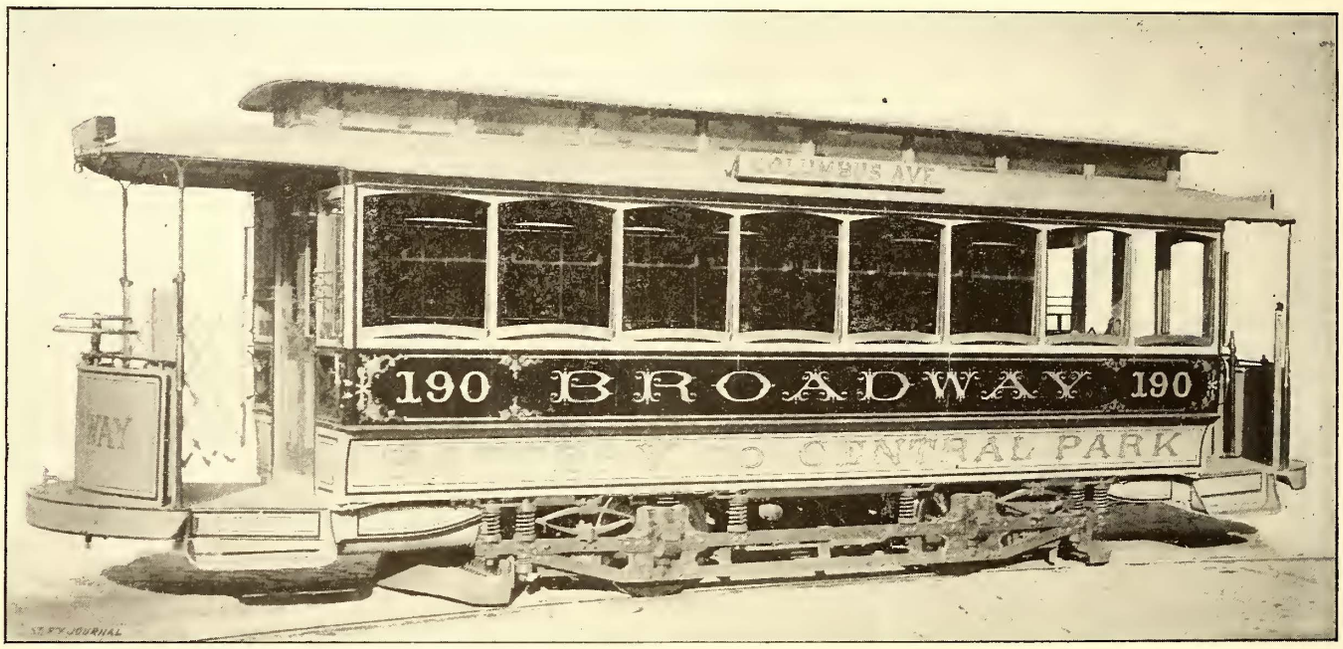
The company began to perfect its system and to issue transfers in 1887. In the first year, the number of transfers issued daily was about 3,000. In 1888, the transfer business was, in round figures, 1,000,000 passengers; in 1889, 2,000,000; in 1890, 2,225,000; in 1891, 2,500,000; in 1892, 2,800,000; in 1893, 3,150,000, and in 1894, when the many transfer stations were established, the figures have already reached the enormous total of 7,000,000. In 1895, it is estimated that from 12,000,000 to 15,000,000 transfers will be issued.

A New Street Railway Association in Georgia.

The meeting of the American Street Railway Association in Atlanta is already bringing about excellent results in the cultivation of a more fraternal feeling among the South. A few prominent Southern presidents met quietly at the Kimball House, in Atlanta, immediately after the Convention, and appointed a committee to take steps to organize a state association in Georgia, the committee being composed of Joel Hurt, president of the Atlanta Consolidated Street Railway Company and of the American Street Railway Association, Col. D. B. Dyer, of Augusta, and Jack King, of Rome. It is needless to say that this association will be cordially welcomed by all similar organizations which are becoming so numerous.

The Columbus Avenue Cable Railway.

The Columbus Avenue cable railway will be put in operation, it is hoped, the first week in December. The track construction is practically completed and all that remains to be done is to finish the work of reconstruction at the power station and lay the cable in place. The cable will be driven from the power station of the company, corner of 50th Street, 51st Street and Sixth Avenue, the one formerly used for operating the uptown section of the Broadway cable line. Its use for this purpose has been given up for several months, the Broadway system being operated entirely from the Houston Street station. The station and the type of yokes used have been illustrated and described in former issues of the Street Railway Journal. We present on this page an engraving of the type of car adopted as standard by the Metropolitan Street Railway Company for its Broadway, Columbus Avenue and Lexington Avenue lines. All the new cars on these lines will be similar to that shown, the route of the car being indicated by a triangular sign on the roof adjustable from the interior of the car.



STANDARD GRIP CAR—METROPOLITAN STREET RAILWAY CO., OF NEW YORK.

The car bodies are being furnished by the John Stephenson Company, Ltd., and are of the "Broadway" type, which has been described in these columns, two of the characteristics of which are wide aisles and platforms. The cars will be lighted by Pintsch gas. Folding gates are used to enclose the inside of the platforms.

The cars are mounted on Peckham improved extra long 6 E trucks, which have been adopted by the Metropolitan Street Railway Company as its standard.

The street railway mail service has been introduced into Pittsburgh, the first branch put in operation being on the main line of the Duquesne Traction Company, on November 11. The east end office receives fourteen dispatches from the main office and two direct from Pennsylvania Railroad trains, and sends out eleven dispatches to the main office and two direct to the trains. The assistant superintendent of the mail service says that the department intends to place regular mail cars on the Duquesne line, on which route agents will distribute mails in transit to the suburban post offices. It has also been decided to put boxes on the cars of the principal lines.

At the request of the post office department, the Pittsburgh, Allegheny & Manchester Traction Company has submitted a map showing its facilities for carrying the mails to Sharpsburg, Etna and Millvale. Maps of the West End and Second Avenue lines with their connections have also been prepared.

Kinks in Station and Railway Practice.

From F. M. Leland, superintendent of the Oakland, San Leandro & Haywards Electric Railway, of Oakland, Cal., we have received several practical ideas. The company has recently built in its machine shop a small air pump, to be used in blowing out armatures when they are brought in to be overhauled. A forty pound blast has been found to do the work much better than the old fashioned bellows. Armature thrust plates have been found to be too weak, and specially heavy plates, with ribs, have been manufactured in the shops to replace the original plates. The company uses and likes the Crossley rope brakes. The standard axle is 3⅝ ins. in diameter. No passes are issued, the employes and officials only riding free.

The company's run cards are arranged with great care, are neatly printed, and contain a number of interesting features. The motorman's inspection sheet is worthy of reproduction.

MOTORMAN'S INSPECTION SHEET.

OAKLAND, SAN LEANDRO & HAYWARDS ELECTRIC RAILWAY CONSOLIDATED.

Run No...... *No Car*.....
Date.....*Name*.....
Condition of Cap.....
" " *Coat*.....
" " *Vest*.....
" " *Pants*.....
General Appearance of Man.....
" " *Car*.....
Position of Badge.....
Condition of Brakes.....
" *Trolley*.....
" *Rheostat*.....
" *Motor*.....
What Kind of Watch?.....
Is his Time Correct?.....
Has Motorman got Dope?.....
" " *Oil in Torch?*.....
Has Car a Proper Link?.....
Has Employee Proper Time Card for this Run?.....
Remarks.....
.....
Inspected by.....

REGISTERING FARES AND TRANSFERS.

The Buffalo Railway Company uses two registers in its cars, one for cash fares and tickets, and the other for three cent fares and transfers. F. O. Rusling, superintendent, reports that this method of keeping account of the number of passengers in the cars is very satisfactory. No employe or policeman rides upon his badge. The conductor gets something from every person in the cars, and registers every fare, ticket or transfer as received.

IMPROVEMENTS IN CLEVELAND.

J. B. Hanna, secretary and treasurer of the Cleveland City Railway Company, writes us as follows:

"Our latest idea is to fit up a special car, to be used as a car for our directors and officers, and also to rent to parties for an afternoon or evening. We believe it will be a paying venture. Our lines are now long, compared with what they used to be, reaching out into the country in pleasant districts, and the rides are attractive, aside from the novelty.

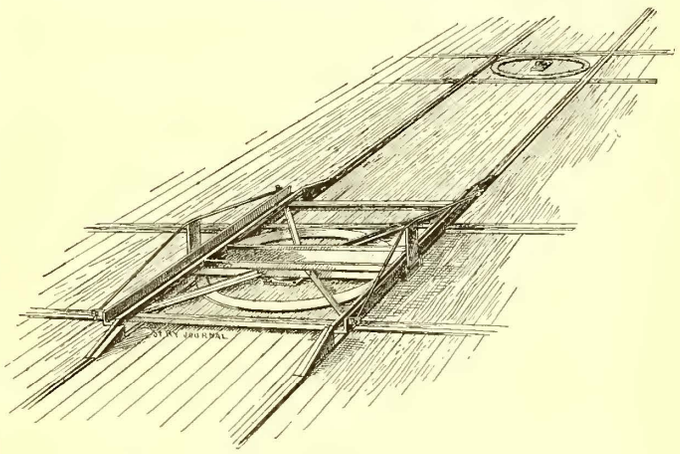
"Both the nine inch, ninety pound and the six inch, seventy-eight pound girder rails, spiked directly to the ties, laid two and three years ago, still stand up.

"The everyday operation of our power plant convinces us that the marine boilers and triple expansion engines are economical to a degree beyond our expectations or figures claimed for them. We are just as well pleased with the direct connected generator in this plant. The dangerous results predicted by those opposed to this type have never been experienced. In a run of two years we have never burned out or short circuited a machine. The strains predicted on the engines, on account of the variation of loads, have not bothered us at all. The more we see of this the more thoroughly we are convinced that our pioneer work in this field has been demonstrated a success." (The plant referred to by Mr. Hanna was illustrated in the March, 1893, issue of the STREET RAILWAY JOURNAL.—Ed.)

A CONVENIENT TURNTABLE FOR A CAR HOUSE.

A convenient turntable, which can be placed in car houses without cutting the floor, is in use in some of the car houses of the Metropolitan Street Railway Company, of New York. It was designed by Thomas Millen, master mechanic of the company, and is easily constructed. A sketch of one of these tables is shown in the accompanying engraving.

The table consists of a frame of channel iron. The side members are three inch angle bars with supporting trusses using a three-quarters inch rod. On the horizontal flange of these angle bars is riveted a strip of iron upon which the car wheels run. The center girder is made of a six inch I beam with two three inch angle irons riveted to it, as shown in the engraving. The upper flanges of the



SURFACE TURNTABLE.

I beam are planed off at the ends, so that the side frames rest on the center web. At their ends the side bars are connected by means of one and a half inch angle bars, and to the center girder by two inch angle bars.

The under side of the central truss is provided with a boss which fits into a socket bolted into the floor. A circular track about four feet in greatest diameter is provided for the turntable to slide upon. Inclined blocks which rest on the rail permit the car wheels to mount the turntable.

The chief advantage of this table is that it can be moved from any part of the car house to another, as occasion requires, it being easily lifted by two men. It is also very cheap to construct.

CAST IRON TROLLEY WHEELS.

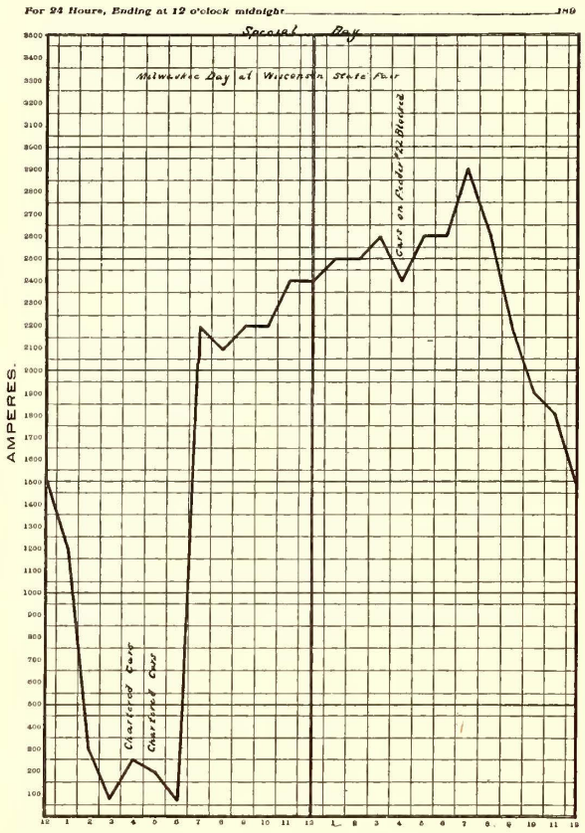
Cast iron trolley wheels have been in use for some time on the line of the Dallas (Tex.) Rapid Transit Railway of which George D. Hartson is superintendent. Mr. Hartson writes that while the wheels do not show any great difference in the first cost compared with brass wheels, they have much longer wearing qualities, and they do not wear the trolley wire any more than brass, nor do they heat any more than when made of the latter metal.

Mr. Hartson has also been employing a wooden line insulator or hanger between the trolley wire and span wire. The wood employed is bois d'arc which is plentiful in that part of Texas. It is a hard, close grained wood. The insulator is turned in a lathe to the shape of of the regular bell hanger and after being well filled with P. & B. paint is slipped down on the bolt of the trolley wire clip and is wired to the span wire with a tie wire in the same way as a feed wire is fastened to a glass insulator. The cost of the wooden insulator is about twelve cents.

POWER HOUSE CURVES.

O. M. Rau, electrician of the Milwaukee (Wis.) Street Railway Company, sends us power station blanks used by his company, and intended to furnish to the executive officers a current history of the day's operation. Reports of this kind are highly interesting, showing the effect that special days have on the operation of a road, and being—with the summary of results which usually accompanies these blanks—an excellent check on the operating force at the station. Mr. Rau believes, and with reason, that the graphical system is the best for a quick understanding of results. It requires but little practice to be able to trace, in the curves, the effect of special incidents of the day, such as the delay of cars by accidents, excursions, baseball games, etc.; and by comparing "cards" from month to month the general condition of the feed wire and return circuits can often be learned and steps taken to prevent the gradual increase in resistance due to deteriorating contacts. The crying need of the hour, however, is a thoroughly practical self registering current and wattmeter adapted for a continuous "indication" of the station output, so that "plotting" with all its crudities and inaccuracies may be made unnecessary.

Load Diagram of River St. Power House.

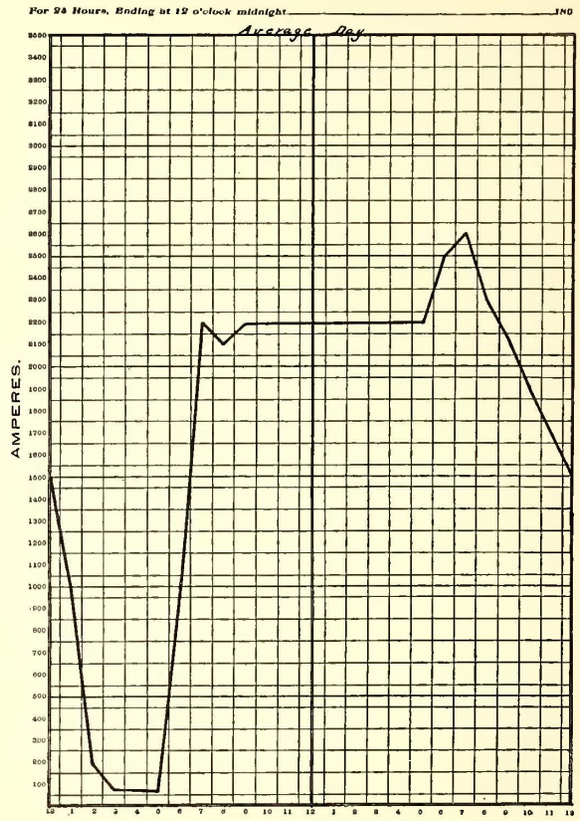


ARMATURES, LIGHTNING ARRESTERS, ETC.

S. Roy Wright, superintendent of the West End Street Railway Company, of Denver, Colo., says:

"On our Sprague No. 6 motors we have made the field terminals with a double turn or bend, both turns being well tied down to the field, so that if the terminals should break off, as frequently happens, the inside turn would still remain, and another terminal can be soldered on, without having to take off and unwind the field to get at the end of the wire. We use strong sheet brass instead of thin ribbon copper for connections, and instead of one strand of fine flexible cord we use No. 7 B. & S. copper cable for connections between the fields. On the armatures we use sheets of thin mica to insulate between the layers of wire, heavily shellacing the ends of the armature only. We then bake until quite dry. For bands we use a heavier wire, and have fewer armatures burn out now than has been the case before. We connect the armature wires direct to the commutator bars, having discarded flexible connections, as we find that by giving the wire a loop back we get better results than when we used straight, flexible or other methods of connection. Our armatures are baked by electricity in a simply constructed heater of our own design, and we find this method more satisfactory than the use of steam coils. We make all our own commutators, using soft copper for the bars, and micanite for insulating. We then heat and screw up the bars alternately two or three times to get them well in place and tight. The brush holders, rocker arms, contact buttons, etc., we have cast and dress them ourselves. We make our brush holder insulators out of a composition of sawdust and glue pressed very hard, and find them more satisfactory and much cheaper than vulcanite.

Load Diagram of River St. Power House.



"The lightning arresters on our switchboard we have altered and increased in number, one arrester having two wires from the bus bar to a water resistance, a zinc plate in this being connected by wire to the pump of the artesian well. The circuits are broken by four sets of sharp pointed carbons held as close together as we can place them without touching one another. As lightning passes from one carbon to the other a plug is drawn to break the following arc. We think that by having pointed carbons close together lightning of a lesser voltage will cross than would be the case with flat or smooth surfaces a little further apart. We have also put one new lightning arrester on the switchboard so that we might have three in line on the bus bar in addition to those previously up, that is, one on each of the feed wires. These were through fuse wires with the circuit broken by circular carbons, and worked well enough until a severe stroke of lightning blew out the fuse wires. Then we had to wait until they were replaced, and replacing them was not always a pleasant thing to do during a heavy storm.

"We have put up electric signal lights operated by the cars on the curves with single track, where the motorman cannot see the approaching car, aud we find that they work most satisfactorily "

USES FOR OLD STREET CARS.

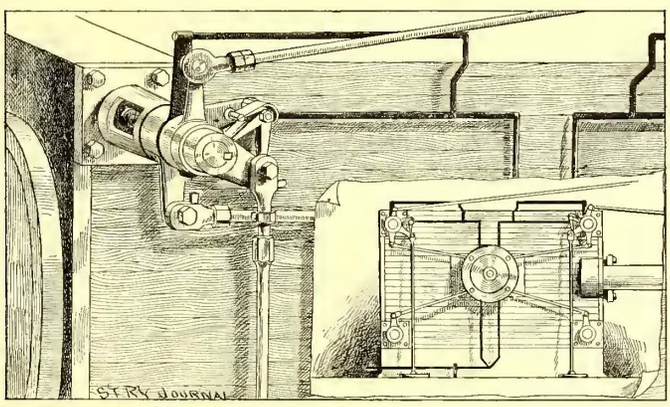
Under the above title the *Boston Transcript* gives an interesting account of Yankee enterprise in Cambridge, Mass. While the West End road was considering where to dump, burn or otherwise dispose of its old horse cars at minimum expense, a Mr. Sturtevant quietly stepped in

and bid for thirty-six of them. The price is not named, but he got all he wanted. Then he adroitly put one in a friend's back yard in Brighton, and told the children they might use it for a play house. Never were children more permanently pleased at a new toy. They sat up nights to use the car. Other little folks came for miles, peered through the fence, went home and teased for a street car to such an extent that a demand was immediately created. In a few days Mr. Sturtevant began to make sales. The amount of amusement obtained for five or ten dollars per car was more than had ever been within the power of parents to provide before. Other uses for the cars began to be suggested. One purchaser concluded to turn his into a hen house; a contractor pays his men every Saturday night from an old car; one man has turned his into a carpenter shop for his boy; another car furnishes a club house for young men, the lamps being useful (as well as the curtains) when card playing is on the tapis. Altogether, it would seem from the *Transcript* article that suburban Boston has gone car hunting with a vengeance, and that one of the minor problems of electric railway operation bids fair to be solved.

AN EMERGENCY CUT-OUT FOR CORLISS ENGINES.

Our illustration shows an extremely simple and effective device designed by W. H. Goodwin, chief engineer of the power station of the Atlantic Avenue Railway of Brooklyn, for quickly shutting off steam from Corliss engines in cases of emergency. With this device the dash pots can instantly be released, thus shutting off all steam, without unhooking or closing the throttle of the engine.

It is entirely independent of the governor, and consists of a horizontal bracket attached to the inside of the bonnet of the admission valve by two small studs. Pivoted to the end of this bracket is a bell crank lever, one arm of which is attached to a horizontal rod, which operates a cam attached to the wrist pin. The lower side of the cam is provided with a boss, which is designed to engage and release the latch of the dash pots. A vertical rod is attached to the other arm of the bell crank lever, and extends down to the floor where it is connected to a Y. A horizontal rod extends from this Y to the rear end of the cylinder.



EMERGENCY CUT-OUT FOR CORLISS ENGINE.

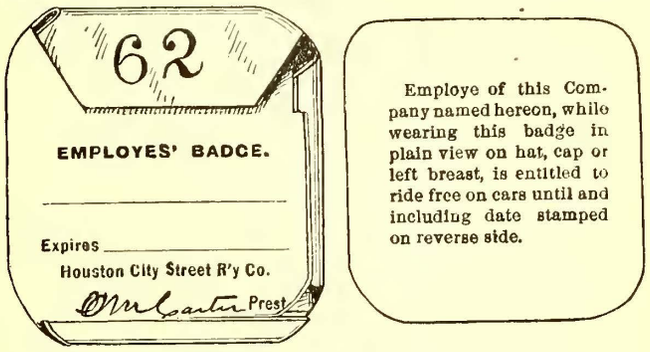
To operate the device, all that is required is a slight pressure of the foot on the floor lever which, through its connections, operates the bell crank lever and throws the cam in contact with the latch and instantly releases the dash pots.

It is constructed of quarter-inch brass pipe, and weighs, complete, less than five pounds.

In large power stations where a number of engines are employed, the device may easily be arranged to be operated by electricity. The floor levers may be operated by electro-magnets, and connection made to a keyboard at the chief engineer's desk, so that in case of emergency, the engineer may instantly shut off steam from any engine.

EMPLOYE'S BADGE.

The Houston City Street Railway Company uses the badge illustrated herewith. It consists of a brass holder with card on which is written the name of employe and date of expiration. This card can be changed as often as may be desired.



Street Car Ticket for Letter Carriers.

The Rochester Railway Company—always well in advance in new devices for fare collecting—has put in use a special ticket for letter carriers, arranged for the purpose by J. H. Stedman. The purpose of the ticket is to enable the postal authorities to get the full benefit of the tickets paid for by the Government for carriers. The tickets are divided into two classes, one for the morning routes and the other for the afternoon and evening routes. Each package bears the carrier's number, and when given to the conductor the date and hour are punched. The tickets can only be used when the carrier is on duty and carrying the regulation satchel. The conductor punches out the month, day and hour, and misuse of the ticket can thus be easily detected in the office.

Street Railway Casualties.

ON November 16, a boiler exploded in the street railway power house, at Elwood, Ind., killing one man, and doing damage to the extent of about $60,000.

THE new building of the Montreal Street Railway Company, in course of erection on Craig Street, collapsed on November 9, burying several workmen in the ruins.

THE South Nashville car sheds of the Nashville (Tenn.) Electric Railway Company, containing nine electric cars, and a large number of tools, were burned on November 4, the loss being about $19,000, fully insured.

A LARGE number of books and a quantity of important papers belonging to the Third Avenue Cable Company, of New York, were destroyed by fire on November 10, and the general offices of the company in the upper portion of the building were badly gutted.

The car house and equipment of the North East Electric Railway, of Kansas City, were totally destroyed by fire on November 7. Thirteen electric cars were destroyed. Two new car bodies were saved. The loss was $20,000, fully covered by insurance. The house will be rebuilt at once and new cars added to replace the old.

A Large Electric Railway Combination.

Plans have been published of the consolidation of the Second Avenue Traction Company, of Pittsburgh, Pa., with the Braddock & Turtle Creek, Pittsburgh & Homestead, Glenwood & Dravosburg and McKeesport & Reynoldstown Passenger Railway Companies. The combination will include over fifty miles of electric railway, and will connect McKeesport and other cities mentioned with Pittsburgh. The company intends to establish a pleasure resort on the line of the route, which will comprise some thirty-five acres. The line will cross the Monongahela River at two points.

An Important Legal Decision Sustaining the Trolley System.

Judge Barker, of the Supreme Court of Massachusetts, has recently rendered an important decision in a suit to test the legality of the overhead single trolley electric system brought by private parties' residing on Garden Street, in Cambridge, Mass., against the West End Street Railway Company. The plaintiffs asked that the company be enjoined from operating its road by electricity, claiming that they were owners of the fee of the street, and that the operation of cars by the single trolley system was a new servitude entitling the abutters to compensation, and the act authorizing the use of the system was unconstitutional, in that damages were not provided for. The principal facts on which they relied to prove the new servitude were (*a*) the increased weight of the track, (*b*) the increased size and weight of the cars, (*c*) the fact that the cars might be run in trains and only stop at fixed points, (*d*) the obstruction to street travel from such cars and trains, (*e*) the additional liability to accidents, (*f*) the unsightliness of poles and wires, and the danger that they might fall, (*g*) the danger to life and property of the electric current on the wires, and (*h*) electrolytic action of water and steam pipes. The plaintiffs were represented by able counsel, and presented a great mass of evidence to sustain their contentions. The decision was in favor of the defendants at every point. The prayer for an injunction was denied, and the plaintiffs' bills were dismissed. The importance of Judge Barker's decision is such that we reproduce the more important paragraphs.

It is possible to propel such cars at a much higher rate of speed than street cars can be drawn by horses, and also to propel them more slowly than street cars can be drawn by horses. In sparsely settled districts their usual rate of speed is greater, and in crowded streets is less than that of the horse car. Electric cars are more completely within the control of those who operate them than horse cars. They can be stopped and started more readily, and their course and progress and movements are more easily controlled. As usually operated they stop to receive and deliver passengers only at designated points. * * * As compared with horse cars, the noise of the electric car properly made and in good order is no greater and no more disagreeable than that of the horse car. Electric cars in use are a source of danger to other vehicles and to persons using the streets in their vicinity, but are not unreasonably dangerous beyond other modes of carrying passengers in the streets. There is nothing about the electric car properly constructed and operated, or about the appliances used in their operation, either in respect of noise, or of concussion communicated to adjacent land or buildings, or unsightliness, or of danger either from the cars or the appliances used in connection, which is unreasonable considering their use, or which, considering their use, is calculated to annoy, disturb, or seriously inconvenience ordinary persons who dwell upon lands abutting on the streets through which the cars pass, or who have occasion to be on such streets or in their neighborhood. * * * * * *

In the operation of street cars by this system, when a dynamo in the power house is in use, electric currents of equal value are at the same time leaving and entering the dynamo. * * * * If the track is properly bonded or welded and the proper return wires are laid and connected with the rails and the dynamo, nearly all of the current which passes to the rails from the motors will return to the dynamo through the rails and the return wires. But the ground itself is a conductor and some part of whatever current is at any point discharged from the car wheels to the rails will enter the soil and tend to find its way to the dynamo through the ground itself. In so doing, if it meets with metal pipes leading in the direction of the dynamo, it will enter them and follow them, so far as they afford the easiest means of progress upon its route. An electric current thus entering a metal pipe from the soil, tends to preserve it from oxydation or rust and from disintegration; but such a current thus leaving a metal pipe situated in damp or wet earth or in water, produces electrolysis of the pipe and tends to disintegrate and destroy it.

Whatever appliances may be used for facilitating the return to the dynamo of the electric current discharged upon the rail in the operation of street cars by the overhead single trolley system, there will necessarily be some portion of the current so discharged which will not remain upon the rails and the other appliances constructed to facilitate its return to the dynamo, but will leave them and enter the ground, and will pass through the earth in the direction of the dynamo. The operation of all such currents upon metal pipes in their way is that stated, namely, to tend to preserve them where the currents enter, and to destroy them by electrolysis where the currents leave the pipes in damp or wet ground or in water. When such currents are large in intensity and in volume the destructive process is rapid, and there are instances in which large pipes have been so destroyed in six weeks. But when the system is properly constructed and installed, and kept in order, the amount of electrical current which leaves the appliances constructed to facilitate its return to the dynamo, while appreciable by the application of scientific tests, is yet so small as to produce no damage by electrolysis or otherwise. When the usual method of operation is followed, electrolysis is greatest in the vicinity of the power house, where the return currents concentrate. When that method is reversed, and the current is sent to the motors through the rails, electrolytic action is greatest in the vicinity of the car, and at a distance from the power house.

The fixed tracks and the poles and overhead structures of an electric street railway constructed and operated upon this system do not unreasonably obstruct other travel in the street, and do not hinder or prevent the use of the street by other methods of transportation, except as the street is actually occupied by the cars when in use, and do not unreasonably obstruct the use of the street for water pipes, gas pipes, sewers, telegraph lines, telephone lines, electric light lines, or any other purpose than travel for which the streets may be lawfully used.

As compared with the fixed appliances of the horse car lines formerly in vogue, the tracks of the electric street railway are no greater obstruction to other travel.

All the fixed appliances of an electrical street railway upon or under or over the surface of the street are used solely to transport travelers over the street, and a street equipped with such a line of railway can be used by more travelers than by any known method of surface transportation, and with less danger and inconvenience to the persons transported, to other persons using the street, and to those occupying abutting lands, than when the street is used for the same amount of transportation by other methods.

The usual and ordinary effect of the location and operation of an electric street railway in a street, upon the market value of abutting and neighboring estates, is to increase rather than diminish that value. There are many persons who dislike to have such a railway in the street upon which their residences abut, and who are annoyed by the structures necessary to their operation, and by the running of the cars; but neither the structures nor the operation of the lines have the effect of annoying ordinary people.

There has been, in fact, no such delay or laches, and no such acquiescence on the part of either of the plaintiffs as ought to prevent them from having relief in equity, if the defendant has not a legal right now to construct and operate this line of railway by the proposed system; nor has the defendant done anything which ought to render it liable to be enjoined from completing the equipment of the line as an electric street railway, or from operating cars upon it by the proposed system, if the statutes are valid under which permission has now been granted it so to do by the local authorities and the Board of Railroad Commissioners.

Franchise Decision in Indianapolis.

A highly interesting decision was rendered in the courts of Indiana, on November 10, this decision affecting the respective rights of the Citizens' Street Railroad Company which has operated the entire street railway system of Indianapolis for many years, and the City Railway Company to which the City Council recently gave franchises, together with a supposed right to dispossess the Citizens' Company in the use of the streets on which the latter's tracks are at present laid. The features of this case are of such general interest as to be well worthy of a brief digest of the situation.

The Citizens' Street Railroad Company was chartered by the Legislature on January 18, 1864. No limit was placed upon its corporate life. The franchise obtained from the city of Indianapolis was granted for thirty years only, and would by its terms expire on January 18, 1894. In April, 1880, the original city ordinance was amended so as to read "thirty-seven" instead of thirty years, this amendment being made upon the company's representations that it desired to issue bonds running for twenty years from that date. The city claims that the company never formally accepted this ordinance.

Within the last two years the City Council has intimated that it considered that the company's rights would end in 1894 and that it would not extend the franchise of the Citizens' Company, except under far more burdensome conditions. As the company did not see fit to accept these conditions, the Council on April 20, 1893, granted a franchise to a new organization, the City Railway Company, by virtue of which the latter was empowered to build and operate street car lines through the streets now used by the old company. This, of course, at once brought the trouble to a head, and litigation was commenced.

The Citizens' Company contended that its franchise did not expire in 1894; that the earliest date of expiration which could possibly be construed by the city was January, 1901; and that it really was entitled to operate its road perpetually, unless the Legislature itself should see fit to act upon its reserved right to limit or repeal its charter. In other words, the company's attorneys

(among whom, it will be remembered, was Ex-President Benjamin Harrison) argued that the city had no right to impose a thirty year limitation upon a company chartered by the Legislature in perpetuity, for the specific purpose of operating the Indianapolis lines. It was not denied that the city might have orginally refused to grant the company permission to build its road.

The decision of the ranking judge (Judge Baker dissenting) upholds the right of the Citizens' Company to operate its lines, unless and until the Legislature shall repeal or limit its chartered life. Important paragraphs in the decision are as follows:

"Subject to the reserved power of the legislature to amend or repeal the act, perpetual corporate existence was given in explicit terms, and in the absence of express or implied limitation thereon, the necessary presumption is that the franchise granted was intended to be of like duration—subject only to legislative revocation. It is not to be supposed that the Legislature intended that there should be corporate existence without a franchise—the only reason for such existence. * * * * If agreements by common councils, like the one in question, are authorized and binding they must, when made, operate to suspend *pro tanto* the reserved power of the Legislature by repealing the act to terminate the life of companies organized under it. They are inconsistent with that power. On the contrary, if, when made, the agreements created no vested rights because made subject to the power of the Legislature to revoke or modify them, then in legal contemplation they are without force, and the power of city councils to make them is a mere pretense. It is a delegated power to make an agreement which cannot bind or ought not to bind one party, the corporation, because it does not bind the other party, the state. In respect to such powers the city is the agent of the state, and besides being anomalous, the proposition that the city and company will be bound by such contracts and the state not bound is manifestly unjust and unfavorable to the public interests.

Judge Baker dissents from Judge Woods' conclusion that the Legislature alone has power to compel the Citizens' Company to cease operations, and holds that its rights expire in 1901.

Franchise Decision in Detroit.

To determine the life of a franchise, the United States Court of Appeals reversed the lower court ruling in a suit instituted by the city of Detroit to oust the Citizens' Street Railway Company from the occupancy of the streets. It was contended that the term of occupancy by the company had expired in 1893 by limitation, and was now an unlawful trespasser. The defendant company is the successor of a company which obtained a thirty years' franchise in 1863. A controversy arose in 1879, and resulted in the council extending the franchise for thirty years from that date, in consideration of the company paying increased taxes and reducing fares. The state law under which the company was organized provides that the corporate life of all companies organized under it should be limited to thirty years. Query: Could the council extend the term of street rights of a company beyond the duration of its corporate life? The Circuit Court declared that the council had no such power, and the contract between the city and company was void. But the Court of Appeals, for the Dist. of Mich., October 2, 1894, reverses this view, on the ground that the legislative authority was ample to warrant the council in extending the company's grants, and that the acts of the legislature conferred power, without express terms of limitation. The power to make an irrevocable contract, giving an easement of some considerable duration, is an inseparable incident in any scheme for furnishing public facilities. Hence, the duration of such grants must be a question of discretion to be exercised by some public authority. That the exercise of that discretion should be left with the local government is in accord with the decentralizing policy so peculiar to the state of Michigan, is beyond dispute.

Parades vs. Street Railway Service.

Judge Bradley, of the Supreme Court of the District of Columbia, has recently rendered a decision bearing upon the respective rights of street cars and other vehicles in public thoroughfares, and the various semi-public parades of militia, circuses, masonic organizations, etc. Justice Bradley holds that the sidewalks are appropriated to the exclusive use of pedestrians, and that, while the latter have certain rights in the use of the roadway, these rights are limited by the rights of street car companies and vehicles, and that the pedestrian is under obligation to use proper care to avoid accidents. "No one has the right to stand in the street in the middle of a car track and obstruct the passage of the street cars, and * * * is subject to arrest for obstructing the passage of the cars, and he ought to be arrested. The use of the streets for parades and processions is legitimate whenever authorized by the proper officers * * * but such use of the street should be subordinated to the rights of the citizens and to the passage of their vehicles along the streets, and also to the rights of the street car companies, for their rights are not the exclusive rights of the car company itself, but are the rights of the general public. * * * A man who plants himself in the center of the car track either upon the occasion of a parade or upon any other occasion, and looks neither to the right nor to the left nor backward to see whether or not a car is coming upon him, is guilty of negligence, and if that were the sole cause of the injury, and if any injury is received, he will not be entitled to recover anything from the railroad company."

Legal Responsibility for Accidents.

A charge setting out the duties of a street railway company, but omitting to charge that a person on the street has duties also, is erroneous. And, in determining whether a child was guilty of negligence when playing on the track, the child's capacity and the use she made of it to avoid injury determines; and an instruction that a street railway owes a person on the track no other duty than shouting to her, is improper. Evidence that the car ran an unusual distance before being stopped tended to show defect in appliances. So held by the Wash. D. C., *Mitchell* v. *St. Ry. Co.*, 37 Pac. R. 341.

The Oregon Supreme Court affirms a verdict and judgment in favor of a plaintiff of moderate circumstances who sent a child three years old to play under the care of its nine year old brother. The child was run down at a crossing, the car running 128 ft. after the accident, before it stopped, the grade being only two and a half feet. The court held that the question of negligence upon the part of each was for the jury. *Hedden* v. *City etc., Ry. Co.*, 37 Pac. R. 540.

To some extent a motorman would have a right to assume that one in a position of danger would withdraw from it; that he would hear the gong sounded, and move to a safe place. Thus no recovery can be had, says the Massachusetts Supreme Court, in *Doyle* v. *St. Ry. Co.*, 37 N. E. R. 741.

The Oregon Supreme Court holds that though a child was negligent in going on the track, yet, if the company's servants saw its dangerous position, they must exercise all diligence to avoid injury. Further, whether the running of a car at the rate of ten miles per hour past a school was negligence, is for the jury. *Wallace* v. *Street Car Co.*, 37 Pac. R. 477.

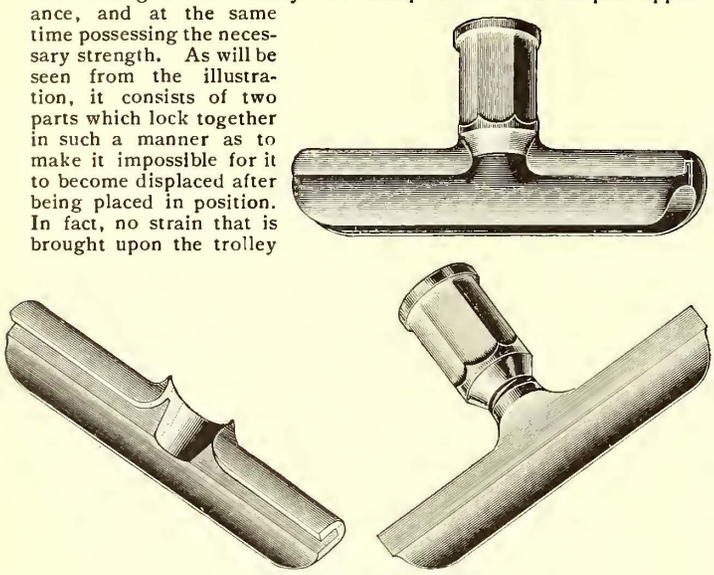
Legal Notes.

Where conductor makes a mistake in giving transfer, and the passenger in consequence thereof is ejected by the conductor of the connecting line, the company is liable. So ruled by the New York Supreme Court. *Muekle* v. *St. Ry. Co.*, 29 N. Y. Sup. 732.

In order to sustain an action against a street railway for maintaining an electric pole in a dangerous manner, it must be shown that it failed in a degree of care for public safety which it should have had, and that complainant was without fault. On the other hand it is no defense to action for injuries occasioned by a pole of an electric railway that it was placed in accordance with the provisions of the charter and city ordinance. So says the Maine Supreme Court, in case of *Cleveland* v. *St. Ry. Co.* 29 Alt. 1,005.

New Trolley Clamp.

The Central Electric Company, of Chicago, has designed, and is now offering a new trolley wire clamp of neat and compact appearance, and at the same time possessing the necessary strength. As will be seen from the illustration, it consists of two parts which lock together in such a manner as to make it impossible for it to become displaced after being placed in position. In fact, no strain that is brought upon the trolley



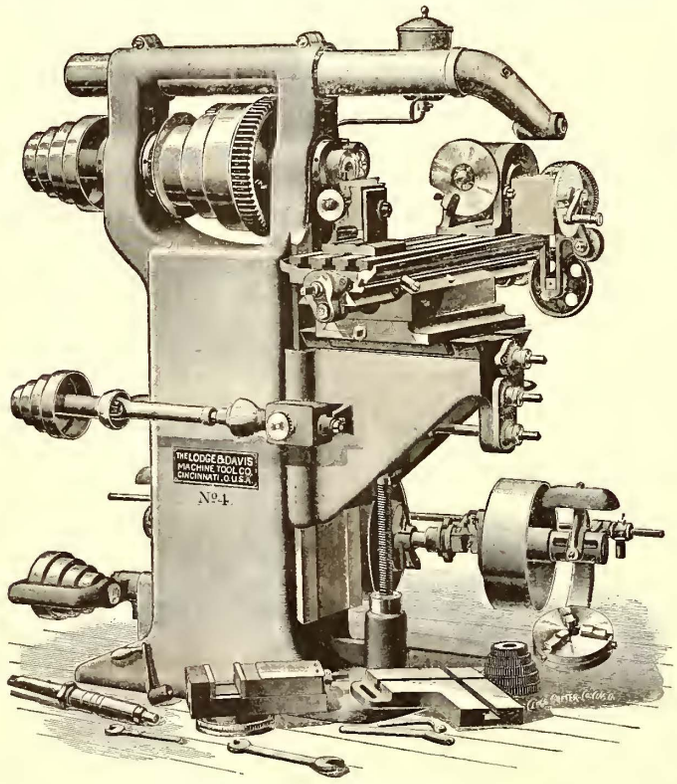
NEW TROLLEY CLAMP.

wire is sufficient to cause the clamp to release its hold. Of course no soldering is necessary.

These clamps are made to fit either a five-eighths or seven-sixteenths inch stud, and are finished in either bronze or malleable iron. No obstruction is offered to the passage of the trolley, it having a perfectly level track to run upon, and consequently there is no destructive and wasteful sparking.

Universal Milling Machine.

We illustrate on this page a universal milling machine, made by the Lodge & Davis Machine Tool Company, of Cincinnati, O. An adjustable overhanging arm is provided and fits in clamp bearings over each spindle bearing, the uprights being independently tied together, as shown. The spindle is of crucible steel, is hollow, and runs in phosphor bronze boxes adjustable for wear. The end of the spindle is



UNIVERSAL MILLING MACHINE.

threaded to take the same chuck that fits also the spiral head spindle. The table has three T slots running its entire length, and around it an oil channel is formed which catches all oil and conducts it to a drainage tube and suitable vessel which can be attached to it.

The footstock center is adjustable vertically for taper work, and the spiral head has the usual adjustments above and below the center line. It is made as compact as possible, and is provided with plates for indexing up to 360 teeth. Gears are provided for cutting spirals from 1.5 ins. to sixty-six inches pitch.

The table is fed automatically in either direction, at twelve different rates relative to spindle revolution, ranging from .007 in. to 1 in., and the feed is reversed by turning the knob seen at the left of the knee. It is automatically stopped by the stud which is adjustable in the T slot, and operates in either direction. The lower feed cone is upon a swiveling yoke which permits it to be adjusted to secure proper tension on both feed belts. The table can also be moved by hand, either from the left hand end or from the front of the knee, and it has a quick return motion. The handle by which the feed is thrown, and by which it may be thrown out if desired, is at the right of the knee.

All traversing screws are provided with micrometer graduations, and the dial plates are adjustable, and are held in place by knurled nuts which are readily loosened or tightened by the fingers. Taper ribs are provided for all sliding surfaces. The machine is provided with all the parts and attachments shown in the engraving.

The International Numeral Register.

Not satisfied with the magnificent record made with its present two styles of fare registers, the International Register Company, of Chicago, has recently perfected a third machine in the shape of a numeral disk, stationary register, a cut of which appears in this column. This new register was shown for the first time at the Atlanta Convention, and created a great deal of favorable comment. A large number of prominent delegates examined the sample which the company had on exhibition and all pronounced it a remarkably simple, substantial and and elegant machine. In the production of this device the manufacturers have not gone into any experiment, as the machine is practically a reproduction of its well known Pratt portable register, which has given such excellent service throughout the country for a number of years. The machine is a double register of a numeral disk design, having a

INTERNATIONAL NUMERAL REGISTER.

tally or permanent register with a capacity of 100,000 fares, and a trip or changeable register with a capacity of 299 fares, the latter capable of being returned to zero.

The permanent register is composed of a series of five wheels or dials arranged in a horizontal row across the face. The figures on these dials are large and plain and easily distinguished at a distance. The method of constructing this permanent register is entirely new with the International Company. The gears are all machine cut and there are no springs or pawls whatever to get out of order. Each wheel is rigid or permanent, and all are entirely dependent on the first or unit wheel for movement. This unit wheel is protected by safety dogs in such a manner as to be moveable only by pulling the cord and actuating the whole mechanism of the register. Thus, if the glass over the dial should be broken or access gained to the internal mechanism, it is impossible to change the reading of the tally, backward or forward, even though the whole mechanism be exposed. The great value of such an arrangement will be appreciated, as it overcomes all possibility of tampering with the total record, which is the most important part of a fare register.

The trip register is composed of three large revolving disks, the figures on which are seen through the aperture to the left of the center. In making this part of the register the manufacturers aimed to produce something plain, large and easily read. The figures on these trip dials are a full inch high and five-eighths of an inch wide, as shown by the engraving on the next page, which is exact size.

With large plain figures like these, the trip register can be read at

a glance, and the manufacturers claim that a person of ordinary eyesight can read them plainly for a distance of over 100 ft. At the end of the trip or run these trip dials are returned to zero (00) by pushing in the handle on the left and turning it to the left. With this operation a red curtain will be thrown into the trip window, remaining there until the register is entirely reset. This shows that the other mechanism of the register is locked and cannot be operated until the red curtain disappears.

The register has a stroke five inches long, which obviates the

EXACT SIZE OF TRIP FIGURES IN NUMERAL REGISTER.

practice of ringing up a number of fares in such quick succession as to make it almost impossible to tell how many fares were actually recorded by counting the vibrations of the bell. The manufacturers claim that a long, easy stroke is greatly preferable to a short jerk, as it will also prevent passengers from ringing up fares when meaning to signal the conductor, as the register will not operate with a short, quick pull.

As in the standard stationary machine, manufactured by this company, satin finished aluminum dials are used throughout the machine. The introduction of this metal for dials has proven very satisfactory, as it retains its beautiful white finish, giving the appearance of being always new. The size of this new register is 10¾ ins. in diameter and 4⅜ ins. thick, including the back part and actuating mechanism.

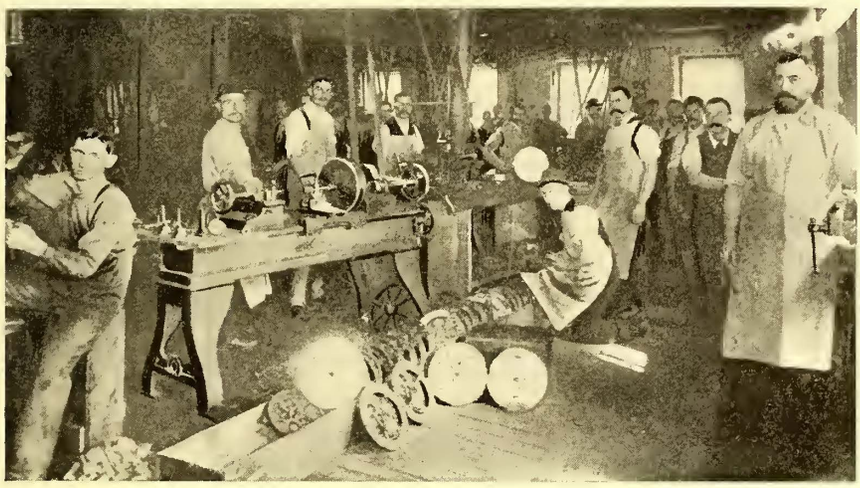


FIG. 2.—REGISTER DEPARTMENT—STERLING SUPPLY & MANUFACTURING CO.

It is made to be operated with the regulation cords and pulleys or with a rod and handles running lengthwise of the car.

The cases are finished in either nickel, antique bronze, lacquered brass or steel blue electroplating. The manufacturers recommend the latter as being the most durable, as well as making the greatest contrast with the white aluminum dials, and thus making the latter stand out plainly.

Reduction of Fares in Philadelphia.

The People's Traction Company has reduced the fares on its Germantown line from ten to five cents, and claims that it will give the longest continuous ride for five cents in the city, the distance from the present terminus of the company's Germantown line at Mount Airy to the southern terminus at Snyder Avenue being nearly ten miles. The present extensive system of one fare transfers will continue in operation, and transfer arrangements between the People's Traction Company and the Electric Traction Company is now under consideration. If accomplished, passengers from Germantown can reach any part of the city for a single fare.

It is expected that the greatly improved electric railway facilities through Germantown and Chestnut Hill will develop that section of Philadelphia to such an extent that the Pennsylvania Railroad Company's earnings, though temporarily reduced, will eventually be increased, while the electric lines themselves will secure an enormous traffic.

THE street railway company of Watertown, N. Y., proposes to extend the electric road from Brownville to the village of Dexter.

Works of the Sterling Supply & Manufacturing Company.

We present on this page some illustrations of the very busy shops of the Sterling Supply & Manufacturing Company, at 97 Bank Street,

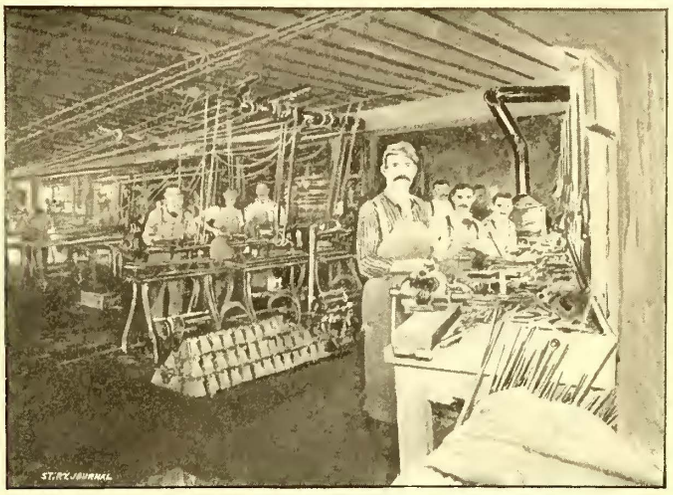


FIG. 1.—SAND BOX DEPARTMENT—STERLING SUPPLY & MANUFACTURING CO.

New York, the manufacturers of the Sterling registers, Sterling fenders, sand boxes, gates, etc. This company has been in existence considerably less than a year. It succeeded the old firm of Benton & Keyes, in the register business, in February last, but immediately added sand boxes, fenders and similar supplies to its line of manufactures. It has been singularly fortunate in having had its devices adopted on some of the largest and most important roads in the country. Among its customers it numbers such companies as the Metropolitan Traction Company, of New York; the Consolidated Traction Company, of New Jersey; the Nassau Electric Company, of Brooklyn; the Citizens' Street Railway Company, of Indianapolis; the New Orleans Traction Company and so on. The selection of the Sterling devices by such persons as are in the management of these and similar roads is equivalent to a certificate of merit, of far greater value than any medal or diploma that could have been procured.

The Sterling Supply & Manufacturing Company occupies two large shops, at 97 Bank Street, of about 10,000 sq. ft. aggregate floor space. It began with half this space, but the growth of its business soon required more room, and it looks now as though still larger quarters would be needed. One of our engravings shows the register department of the company, one the sand box department and one the fender department.

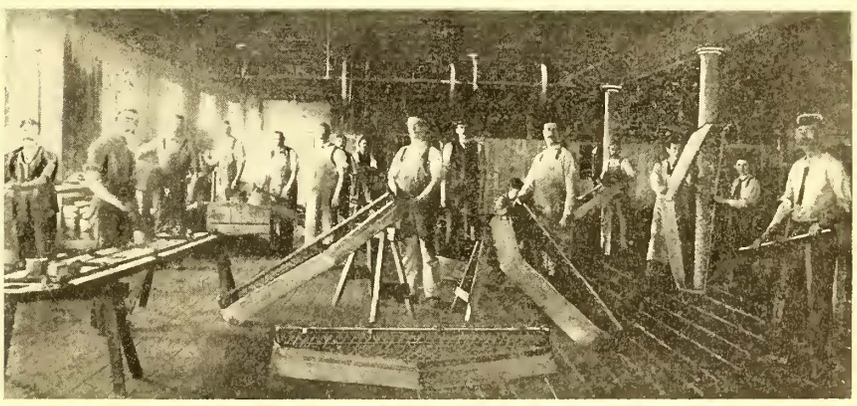


FIG. 3.—FENDER DEPARTMENT—STERLING SUPPLY & MANUFACTURING CO.

The company has in its employ John B. Benton, who may well be called the "Father of the Fare Register," and who without doubt is in the front rank of inventors in his line. Mr. Benton devised the register that has been in daily use on the Third Avenue road of New York for nineteen years, and the newest type of machine, the numeral disk machine is also his invention. The superintendent is the well known John J. Kennelly, familiarly and universally known as "Jack," whose connection with the street railway business covers many years of service, and whose experience embraces all its phases.

The energetic president is John H. Carson, with whom many of the readers of this paper are acquainted. He is urbane, indefatigable and always ready to explain the advantages of the Sterling goods. We wish to the Sterling Supply & Manufacturing Company a continuance of its present prosperity.

New Type of Street Car Heater.

The Safety Car Heating & Lighting Co., whose Pintsch gas lighting system for railway cars has achieved such a high reputation abroad and in this country, has recently put on the market a new type of heater for street cars. The system has been in use on one car of the Third Avenue Railway of New York for some time, and is giving excellent satisfaction both in quantity and quality of heat, and as regards economy of operation.

Coal is used as fuel, and the heat generated is distributed by water circulation similar to the well known and widely approved Baker

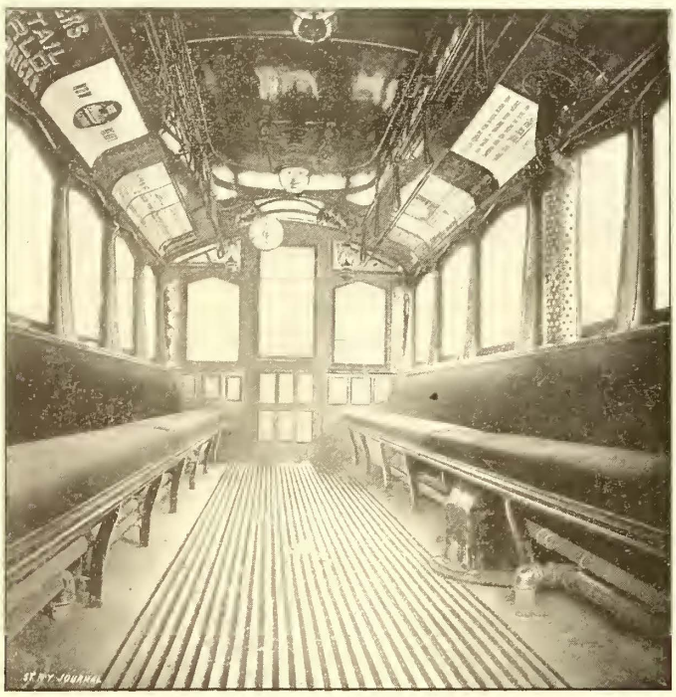


FIG. 2.—INTERIOR OF THIRD AVENUE CAR, NEW YORK.

heater system for steam railroad cars. The radiating pipes extend the full length of both sides of the car underneath the seats. The stove is a suspended heater, the fire being entirely outside of the car, and all ashes and dirt are removed from without. The smoke pipe or flue is arranged behind the seat backs. In this way no seating space in the car is lost, and the cost of the apparatus is soon made up by the additional seating capacity gained.

Fig. 1 shows the general arrangement of the apparatus, and Fig. 2 the interior of a car of the Third Avenue Railway, New York, equipped with the device. In the latter view the circulating pipes are distinctly shown. The upper end of the stove is behind the screen near the center of the car, and the smoke pipe with a protecting shell is shown behind the seat back. A small coal fire, four to six inches deep is used, and from twenty-four to thirty pounds of coal are used each twenty-four hours.

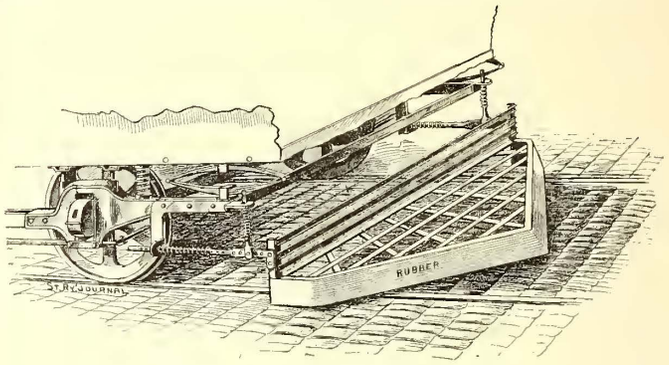
Behind the radiating pipes a galvanized iron deflector is placed, which throws the heat out into the car, and avoids the unpleasant heating of the seat.

This system provides for maintaining a continuous fire, and avoids the expense, dirt and annoyance of having to rekindle fires frequently. It also gives an opportunity for governing the temperature of the car by having the water in the radiating pipes vary in temperature from that of the atmosphere to at least 212 degrees, thus allowing any amount of radiation that may be desired.

The heat afforded is also much pleasanter than that from ordinary stoves. That produced by the latter is local, and is not distributed evenly throughout the cars. As a result, the persons sitting near the stove are overheated, while those at some distance are practically no better off than if there were no stove in the car. Again, with this heater there is no opportunity for the escape of gas into the car, and the atmosphere which the passengers breathe is not vitiated in the least, as all the air supply for combustion is taken from the outside of the car, and the products of combustion are delivered outdoors. By its use, also, there is no chance for drying the air in the cars and creating the close and unpleasant odors often caused by the overheated surfaces of a stove. The location of the heating pipes, under the seats, is a desirable one, and the fact that they are so placed will tend to keep the floor always dry.

The Crawford New Automatic Fender.

We illustrate on this page a fender recently brought out by the R. C. Crawford Manufacturing Company, of Pittsburgh, Pa. Mr. Crawford has made a long and careful study of the fender problem, and his other fenders are well known to street railway managers. The fender illustrated was designed for special service, and is similar to the



NEW TYPE OF AUTOMATIC FENDER.

Broadway fender, except that it is supported in the Crawford patent method.

The frame is made of angle iron, and the ends are bent up, forming the rear of the fender. To these ends is riveted a light steel channel bar forming the back screen. The platform screen is composed of $1 \times \frac{3}{16}$ in. steel strips riveted together, a few of which overhang and are bent at the proper pitch. The rubber toe is riveted to the ends of these overhanging strips. The depth of the rubber is about four inches.

The frame is hung to the truck in the well known Crawford method, using vertical and horizontal spring actuated rods, except that the horizontal rod is riveted to the platform frame instead of pivoted. The fender platform measures from eighteen to twenty inches wide at the center of the V, and tapers to four inches wide at the two sides. It can be carried to run within one inch of the roadbed or any height from the track.

Owing to its construction, if struck by a movable object it will be pressed close to the track, preventing the object from getting under the wheels. If struck by an immovable obstruction or unevenness in the roadbed, it will relieve itself by the spring actuated vertical rod, which permits the fender to move upward. The power or tension of these springs can be increased or diminished as desired by moving a pin.

The fender can be carried as close to the wheel as desired by means of the adjustment holes in the horizontal rod. When necessary to put new wheels under the car, this fender can be removed by pulling two pins, and in case the wheels are of different diameters the fender can be adjusted to suit any diameter of wheel. The fender can also be folded up off the track, if desired.

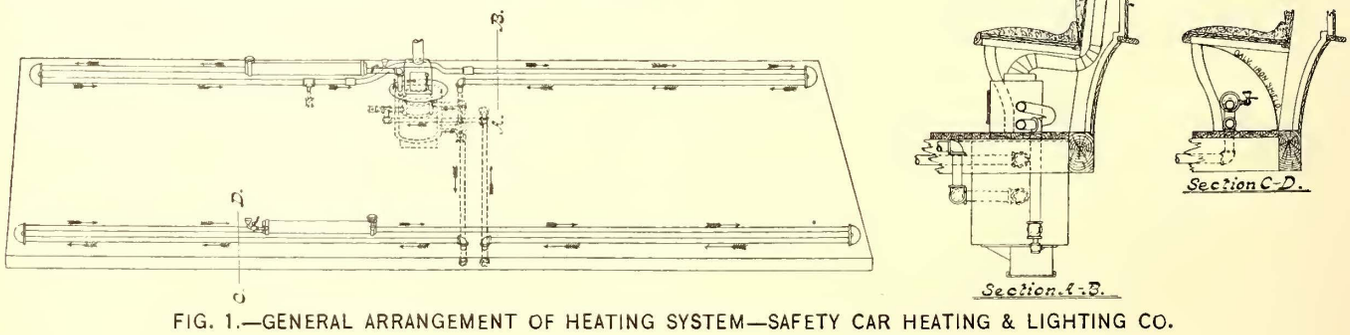


FIG. 1.—GENERAL ARRANGEMENT OF HEATING SYSTEM—SAFETY CAR HEATING & LIGHTING CO.

Removable Vestibules.

Reference was made under "Convention Notes" in our last issue to the Brill removable vestibule shown at Atlanta. We present herewith an engraving of the double truck car exhibited, equipped with the vestibule. The desirable features of a removable vestibule are low cost, facility of attachment to any motor car dasher without extending beyond the line of bumper, and effectiveness. These latter features

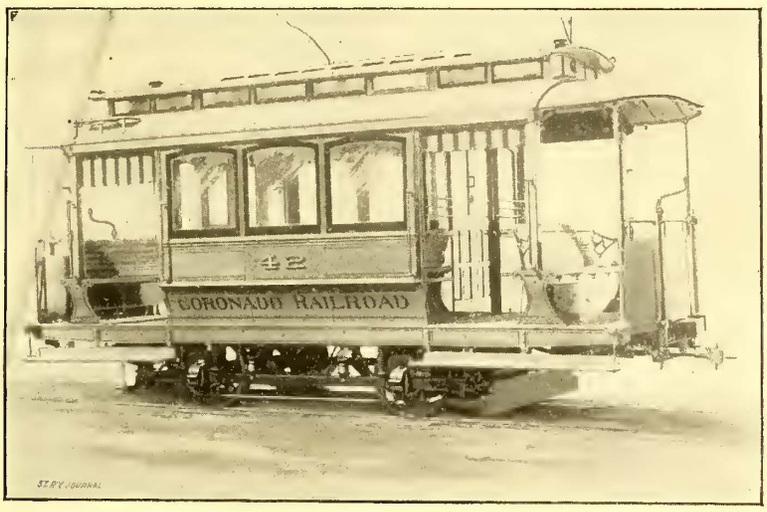


FIG. 1.—COMBINATION CAR—J. G. BRILL CO.

have heretofore been the main difficulty encountered, owing to the location of the brake shaft.

The brake handles used generally on electric cars, having a sweep of twelve inches, make it necessary to extend the vestibule out beyond the line of the buffer, or altering the location of brake shaft on platform, so that the handle will clear the vestibule, occupying much unnecessary room. A vestibule extending beyond the line of the dasher has the disadvantage of liability to breakage by the cars being run together in car houses and on street collisions.

The vestibule shown avoids the disadvantages referred to. It can be applied to any motor car having a dasher, and does not extend outside the line of the dasher. The brake handle is removed from the brake shaft proper and is placed on a short auxiliary shaft, which is fastened to and forms a part of the vestibule, which auxiliary shaft is geared to main shaft, clearance being given for the largest sized handle.

There were altogether three cars shown by the Brill Company at Atlanta. These were respectively a single truck car, a double truck car and a combination car. The first was finished throughout in solid mahogany, having round corner panels and carved finish. The decoration while not elaborate was very tasteful, and the car attracted a great deal of attention. The length was eighteen feet, the width at seat was six feet two inches, and the width over the belt rail was seven feet six inches. The interior of the roof was ceiled with three-ply veneer. The mahogany sashes were glazed with polished plate Mahogany blinds and spring roller curtains were used. The seats and backs were of mahogany strips covered with handsome Wilton carpet. Brill's patented gates, radiating drawbars, steps, ratchet brake levers were used, and solid bronze metal trimmings were employed throughout. The car was mounted on Brill No. 21 B truck with half elliptic springs under the journal boxes and elliptical spring buffers, which in actual service overcame all oscillation. The second car on exhibition was a twenty foot car body mounted on Brill's Eureka maximum traction trucks and is shown in Fig. 3. The finish of this car was identically the same as the eighteen foot car body, except cherry was used in place of mahogany. The car was mounted on Brill's Eureka maximum traction trucks, and notwithstanding the fact that many of the curves in Atlanta were of sharp radius without guard rails and far from perfect, the trucks showed no disposition to get off the track.

The other style of car was a combination open and closed car (Fig. 1), measuring twenty-one feet six inches long and was one of a lot furnished the Coronado Beach Company, of Coronado, Cal. The closed compartment

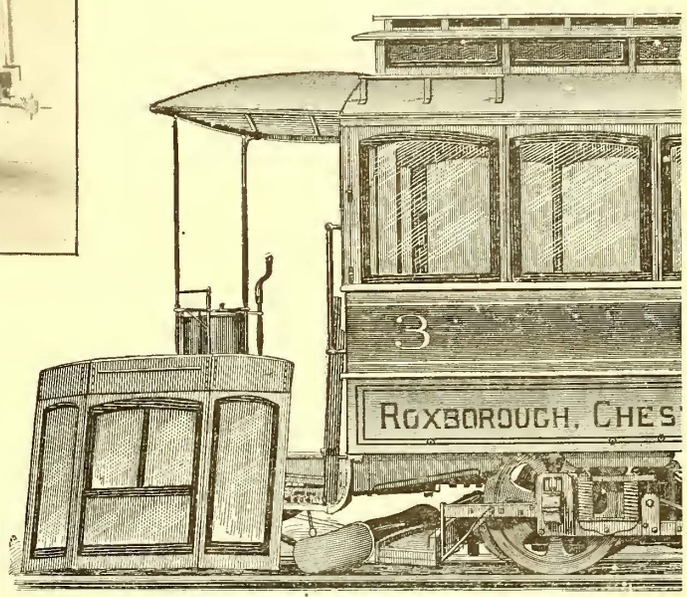


FIG. 2.—REMOVABLE VESTIBULE—J. G. BRILL CO,

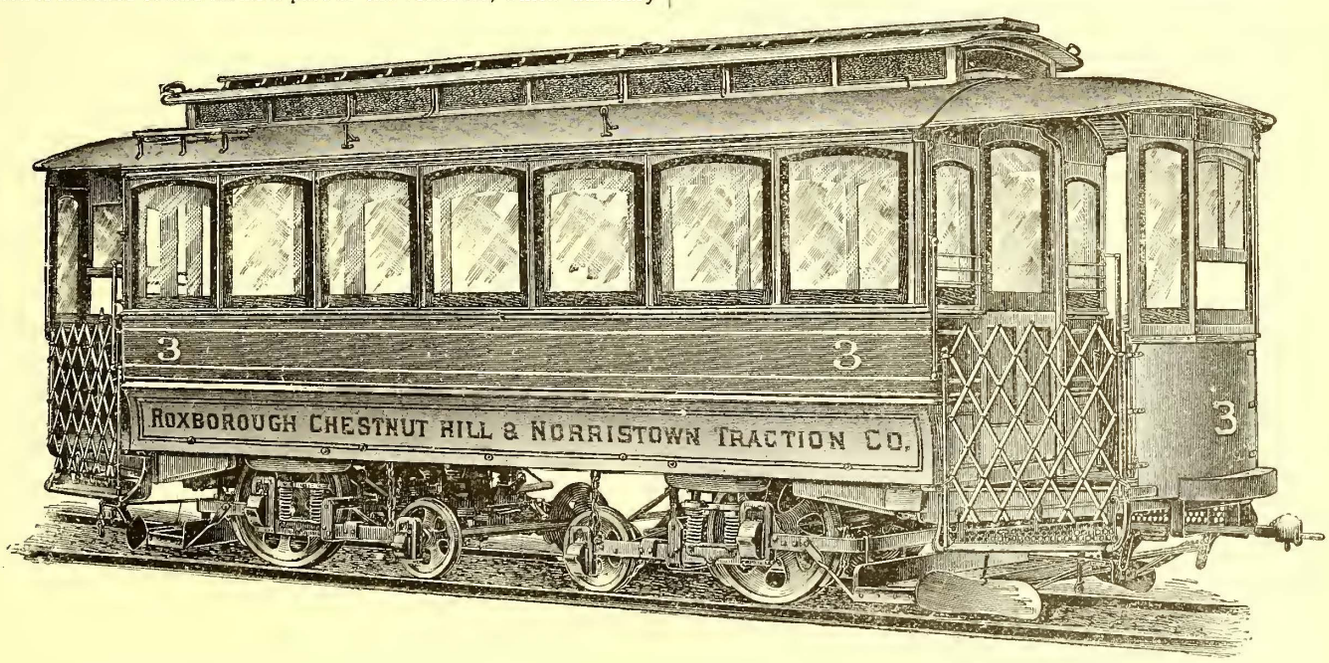


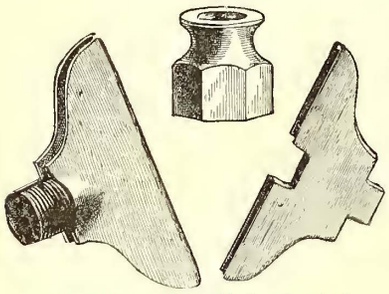
FIG. 3.—CAR EQUIPPED WITH REMOVABLE VESTIBULE—J. BRILL CO.

measured eleven feet nine inches and was elaborately finished in mahogany, with handsome curtains, hand upholstered. In the main the description of the inside finish of the eighteen foot car applies to the closed compartment of the Coronado car. The car was mounted on No. 21 B truck.

IT is stated that certain St. Louis capitalists are trying to obtain a franchise to build a street railway through East St. Louis, Venice and Madison, Ill.

The Van Buren Mechanical Clip.

The trolley wire support, shown in the accompanying illustration, is of the type known as "mechanical." It is designed to hold the line firmly and to make the splice without the use of solder. It is simple in construction, and easily and quickly adjusted. No special tool is required, as any ordinary wrench or pipe tongs will answer the purpose. The clip is composed of three parts, as shown. One is the shoe or U-shaped hanger with a screw lug at the top. In this the wire rests. Another is the tongue or clamping piece, which fits into the shoe, and rests on the top of the wire; while the third is a nut which screws on the lug shoe, pressing the tongue down and making a vise-like pressure on the wire. The nut is adjusted at the top to fit the various insulator studs. It makes, on the whole, a very strong and durable support, avoids the use of solder, and is claimed to save a great deal of time ordinarily consumed in putting trolley supports in position. The shoe, or running surface, is almost straight, so that the trolley wheel meets with practically no obstruction. Another feature is that any of the parts can be replaced with new ones, as they may be needed, at a cost much less than would be necessary if the entire hanger had to be removed. The clip is made and sold by H. Van Buren & Company, of Philadelphia, Pa.



VAN BUREN MECHANICAL CLIP.

The Brady Metal Company.

The Brady Metal Company, with an office in the Boreel Building, 115 Broadway, New York City, is now one of the leading manufacturers of an extensive line of metal goods, among which may be mentioned street car and electric car brass castings, bearings and trolley wheels, babbitt metal of nine different grades, phosphor bronze in ingots, bearings or castings, solder of high grade; standard crowfoot battery zincs, Magnus anti-friction lining metal, Magnus tin, Magnus metal for locomotive engine castings, and bearings for high speed shafting, self-fitting, lead-lined journal bearings for passenger and freight cars, locomotives and all classes of engines. The company has a brass foundry fitted with all modern tools and appliances, including a well appointed pattern shop with more than 6,000 patterns. This is located at 202–208 10th Street, Jersey City, N. J.

The two leading and best known officials of the company are Daniel M. Brady, president, and Adolph Onslow, general superintendent and metallurgist. Mr. Brady, who is also general sales agent of the company, served for more than eleven years as chief clerk to the late Leander Garey, when the latter was in charge of the car department of the New York Central & Hudson River Railroad and leased lines, and has been in active railway and manufacturing service for the past twenty-five years. He is, therefore, well equipped through long practical experience to deal in the most thorough manner with the technical requirements of engine and car equipment.

Mr. Onslow is a mechanical engineer of thirty-five years' experience, and was for seventeen years manager for the late D. A. Hopkins. He has the honor of having put up the first plant in America for the manufacture of self-fitting, lead lined journal bearings, of which in the past twenty-six years he has made more than 10,000,000. As is the case with Mr. Brady, his long practical experience places him in a position to deal intelligently with the demands of steam and street railways for the most serviceable and durable equipment.

An important feature of the method employed by the Brady Company, by which the self-fitting, lead lined bearings are moulded, is that every bearing is cast face down, regardless of the inconvenience in moulding or its extra cost. This method insures a solid bearing surface. The company invites close inspection and caliper tests at its works as well as chemical analysis at railroad or outside laboratories. Every pound of metal sold is fully guaranteed. These bearings are in use on six of the principal railroads in the East, running high speed limited trains, and up to date not one recorded complaint has been made against them.

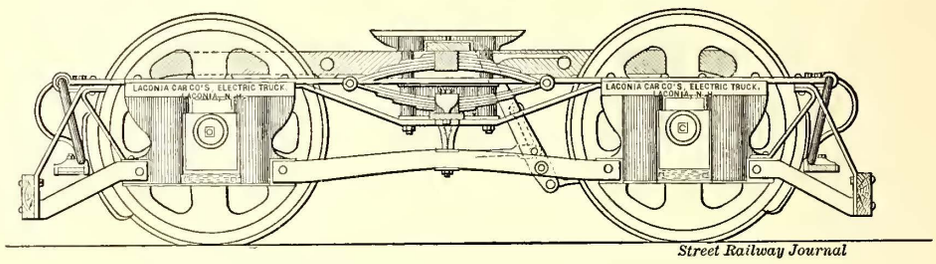
The metals known as "Magnus," which are sold in either ingot or casting form, are now in use on many prominent roads, and the demand is constantly increasing. The latest extraordinary record made by Magnus metal bearings in a competitive test on a well known line, showed 3,194 miles of service to one ounce of wear.

The Brady Company is now supplying many of the largest surface lines with street car and electric car brasses, castings and trolley wheels, and is fully equipped for turning out material for very large orders of the same standard quality as the supplies which have been furnished for locomotive and steam car service. The company has a foundry capaclty of 1,000 bearings and 10,000 lbs. of engine metal per day, and the output has increased 500 per cent. in the past six years.

The company undertakes to furnish metal at fixed prices per pound on monthly and yearly contracts, or, if desired, will furnish metal at current prices, these depending upon the current metal market for raw material.

Laconia Standard Truck.

We present on this page an engraving of the standard four wheel truck of the Laconia Car Company. Since the first of March the company has sold over 200 of these trucks in New England, and it has been adopted as standard by the West End Street Railway Company, of Boston. The chief claims made for this truck are: Absolute simplicity of construction, low cost of maintenance, economy in first cost, quick, powerful brake mechanism, every part exactly fitted and machined, the use throughout of all hot Norway iron rivets in its construction, and material and workmanship of the highest order. The car runs smoothly and steadily, and, it is claimed, avoids all pounding of the track.



Street Railway Journal

FIG. 1.—LACONIA SWIVEL CAR TRUCK.

Since the disastrous fire last June at its works, the Laconia Car Company has rebuilt, with much larger shops and greatly increased facilities. In the electrical department the company can turn out annually 700 car bodies and 1,000 standard trucks. In its steam department it can build 175 passenger coaches and 2,000 freight cars, and in its foundry can supply 15,000 car wheels for steam railways per annum, as well as gray iron castings for other purposes. As will be seen, the facilities in every department are of the best.

The Trimble Car Fender.

Jas. A. Trimble, the car builder, of New York City, is placing on the market a new fender which possesses some interesting features.

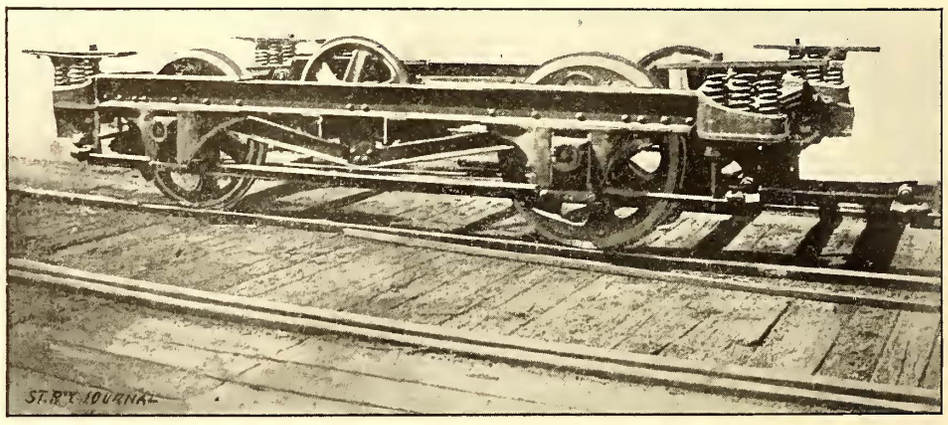


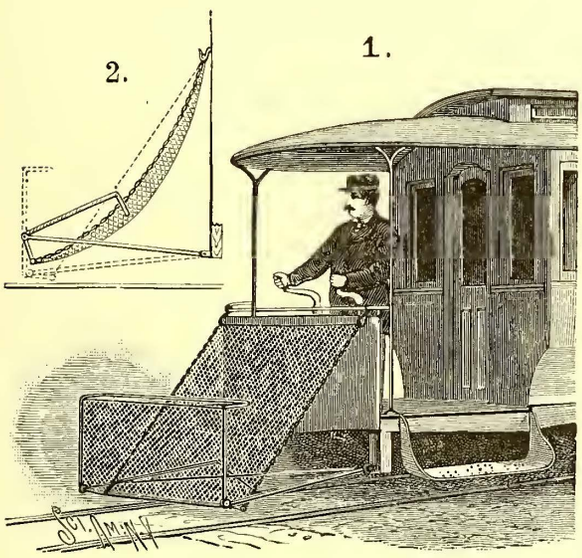
FIG. 2.—LACONIA TRUCK FOR SHORT CARS.

It consists of two folding arms which are attached to the under side of the car platform, and which are so arranged as to fold back of the line of the platform out of the way of the drawbar and bumper. The folding arms, when extended, form the sides and supports of a large basket-like network. The fender in its normal position is folded and at a height of about eight inches above the rails. In case of accident, the motorman by pushing with his foot a trip conveniently located on the platform, releases springs which instantly throw the fender out, spreading the net to within a very short distance of the pavement and covering the entire width of the track. There is no rigid bar or iron pipe across the front of the fender. In this extended position the fender is about two inches from the surface of the pavement, and is so arranged that in striking an immovable object, such as a high paving block, it will rise over the obstruction. The folding feature of the fender is important, because it permits the

use of trailers or the storing of cars close together in the car house without interference. The fender is at present in use on the North Hudson County Railway Company's lines.

An Improved Street Railway Car Fender.

The fender shown in the illustration is designed to be so flexible that it cannot possibly injure a person whom it strikes, but will catch up such person in such way that he or she will be carried safely along with the car until the latter may be stopped. The improvement has been patented by Henry W. Eaton, of No. 45 William Street, New York City. Fig. 1 shows the device in use, Fig. 2 being a side view, representing the position of the parts when a person has been caught on the fender. A forwardly extending lower framework is connected by a hinge joint to the car, and chains extend from the forward end of the frame to hooks at either side of the dashboard. The chains are connected by a netting, and are only indirectly connected with the lower frame, being attached at their outer ends to the arms of a swinging frame pivoted to the lower frame, and which extends normally upward, as shown in Fig. 1, this frame when turned over, as shown in Fig. 2, striking the chains and network to depress them near the center, and swing them and the frame up slightly at the front end of the fender. The lower arms of the swinging frame have at their free ends a cross bar extending beneath the sides of the lower frame, limiting the upward swing of the arms and the outward movement of the swinging frame. The first effect of striking a person is to cause the upright frame to yield gradually, so as to break the force of the blow, and the same moment the network, engaging the legs tightly between the knees and the ankles, relieves the body of much, if not all, of its weight and prevents the danger of breakage of the ankles by sudden shock. There is no chance for a person to be thrown violently against the dashboard. The vertical frame then swings inward under the weight of the falling body thus thrown upon the two nettings, the side chains buckling and raising the lower portion of the fender frame at its outer end. The whole device may be folded up in small space on the end of the car when not in use.



THE EATON STREET RAILWAY FENDER.

Coal Handling Machinery.

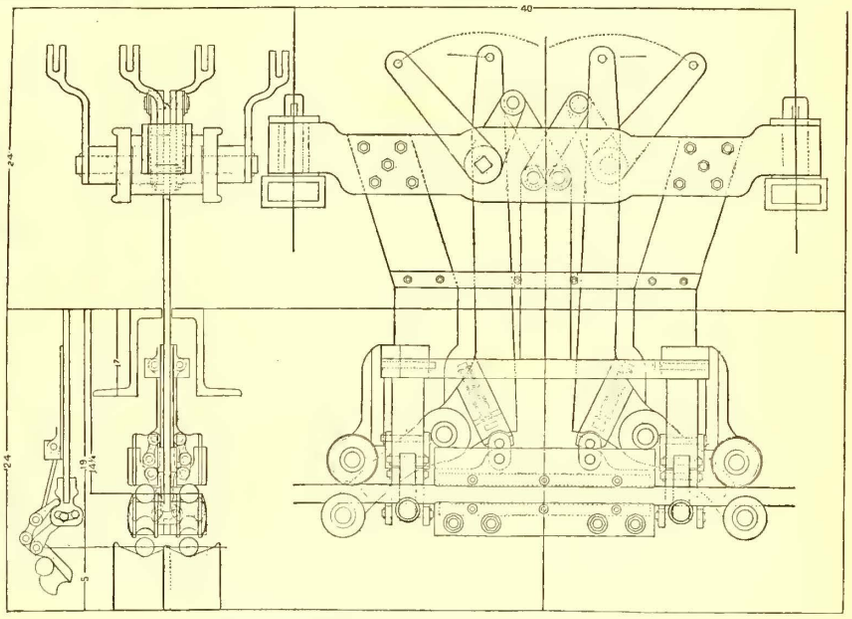
As before mentioned in these columns, the C. W. Hunt Company, of New York City, is furnishing some of the largest plants in the country with the most modern machinery for handling fuel and its refuse. One of the street railway plants in Brooklyn, equipped in this way, was recently described in our columns. Another plant of considerable importance, which this company has recently equipped, is that of the Ridgewood pumping station, of the Brooklyn (N. Y.) Water Works. This station has a daily capacity of 110,000,000 gals. The boiler plant consists of six boilers of the Bigelow make, and four internal fire, return flue boilers built by the Edge Moor Iron Company, of Delaware. About 120 tons of coal are burned daily. This is received in bottom dump cars, the track coming into the building at right angles to the line of the boilers and is loaded into the conveyor which passes below the cars underneath the hopper. It then passes vertically to the monitor of the storage building, where it is carried horizontally, and discharged at any part of the building. As the upper line of the conveyor is situated in the monitor at a considerable distance from the floor of the storage building, it is intended that as the coal is stored in the building, it shall be dumped on the side of the pile, which is nearly as high as the conveyor line, and gradually run down the slope to the floor, so that in falling the breakage of coal may be the least possible.

As the coal is received by railroad, it necessarily comes intermittently, and for this reason an especially large conveyor has been installed, which has a capacity large enough to unload a thirty ton car in thirty minutes. This conveyor consists of a series of gravity buckets pivoted on a double chain, the whole system being carried on self lubricating wheels. The buckets are so pivoted on this double chain that the force of gravity keeps them always in an upright position, whether full or empty, and no matter how tortuous may be the track over which they are drawn. The conveyor chain is driven by a special engine located in the top of the storage building, which engages with the chain by pawls, and the whole machine is so designed that dust cannot get into the working parts. It is noiseless in operation and moves slowly, the capacity being obtained by the size of the buckets and not by the speed of the chain. The coal is taken from the storage, weighed and delivered to the boiler room by a system of cars, tracks and scales. The cars are so designed that the fireman shovels direct from them into the furnaces.

The whole plant is of the most modern type. Although in this particular instance, the steam generated is used for pumping machinery, the methods of handling coal are applicable to similar boiler plants which are used in connection with street railway power houses. The adoption of modern methods in the handling of coal and ashes simply from the standpoint of economy cannot be too strongly urged.

A Combined Grip, Pick-up and Throw-off.

The accompanying engraving shows a grip with pick-up and throw-off, for cable railways, invented by George Muller, of Hoboken, N. J. The grip was designed for the Broadway cable conduit which has a depth of twenty-four inches. The mechanism of the grip consists of a fixed lower jaw and a movable upper jaw, the latter being actuated by two pivoted levers which carry gripping pulleys on their lower ends. Above these pulleys are arranged stationary pulleys which are mounted to turn on fixed spindles secured to the same frame which supports the lower jaw. The pulleys grip slightly in advance of the jaws, making the grip on the cable a gradual one, and causing the car to start without a jerk or jar. The pulleys are adjustable for wear, and their use reduces the friction on the cable when the car is running at slow speed. A very important feature of the grip is that a car can pass around curves at any speed, or, if necessary, can be brought to a stop on a curve. In this case, if the inner cable is in the grip, the flanges of the pulleys will prevent it from being drawn out of the grip, and if the outer cable is gripped the flanges of the pulleys will hold it free from the corners of the grip frame, and thus prevent the excessive friction and avoid the stranding of the cable.



COMBINED GRIP, PICK-UP AND THROW-OFF.

On a straight section of road, the grip, when released by the gripman, will open automatically, owing to the downward tension of the cable on the pulleys which are fixed on the ends of the levers. The cable is thereby freed as soon as the brake is applied to stop the car. The length of the two levers from the fulcrum to the upper ends produces such force that the grip is operated by the gripman with very little exertion.

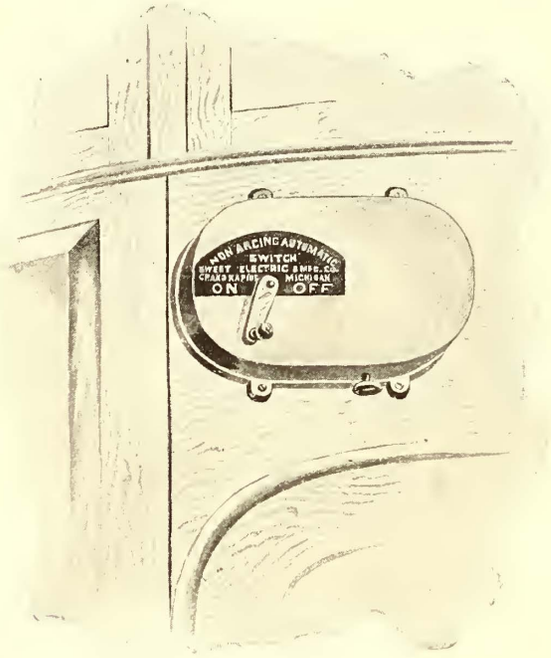
The combined pick-up and throw-off is shown in the cross section and detailed view of the pick-up at the lower left hand corner of the engraving. By this device either cable can be picked up at any straight section of the road, and should the pick-up arms come in contact with a carrying pulley they are so constructed as to roll over the latter without injury. The throw-off movement of the pick-up arms is a positive outward push that will force the cable out of the grip, even if there should be a loose strand in the cable; therefore, when the gripman first discovers that his cable is stranding, he can throw it off, stop his car and telephone to the power house.

As will be seen, the grip is devised for a duplex system, and by means of the pick-up can throw off the dead cable and pick up the live cable, in case of change of cables at any time. This will avoid the long stops of the cars in case of an accident during the busy hours of the

day, and should the road be blocked by a fire, the gripmen, after they have brought their cars over the crossovers, can pick up the cable and proceed. Should a car be stalled on a curve by a stranded cable which has been stopped and the cable be behind the grip, the outward push of the throw-off movement makes it possible to free the car from its anchored position, the leverage being sufficient to accomplish this result. An earlier form of the grip was illustrated in the STREET RAILWAY JOURNAL for December, 1892, in which four positions of the pick-up arms were shown.

Street Car Limit Switches.

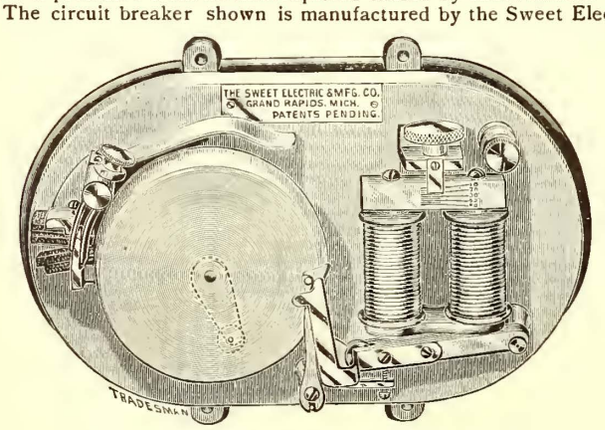
The definition of a limit switch is a cut-out or a magnet circuit breaker which opens the circuit instantly on a predetermined strength of current. The circuit breakers or magnetic cut-outs most familiar are those which are used on switchboards in power stations, and embody in all instances the long-throw switch to break the violent arcing, which always occurs on the breaking of the current.



NON-ARCING AUTOMATIC SWITCH, CLOSED.

Circuit breakers have been found more reliable than fuses, since the latter will pass momentarily great volumes far in excess of their nominal fusing capacity. In other words, if a coil in the armature in the field or any part of the motor should short circuit, or even a dead ground through cable connections becoming bare, momentarily the fuse will often carry 250, 300 or 500 amperes without fusing, and will open the circuit breakers at the station controlling the division on which the disabled car is. This affects every car on that division, whereas, if a simple and absolute circuit breaker is on each car the station is protected from all interruptions caused by short circuit.

The circuit breaker shown is manufactured by the Sweet Electric



NON-ARCING AUTOMATIC SWITCH, OPEN.

& Manufacturing Company, of Grand Rapids, takes up but little room, occupying a space of only $3 \times 8 \times 11$ ins. It has no lever for opening the circuit, but when the latter should be opened a small push button, conveniently located outside the circuit breaker may be pressed, accomplishing this result The switch is non-arcing and circular in form, and is easily charged from one car to another.

It has been urged that a magnetic or automatic circuit breaker is too sensitive, and that sluggishness is desirable for a street railway fuse. This may be true as far as the regular range of variation is concerned, but the same result can be accomplished by setting the breaker to the proper point. For instance, if the extreme maximum limit of current, even momentarily used is, say, seventy-five amperes, the circuit breaker can be set to open on the passage of, say, 100 amperes. The fuse does not protect, although rated at fifty, for it will momentarily carry 500 amperes.

No More Passes in New York State.

According to the new Constitution recommended for passage by the Constitutional Convention of New York, and passed upon favorably by the people at the last election, it is provided that

"No public officer or person elected or appointed to a public office under the laws of the state shall directly or indirectly ask, demand, accept, receive or consent to receive for his own use or benefit or for the use or benefit of another, any free pass, free transportation, franking privilege or discrimination in passenger, telegraph or telephone rates, from any person or corporation, or make use of the same himself or in conjunction with another. A person who violates any provision of this section shall be deemed guilty of a misdemeanor, and forfeit his office at the suit of the Attorney General. Any corporation, or officer or agent thereof, who shall offer or promise to a public officer or person elected or appointed to a public office any such free pass, etc., shall also be deemed guilty of a misdemeanor, and liable to punishment, except as herein provided. No person, officer, etc., of a corporation giving any such free pass, etc., herein prohibited, shall be privileged from testifying in relation thereto, and shall not be liable to civil or criminal prosecution therefor if he shall testify to the giving of the same."

According to a recent decision of Justice Ingraham, of the Supreme Court, a policeman is a "public officer," and cannot ride free on street cars, as is now the almost universal custom in New York City and State. This decision has created a sensation among the police force in New York, as it is believed that it will have the effect of taking at least $100 a year out of every policeman's pocket.

Portland Cement.

A recent number of *Engineering* contains a valuable article on methods of testing Portland cement, from which we quote as follows:

"It has been repeatedly shown that the tensile strength of coarsely ground cement, gauged neat, is much greater than that of the same cement finely ground, but that the tensile strength of a mixture of the former with sand is much less than that of a similar mixture made with the latter. For example, Messrs. Dyckerhoff found that cement which would leave a residue of 10 per cent. of coarse particles on a sieve of 400 meshes to the square centimetre (equal, say, 2,500 meshes per square inch) has a tensile strength when gauged neat nearly 42 per cent. greater than that of the same cement from which the coarse particles had been removed by a sieve of 5,000 meshes to the square centimetre, (equal, say, 32,200 meshes per square inch), but that a mixture of one part of the fine sifted cement to three of sand had 41 per cent. greater tensile strength than a similar mixture made with the unsifted cement, this percentage being increased to 64 in the case of a mixture of one of cement to five of sand. The samples in each case were twenty-five weeks old.

"Similar results have been obtained by many others who have investigated the subject. In one series of experiments made by the writer, it was found that adding 20 per cent. of the coarse particles to fine sifted cement decreased the tensile strength by 47 per cent., the age of the sample being seven days. Taking all the evidence into consideration, there can be no doubt that the tensile strength of neat cement is a comparatively useless test in assisting us to form a correct judgment of the true value of the material; nor does it seem reasonable to expect that the tensile strength of any material should be any indication of its cementing power. If, however, it should be desired to know the true tensile strength of cement, the active portion alone should be used, the inert portion being removed by a No. 180 sieve.

* * * * *

"A careful review of the present system of cement testing leads to the following conclusions:

"1. That the strength of a mixture of cement and sand is the most reliable of the present tests.

"2. That the tensile strength of neat cement may be omitted altogether as a test of good quality.

"3. That the weight per bushel is misleading, and should be omitted altogether.

"4. That color is not of sufficient importance to be considered as a test.

"5. That extreme fineness of grinding is so absolutely essential that a sieve of not less than from 175 to 180 meshes to the lineal inch should be used for testing purposes.

"The result of experience, therefore, compels us to arrive at the further conclusion that the present method of testing Portland cement requires very considerable alteration."

THE Allegheny Traction Company's property in Pittsburgh has been damaged by fire to the extent of $75,000.

St. Louis Street Railways—Statistics of Mileage.

The following figures, showing the exact mileage of the street railway companies in St. Louis, have been kindly furnished to us by Mr. Winthrop Bartlett, a civil and electrical engineer of that city. This table is correct to September, 1894.

	Miles of Single Track.	
	Owned.	Extensions.
Union Depot Railway Co.	76.74	0.55
Lindell Railway Co.	55.08	2.73
People's Railway Co.	13.60	.....
Missouri Railroad Co.	26.04	2.68
Southern Railroad Co.	15.66	11.02
St. Louis & Suburban Railway.	28.64	.....
Cass Avenue & Fair Grounds Railway.	32.18	18.03
Citizens' Railway Co.	16.60	1.49
Southwestern Railway Co.	5.04	5.04
St. Louis Railroad Co.	26.69	.....
Clayton & Forest Park Electric Railway.	4.00	.....
Delmar & Clayton Electric Railway.	0.97	3.09
Manchester Road Electric Railway Co.	2.60	2.60
Total.	303.84	47.23

Electric Mileage.	265.02
Cable "	33.83
Horse "	4.99
Total.	303.84

Statement From St. Louis.

The street railway companies of St. Louis have made returns to the City Register, of business done during the third quarter, as follows:

	Trips.	Pass.
Baden & St. Louis.	22,238	149 854
Cass Avenue & Fair Grounds.	174,960	2,372,147
Citizens'.	142,732	1,825,583
Jefferson Avenue.	23,025	343,049
Lindell.	339,740	4,572,958
Missouri.	280,798	3,572,829
People's.	49,904	1,011,792
St. Louis.	171,522	2,695,703
St. Louis & Suburban.	30,389	2,025,525
Southern Electric.	78,384	1,136,465
Union Depot.	173,749	5,039,491
Total.	1,487,441	24,745,396

The totals for the third quarter of 1893 are: Trips, 1,518,566 passengers, 25,045,049.

Electric Locomotive for the Baltimore Belt Line Tunnel.

The General Electric Company has just completed at its Schenectady Works the trucks for the electric locomotive which it is constructing for the Belt Line tunnel of the Baltimore & Ohio Railroad at Baltimore. The locomotive when completed will weigh at least 100 tons and will be 1,200 H. P. traction. Its speed can be varied from zero up to thirty-five or forty miles an hour, and this can be increased if desired. For the work contemplated, thirty miles an hour will probably be the maximum. The locomotive will be mounted on trucks of this type, each with four drivers. Each axle carries a 300 H. P. gearless motor supported on springs resting on the frame of the locomotive truck. This leaves the wheels free to adjust themselves to the irregularities of the roadbed and to diminish the wear on both tracks and motors. The armatures are mounted on hollow shafts which surround the axles and are connected to them by universal couplings which allow a freedom of motion in all directions.

The locomotive is fitted with air brakes, the air being compressed by a small auxiliary motor in the cab. The electrical air compressor will also operate the whistle.

A Large Order for Electric Heaters.

An order which, it is said, is the largest which has ever been awarded for electric heaters was closed last month by the Central Electric Heating Company, of New York, with the West Side Construction Company, of Chicago. The heaters will be used for the equipment of all the cars of the Metropolitan Elevated Railway of that city, and the Central Electric Heating Company is to be congratulated for having secured this order.

This company is also equipping all the electric cars of the North Side Electric Railway, of Chicago, with heaters, and is doing an excellent business in other sections of the country.

Manufacturing Expositions in Mexico and South America.

The suggestion recently made by our enterprising contemporary, *Dixie*, that manufacturers in this country should unite in sending exhibits of their products to various places in Mexico and South America for exhibition purposes, is receiving the approval of some of the leading manufacturers in the country, including the J. A. Fay & Egan Company and the Lodge & Davis Machine Tool Company, of Cincinnati. These gentlemen claim that they have for a number of years been sending Spanish-speaking representativcs into the countries named, and that they have always received good returns in the shape of substantial orders. A movement is on foot to hold a nationa convention of interested parties in Cincinnati early next year.

Electric Lighting of Cable Cars.

The Brooklyn Bridge cable cars are to be lighted by electricity and the contractors for this work, the Electrical & Mechanical Egineering & Trading Company, of New York, is completing the necessary apparatus. A trolley wire will be suspended over the track by span wires and the current will be there from by a pole somewhat similar to the ordinary trolley. The standard 500 volt system will be used.

Some New Corporations.

Bucyrus, O.—J. G. Meuser, of Galion, recently laid before the County Commissioners an application for a franchise to a new corporation, to build an electric railway on the public road between Bucyrus and Galion, the work to be completed within one year. This is a rival to the Bucyrus & Galion Suburban line, for which a franchise has already been granted.

Carthage, Mo.—The Jasper County Electric Railroad Company was incorporated November 12, with a capital stock of $150,000. Among those interested are F. H. Fitch, Isaac Perkins and J. W. Haliburton, all of Carthage.

Elyria, O.—A company to build an electric railway to connect Oberlin and Elyria has been formed here, with a capital stock of $100,000. Among the principal stockholders are W. B. Bedortha, of Oberlin, W. B. Thompson, of Lorain, and Parks Foster, of Elyria

Hull, Que.—A Montreal engineer is making surveys for the proposed power house for the new electric railway.

Indianapolis, Ind.—Grafton Johnson and John A. Polk, of Greenwood, have applied to the Johnson County Commissioners for a right of way for an electric line between Indianapolis and Franklin.

Ironton, O.—A five mile electric railway is projected between Pomeroy and Middleport, O. Frank E. Holliday, of Ironton, O., is interested. The line will be built in the spring.

Mackinac Island, Mich.—A franchise has been granted by the Council to John H. Roberts, representing a Grand Rapids company, for an electric railroad around the island, along with a telephone and electric light system.

Newark, N. J.—At a meeting, lately held here, of representatives of the Union Traction Company and the Newark, Rutherford & Hackensack Electric Railway Company, it was agreed that the latter company should be absorbed by the former, Delos E. Culver and Henry H. Copeland becoming members of the directorate.

Niagara Falls, Ont.—It is reported that Joseph Tait and John Flett, of Toronto, L. C. Raymond, of Welland, and others are seeking incorporation as the Niagara River Tramway Company, to build and operate a cable tramway over the Niagara River. The headquarters of the company are to be at Niagara Falls, and the capital stock is placed at $40,000.

Ottawa, Ont.—The promoters of the proposed Ottawa & Brockville electric railway are applying for a charter. It is said that a bonus of $100,000 will be asked from the city of Ottawa.

St. Thomas, Ont.—The street railway is reported to have been purchased by Henry Everett, of Cleveland, who will convert it into an electric road in the spring.

Shelburne Falls, Mass.—There is a movement on foot for an electric railway from Shelburne Falls to Coleraine. Several Boston capitalists and C. A. Marcy, J. B. Clark and Arthur A. Smith, of Coleraine, are interested.

South Paris, Me.—A new electric road, soon to be constructed, will be the Norway & Paris Street Railway. The capital stock will probably be $25,000. The following have been chosen directors of the company: Geo. L. Beale and Freeland Howe, of Norway; John F. Hill and Geo. E. Macomber, of Augusta; H. L. Shephard, of Rockport.

Trenton , N. J.—The New York & Philadelphia Traction Company, whose offices are at the corner of State and Montgomery Streets, has received franchises to pass through Hillsborough, Millstone and East Millstone, making a complete franchise now from Kingston to Bound Brook.

Westport, Conn.—Steps have been taken for the incorporation of the Westport & Southport Street Railway Company, whose promoters intend to run electric cars from Lyon's Plains to Saugatuck, thence to connect with the system of the Bridgeport Traction Company.

Personals.

Mr. S. L. Nicholson, of Philadelphia, was in New York last month.

Mr. J. H. Bickford, of Salem, Mass., made a business trip to New Orleans during the month of November.

Mr. Joel Hurt, president of the American Street Railway Association, was in New York City last month.

Mr. F. S. Kenfield, of the *Street Railway Review*, was married October 24, at Rock Island, Ill, to Miss Amy Sweeney.

Mr. Charles Desmond has again assumed the editorship of the *Stationary Engineer, and the Master Steam Fitter*, of Chicago.

Mr. Everett K. Day has been appointed superintendent of the Skowhegan & Norridgewock Electric Railway, of Skowhegan, Me.

Mr. J. W. Parker, the well known representative of the Ball Engine Company, in Philadelphia, was married November 1, to Miss Albury, of Beverly.

Mr. John W. Baker, of the E. T. Burrowes Company, of Portland. Me., called at our office last month. Mr. Baker is making an extended trip through the West in the interests of his company.

Mr. S. Dana Greene, of the General Electric Company, read a paper last month at the annual meeting of the Society of Naval Architects and Engineers, on "Electricity on Shipboard."

Mr. Carl P. Young, general manager and chief engineer of the Philadelphia Electrical Equipment Company, of Philadelphia, was in New York City a few days ago, attending to the business of his new company.

Mr. C. J. Field will read a paper at the annual meeting of the American Society of Mechanical Engineers, to be held in New York City, December 3 to 7, on "The Present and Prospective Development of the Electric Tramway."

Mr. F. D. Rounds has been appointed superintendent of the Broadway & Seventh Avenue division of the Metropolitan Street Railway Company, *vice* Mr. Newell, who has been appointed superintendent of the 34th Street division.

Mr. George Cradock, of George Cradock & Company, Wakefield, England, is making a trip around the world, and landed recently in San Francisco. Mr. Cradock has spent some time in Australia, and will return to England in December via Chicago and New York.

Mr. W. S. Dimmock, superintendent of the Omaha & Council Bluffs Railway & Bridge Company, Council Bluffs, Ia., called at the Chicago office of the Journal on his way home from the Convention. He spent several days at Louisville, Cincinnati, Indianapolis and Chicago inspecting the street railway systems. Mrs. Dimmock accompanied him.

Mr. Frank X. Cicott, manager Railway Department of the Pettengill-Andrews Company, of Boston and New York, will sail on the steamship "Lucania" December 1st for England. Mr. Cicott, while abroad, will confer with Dick, Kerr & Co. (Ltd.), of London, manufacturers of rails, on the subject of extending this company's American trade.

Mr. F. L. Hart has been appointed chief engineer of the Baltimore City Passenger Railway Company. Mr. Hart was formerly connected with the Third Avenue Railway Company, of New York, and has recently been engineer of operation of the Metropolitan Traction Company of New York, and is thoroughly versed in the details of cable railway construction and operation.

Mr. W. Frank Carr, who was the constructing engineer of the Roanoke Street Railway, illustrated in our last issue, has been connected with a number of electric railway enterprises. He is a native of Massachusetts, and was graduated from the Massachusetts State College, and later, in 1884, from the Institute of Technology, in Boston. After practising as consulting engineer for four years in Minneapolis, he was appointed, in 1889 assistant engineer of the Minneapolis and St. Paul street railway system, with full charge of all outside engineering work, and the drawing up of plans and estimates for thirty miles of cable railway for those cities. After the abandonment of the cable plans and the resignation of Chief Engineer Wise. Mr. Carr was appointed chief engineer of the system. Under his charge 238 miles of electric road, including the interurban line between the two cities, was built. Mr. Carr designed, for use in Minneapolis, the now well-known Shanghai T rail, rolled by the Illinois Steel Company. In the winter of 1891–92 Mr. Carr went South on account of ill health, and on April 1, 1892, was appointed general manager and engineer of the Roanoke Street Railway Company and Roanoke Electric Light & Power Company. He severed his connection with the Roanoke companies last August, and expects to return North in the spring. Mr. Carr is a member of the American Society of Civil Engineers.

W. FRANK CARR.

Mr. H. E. Hunt, of the Hunt Air Brake Company, Pittsburgh, Pa., was in New York City last week on business connected with the organization of his company for the manufacture of street car air brakes. Mr. McGuire, of the Pittsburgh Reduction Company, whose office is in the Havemeyer Building, New York, will look after the New York business of the new company.

Mr. Robert Beall, who was mentioned in our list of attendants at the Atlanta Convention, as a director of the Metropolitan Railroad Company, of Washington, D. C., is, instead, a director of the Washington & Georgetown Railroad Company, of Washington, D. C. Mr. Beall was formerly a director of the Metropolitan Railroad Company, but resigned this office about two years ago.

Mr. E. P. Vining has been appointed general manager of the Market Street Railway Company, of San Francisco and leased lines. This is the first appointment which has been made to this position since the consolidation of the road, Mr. M. D. Stein having held the position of active manager of the transportation department, which office has been abolished. Mr. Vining is well and favorably known in traffic circles, having been connected for a number of years with the Union Pacific Railway, and manager of the Western Trunk Line Association.

Mr. John Graham, whose portrait we present herewith, has been general manager of the Wilkesbarre & Wyoming Valley Traction Company since its organization, and is one of the largest stockholders in the company. He was born in Cumberland County, Pa,, August 4, 1843, and is of Scotch-Irish descent. He remained on a farm until twenty-three years of age, at which time he moved to Newville, Pa., and was appointed teller in the First National Bank of that place. This position he held until 1876, after which he engaged in the tanning business. Mr. Graham served in the Pennsylvania Legislature during the session of 1883 and 1885, representing his native county of Cumberland. In the latter year he made his first venture in street railways, purchasing, with two friends, the Bloomfield City Street Railway, of Bloomfield, Ill., for $150,000, reselling the road the same year for $200,000. Since that time Mr. Graham has devoted his attention almost exclusively to street railway affairs, and is widely recognized for his ability and general knowledge of the street railway business. He went to Wilkesbarre in November, 1890, and a few months later, with several friends, organized the Wilkesbarre & Wyoming Valley Traction Company. Associated with Mr. Graham in the organization of this company was the Hon. J. J. Patterson, who is still a director in the company, but who has moved to Lancaster, Pa., and is largely interested in street railways in that city. Mr, Graham's history since 1890 has been that of the company of which he is general manager.

JOHN GRAHAM.

New Publications.

Illustrated Catalogue and Price List of the Lunkenheimer Company, Cincinnati, O.

The Lunkenheimer specialties are well known for the high standard of superiority which they have always held. The gate and other valves, the lubricators, cocks, etc., of this company have been mentioned in our columns, and our readers are well acquainted with their characteristic features. The company's 1895 catalogue, which is just issued, is a handsome publication and shows forth clearly the features which have contributed to the popularity of these appliances.

Catalogue of the Barney & Smith Car Company.

The Barney & Smith Car Company, of Dayton, O., is one of the oldest companies in the business, having been established in 1849. The facilities of this company for supplying the highest grade of car work have been described in these columns. The company has recently published a handsome catalogue illustrating a number of different types of street cars manufactured at its works for street railway companies. The catalogue shows cars of all types, including freight and mail cars, and the interiors of a number of the cars are illustrated.

Modern Methods of Handling Fuel as Practiced in Locomotive Coaling Stations, Electric Light and Steam Railway Power Plants. Published by the Link-Belt Engineering Company, of Philadelphia and New York.

This is a very handsome catalogue, and contains engravings of different types of coaling stations belonging to street railway and other companies. Among the street railway installations illustrated are: The boiler room of the 33d Street power station of the Philadelphia Traction Company. two views, the ash conveyor of the same station, and two views of the power station of the Electric Traction Company, of Philadelphia. The Link-Belt Engineering Company has also equipped with coal handling machinery a large number of other street railway stations, as well as many plants for other coal using concerns. The pamphlet is also illustrated by engravings of the works of the

Link-Belt Machinery Company and of the Link-Belt Engineering Company.

Stresses in Girder and Roof Trusses, for Both Dead and Live Loads, by Simple Multiplication, With Strain Constants for One Hundred Cases. By F. R. Johnson. Spon & Chamberlain, New York, 1894. Price $2.50.

This book, while not intended for the general reader, is an extremely useful one for civil and mechanical engineers, architects and draughtsmen who find it necessary to calculate the stresses in girder and roof trusses. It is intended to simplify these calculations, and to assist practical engineers and draughtsmen who have little time for mathematical investigation. The stress constants for both dead and live loads need only to be multiplied by the panel load to give the maximum stress in any member of the truss which may be mentioned. The work is apparently compiled with great care. The detail figures, as far as possible, have been determined in two or three different ways, and the results of this, of course, add greatly to the value of the book. Such books as this are of great assistance in reducing to a minimum the labors of working engineers.

Electric Light and Power. By Arthur F. Guy. Published by Biggs & Company, London. 346 pp. Price $2.00.

This book embodies a great deal of practical information on central station work, and the principles underlying the action of apparatus have been discussed, the author explains, only so far as to enable the reader to grasp the laws that govern their action. The subjects treated include motive power, with a discussion of the relative values of the gas engine and different types of steam engines and water wheels for operating dynamos, electrical generating machinery, arc and incandescent lighting with a comparison of the cost of these methods of illuminating and by gas, and the distribution of electric power. The relative costs of installation and operation of different types of apparatus are treated at considerable length, and a number of interesting comparisons are made of different systems and methods of practice. Electrical development in the lighting has been slower in England than in this country, if we can judge from the statement made that, up to the end of 1893, the city of London had a total of only 349,000 sixteen candle power incandescent lamps. Of the three methods of driving dynamos—by belts, ropes and direct connection—the central stations seem to be about equally divided, though the present tendency, the author states, is toward direct driven, high speed engines coupled to low speed armatures. Whether this is also the trend of practice in railway stations is not mentioned, but we notice that rope driving is used in one of the two large railway installations, that of the Liverpool Elevated Railway, and belts in the other, the City & South London Railway. But little space is devoted to electric traction, and in this department of electrical development, the author states that England is a long way behind America, though in heavy and large engineering work it acts as pioneer. The greatest field for electric traction at present in England, it is thought, lies in the construction of tubular underground electric railways. The book is written in a clear and attractive style and is illustrated by a number of diagrams.

Equipment Notes.

The Gold Car Heating Company, of New York, is equipping 180 cable cars of the Third Avenue Railway Company, of New York, with car heaters.

Westinghouse, Church, Kerr & Company announce the removal of their New England office from 620 Atlantic Avenue to Exchange Building, 53 State Street, Boston.

The Brooklyn Railway Supply Company, of Stamford, Conn., has recently delivered a snow sweeper to the Broadway & Seventh Avenue Railway Company, of New York.

Charles J. Mayer, of Philadelphia, Pa., who deals in electrical railway supplies, has removed to Room 1211 Betz Building. Mr. Mayer has charge of the Middle States sales department for the R. D. Nuttall Company, of Allegheny, Pa.

The C. W. Hunt Company, of New York, reports that Messrs. Pardee & Young, coal dealers, of Fall River, Mass., have awarded it the contract for a coal elevator and two automatic railways for coal wharves, which the latter are erecting.

The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., writes us that the office of its New England agency, which was formerly located at 620 Atlantic Avenue, Boston, Mass., has been removed to Exchange Building, 53 State Street, Boston, Mass.

Charles A. Baldwin & Company, bankers, at 40 and 42 Wall Street, are making a specialty of street railway securities, and persons interested may find it profitable to communicate with them. The house has, we understand, many rich clients who are interested in trolley development.

George Cradock & Company, of Wakefield, Eng., whose ropes have been making excellent records on this side of the Atlantic, report the record of 172 weeks or 196,764 miles for one of its cables on the Fitzroy line in Melbourne. Some remarkable records in Dunedin, New Zealand, by the ropes of this company were given in our last issue.

The Clayton Air Compressor Works, of 26 Cortlandt Street, New York, has sent us a copy of its newest publication on the "Uses of Compressed Air." This list cites about seventy different applications of air under pressure, and is a most convincing commentary upon modern advancement in engineering, manufacturing and industrial lines.

The Western Electric Company, of New York City, has been appointed the wholesale agent for the hot pressed steel pinions manufactured by the United States Projectile Company, of Brooklyn. This arrangement supersedes the old one under which C. S. Knowles, of Boston, was acting as sales agent. The Western Electric Company proposes to push vigorously the sale of these pinions.

C. S. Stearns & Company have just started in business, at 9 Haynes Street, Hartford, Conn., as manufacturers' agents and dealers in street railway supplies. The firm is composed of C. S. Stearns and E. R. Gilbert. Mr. Gilbert is already well known to the trade through his former connection as traveling salesman of the Eddy Electric Company. The new firm is in a good position to handle to good advantage the products of Western manufacturers.

Charles E. Chapin, manufacturers' agent and dealer in general electrical supplies, has so increased his business recently that he has been obliged to take larger quarters on the first floor at 136 Liberty Street, in the Electrical Exchange Building. Among the recent large contracts taken are two complete electrical plants for export. Mr. Chapin has recently secured the sole agency of the Perfection woven wire gauze brush, especially adapted for large railroad generators.

The Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., is doing a large business in all of its departments. Mr. Dobbs, general manager of the company, reports special activity in the snow sweeper, stove, trimming and register departments. The excellent service given by the Lewis & Fowler snow sweepers last winter has been referred to in these columns, and has brought its return in a large number of orders, which it has filled during the summer and autumn.

The Penn Bridge Company, of Beaver Falls, Pa., is building a bridge across the Monongahela River at Glenwood, Pa., for the new line to Homestead and McKeesport, of the Second Avenue Traction Company, of Pittsburgh. The bridge has a center span of 520 ft., two spans of 300 ft. each, beside viaduct approach at each end. The company is also building an extensive bridge with five spans for the Wilkesbarre & Wyoming Valley Traction Company, as mentioned elsewhere in this issue.

The Graham Equipment Company, of Providence and Boston, has published a circular, calling attention to a very striking remark in the paper read by E. C. Foster, general manager of the Lynn & Boston Street Railway Company, at Atlanta, in regard to using a tram rail. The Graham Equipment Company calls attention to the fact that a great deal of the waste of money in roadbeds has been due to the use of too heavy trucks, and points the obvious moral to buy spring suspended trucks and save in the roadbed.

The Storm Manufacturing Company, of Newark, N. J., is sending out to its customers a miniature of the H. & C. patent ice and sleet cutting trolley wheel, in the shape of a paper weight. It is a reproduction of the wheel about two inches in diameter. It is the only wheel, the manufacturers claim, which will entirely remove ice from the wires and allow the same speed to be made in sleet and ice storms as in good weather. John H. Graham & Company, of 113 Chambers Street, New York City, are the sole agents for this wheel.

William Hazleton, 3d general agent for the United States of the Société Anonyme Industrielle Des Établissements Arbel, has presented us with a very neat paper weight in the form of one of the Arbel wheels for street railway service, which he has just received from the home office at Rive-de-Gier (Loire), France. Mr. Hazleton expected to receive a large number of these paper weights in time to distribute them as souvenirs at the Atlanta Convention, but they were delayed in the Custom House so long that he was not able to have them at Atlanta.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., has recently shipped to New Orleans sixty-six patent pick-up car equipments with rope net. The company also reports orders for all the cars of the McKeesport & Wilmerding Street Railway Company, of McKeesport, Pa., with its folding pick-up fender, and all the cars of the Paterson Central Railway Company, of Paterson, N. J. The company has also received the order for all the cars of the Paterson Railway Company. R. A. Crawford is enthusiastic over the favorable reception which his fender is receiving.

W. P. Seguine, of the Frost Veneer Seating Company, has recently invented a waterproof and heatproof glue, which promises to be of great value, not only in car construction, but in all places where a waterproof glue would be valuable. Mr. Seguine has been experimenting in this line for many years, and has subjected the glue to a series of severe tests, under all of which it has given very favorable results. The right to use this glue for veneer has been secured by the Frost Veneer Seating Company, but the right to use it in other industries is still the property of Mr. Seguine. We understand that the product is inexpensive to manufacture.

Edward F. Austin, former sales agent in Pittsburgh, of the Altoona Manufacturing Company, recently assigned, has taken charge of the Pittsburgh office of the Phœnix Iron Works Company, of Meadville, Pa., manufacturers of the well known Dick & Church engines, boilers, feedwater heaters, etc. Mr. Austin reports the sale of a 15 × 18 engine, to Jones & Laughlin; three 100 H. P. boilers for the Schenley Park Casino. These boilers are particularly designed for safety, etc., and are of special make all through. He also reports several smaller sales, and states that inquiry is increasing from all localities, and that he looks forward to an increase of the trade in the boiler and engine business.

The John Stephenson Company, Ltd., of New York, has been kept busy recently turning out the cable cars for the Metropolitan Traction Company's Columbus Avenue line in New York. This car

is of the "Broadway" type, and is illustrated and described elsewhere in this issue. The Stephenson Company also mentions, among other recent orders, some electric cars for Allentown, Pa. Yonkers, N. Y.. and the Nassau electric road, of Brooklyn, N. Y. The company has also received orders for cars from Bridgeport, Conn., Lorain, O., and elsewhere. The company has no difficulty in maintaining its business, owing to the high standard of work which has come to be recognized as characteristic of the Stephenson cars.

Robinson's Patent Trolley Wheel manufactured and sold by the Wallace Electric Company is making many friends. The independent contact ring, one of its principal features. allows an easy passage on sharp curves, without it jumping the trolley wire. Wood's specialties, such as the flexible pole bracket, adjustable switches and crossovers and the trailer connector are favorites and are well liked by those using them. The Wallace Electric Company, of Chicago, is general sales agent for the manufacturers of the Brilliak incandescent lamp. This lamp is made with an anchored filament especially adapted to withstand the severe conditions which lamps are subjected to in street railway service. Although the Brilliak is a new comer it is meeting with great success, and the factory is kept busy filling orders now on hand.

J. H. Bickford, of Salem, Mass., has under way the construction of nine miles of line between Long Island City, N. Y., and Flushing, extending through the villages of Woodside, Winfield, Newtown and Corona. The road will be double track as far as Newtown Village, and the whole line is to be built especially for rapid transit. As the road leaves the village of Corona it passes across the "meadows" for a distance of a mile and three-eighths on a trestle work structure, which will have some interesting engineering features. Power to operate this line will be provided from the station of the Steinway Railway Company, and the line will be operated as a part of that company's system. Mr. Bickford also has under way the construction of the Manchester (N. H.) Street Railway, which will include about fifteen miles of line.

The Safety Car Heating & Lighting Company, of New York, has recently equipped eighty electric cars of the Columbus (O.) Street Railway Company with its system of lighting by Pintsch gas. This is the first instance in this country, so far as we are acquainted, of the use of gas for lighting electric cars, although its use on steam railways and cable railways is very extensive, as our readers well know. The reason which led the management of the railway company to adopt gas in place of electricity for lighting, we understand, was the desire to provide its patrons with a perfectly steady and certain light, and one which would not go out in case of interruption of power, or if the trolley should leave the wire. The result of this installation will be watched with interest. The company is also equipping the Columbus Avenue cars of the Metropolitan Traction Company, of New York, with lighting equipments.

The Berlin Iron Bridge Company, of East Berlin, Conn., writes us that it has just completed the new machine shop for the American Hard Fibre Company, at Newark, Del. This building is 50 × 226 ft., the roof being made of steel, and covered with the Berlin Iron Bridge Company's anti-condensation, corrugated iron roof covering. The New England Electrolytic Copper Company, at Central Falls, R. I., has also just completed an addition to its works. This addition is made entirely of iron and steel, furnished by the Berlin Iron Bridge Company. This company will also furnish the new power station for the United Electric Light & Power Company on East 28th Street, New York City. This power house is 100 × 200 ft., the engine room is 100 × 80 ft., and the boiler room is 56 × 100 ft., the whole covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron roofing. The coal pockets in the boiler room have a capacity of 3,000 tons.

The Philadelphia Electrical Equipment Company is a new enterprise, formed on October 21, and has its offices and works located at 816-18-20-22 Cherry Street, Philadelphia, Pa. So far the electrical business has been divided very much into the three general branches, viz., construction department, supply department and repair department, these branches usually being owned by separate persons, and operated independently of each other. This company has consolidated the three in one, and believes the consolidation will inure to the benefit of all interested, because the mistakes of those not experienced will be avoided. Again, as the company will buy supplies in large quantities, at the lowest market cash prices, and as it has no expensive agents to pay, it can give the trade the benefits. Certainly, quick deliveries and low prices, with a full guarantee, should win. The company's project, with the many years' practical experience of C. P. Young, the business ability of J. R. Rettew, together with the finest mechanics and none but the best tools in the market, afford ample grounds upon which to guarantee everything to be absolutely right when it leaves the works. The JOURNAL welcomes it, and wishes it great success in its new undetaking.

The New Process Raw Hide Company, of Syracuse, N. Y., has received a letter from H. S. Cooper, general manager of the Schenectady Street Railway Company, enclosing an order for two more pinions. The letter concludes: "The pinions have done excellently well. On May 10 we equipped an open car with steel pinions; on May 28 we equipped an identical car with raw hide of your make. To-day, the steel pinions are worn out, and have also worn out the axle gears in which they mesh, while the raw hide pinions are not nearly worn out, and the axle gears in which they mesh are not worn at all perceptibly. Both these cars have run steadily over identically the same route, and have carried very closely the same number of passengers, and averaged the same mileage, 100 miles per day. As you know, our road is a very hard one on gears, as it is all curves and grades, with the curves all on grades 6, 7½, 10 and 12 per cent., and some of them pretty long ones. We are well pleased with the results, the more especially as the writer was somewhat dubious at first as to the using of raw hide on single reduction machines, although his experience with them on double reduction had been very satisfactory."

Stern & Silverman, of Philadelphia, Pa., report closing a nice contract last month with the Pikesville. Reistertown & Emery Street Railway Company, of Baltimore, Md. This is a new company just entering the field. Three tandem compound, 250 H. P. Ball & Wood engines will be used. The electric plant will consist of three Westinghouse K. W. generators, and the steam plant of four 200 H. P. Brownell Company boilers, with a ninety foot, self supporting stack. All the pipe fitting, placing of the pumps, etc., will be done under the direct supervision of Stern & Silverman. The officers of the Pikesville, Reistertown & Emery Street Railway Company are: President, James Parr; vice-president and general manager, Charles Webb; engineer, W. D. McQuestion Stern & Silverman have also been awarded a contract by the Scranton (Pa.) & Pittston Traction Company for the building of four and a half miles of track between Pittston and Avoca, Pa. The rails are to be fifty-six pound, ties two feet centers. The same firm has also secured the contract for the furnishing of car bodies and trucks, as well as motors. The motors are to be two thirty horse power Westinghouse se.ies motors to each car. The contract also includes the furnishing and erection of all overhead material and the construction of the road complete.

The Mather Electric Company, of Manchester, Conn., has just concluded arrangements with Manning, Maxwell & Moore, of New York, and the Niles Tool Works, of Hamilton, O., for a large amount of new machine tools which will be installed in the Manchester plant at once. These tools are especially adapted for the building of large direct connected and belted generators which the Mather Company is now making quite a specialty of The plant at Manchester has been running overtime with full force for the last two months, and the company now has orders on hand to keep its entire plant busy from four to five months. The company reports on hand an especially large number of orders for its new type multipolar generators for railway work. The company has now in course of construction in its shop six 200 K. W. and fifteen 100 K. W. belted generators, besides a number of large direct connected generators. The company has closed a contract with the Ithaca Street Railway Company, of Ithaca, N. Y., for a 100 K. W., new type multipolar railway generator. Other users of Mather generators, who have recently written to the Mather Company expressing their most favorable opinion of these machines, are the Gardner Electric Street Railway Company and the Hartford & West Hartford Street Railway Company.

The Philadelphia Engineering Company, of Philadelphia, Pa., has just completed contracts with the Carnegie Gas Company, of Pittsburgh, for three 30 × 60 in. gas compressors. Each is driven by a 32 × 60 in. Philadelphia-Corliss engine of the company's rolling mill type. The company has also contracted with the Pittsburgh Natural Gas Company, of Pittsburgh, for a pair of 30 × 60 in. gas compressors, each driven by a 24 × 60 in. Philadelphia-Corliss engine, also a pair of 30 × 60 in. gas compressors for the Ohio Valley Gas Company, each driven by a 26 × 60 in. Philadelphia-Corliss engine. The company has just contracted with Marshall Brothers, of Philadelphia, for an 800 H. P., tandem compound, condensing engine, of the rolling mill Corliss type, to drive the tin plate mills. It is also just shipping for the Chamberlain Coal Company, of Pottsville, Pa., two 34 × 60 in. Philadelphia Corliss hoisting engines, complete with drums, brakes, etc.; also two 14 × 36 in. heavy Corliss engines for the same company, to be used for its coal breaker. It is also shipping to the Standard Steel Works, of Burnham, Pa., a fifteen ton, revolving, open hearth steel furnace, together with gas producers, piping and chimneys. The company reports that its works are operated full force night and day, and prospects are very good for plenty of trade in the future.

The Joseph Dixon Crucible Company, of Jersey City, N. J., reports an active interest in its dressing for leather belts. No one using leather belts can afford to be indifferent to their care. There is a certain amount of elasticity in all good leather belting, but time and continued hard work seem to destroy or at least weaken its power. Then comes the question whether it is better to simply tighten the belt or use some form of dressing. Experience of many very practical observers seems to favor the use of a good dressing, as tightening the belt strains it and calls for more engine power, but, of course, one should be careful what sort of dressing is used. Dixon's belt dressing and leather preservative, was the only article that would start the big driving belt used at the Paris Exposition in 1878, and keep it from slipping, and the company has excellent testimonials from users in this country, of its value. The Jos. Dixon Crucible Company, has manufactured a pure linseed oil and graphite paint for over twenty-five years and has some very convincing testimonials of its value. At the Montreal meeting of the American Society of Mechanical Engineers, an interesting paper was read on methods for preserving metal used in pipes, roofs, bridges, poles, construction work, etc. In conclusion, the whole question of how best to protect iron and steel from corrosion in all the varying conditions that the wants and usages of to-day demand, seems to resolve itself into several "Donts'," as the best method of answering it, to wit: Don't have any scale on the metal. Don't paint it with anything but pure linseed oil and oxide of lead or graphite paints. Don't forget that frequent inspection and care are very necessary. Don't let the cost and interest accounts be the governing factors in the case of protecting any metal structure on whose continuity and strength human life and safety depend. In comparing the two paints recommended, the Jos. Dixon Company claims that a properly made graphite paint should prove more durable and a better protector than oxide of lead. Graphite has a strong affinity for metal surfaces, and experienced painters claim that even where light colors

are desirable, graphite paint should be used as a priming coat. Again, graphite is impervious to the action of heat, cold, sea air, acid or alkali fumes, which are more or less destructive agents to lead paints.

The Consolidated Car Heating Company, of Albany, N. Y., among its other large orders, numbers one of 1,200 electric heaters to the People's Traction Company, of Philadelphia, which will equip 300 of its cars. We believe this is the largest order ever given, in this or any other country, for electric heaters, and we wish to extend congratulations to H. N. Ransom, through whose untiring effort this order was secured. It certainly speaks wonders for his ability as a salesman. Among the orders recently taken by Mr. Ransom are forty car equipments to the Buffalo Street Railway Company, ten car equipments to the Cleveland Electric Railway Company, and ten to the South Covington & Cincinnati Street Railway Company. The electric heater of the Consolidated Car Heating Company is the only electric heater that received an award at the World's Fair. A medal and diploma were given it for efficiency and economy of operation, combined with admirable regulation of temperature. The heater is now in use in 100 cities and towns of the United States and Canada, and on over 1,300 cars. The Consolidated Car Heating Company writes us that an error was made in the statement of the electrical equipment of the Poughkeepsie City & Wappingers Falls Street Railway Company, in our November issue. This company supplied all of the heaters in use on this road, and not another car heating company, as stated. The Consolidated Car Heating Company is extending its business rapidly, and its heaters are very popular on all the roads where they have been installed. The West End Railway Company, of Boston, has also ordered 149 cars equipped with the electric heater manufactered by the Consolidated Company. This is perhaps the most important order yet given in electric heating, and was obtained by the Consolidated Company only after the most rigorous practical tests in competition with electric heaters offered by five other companies. The Consolidated Car Heating Company has just awarded the contract for the addition to its factory, which will practically double its capacity. Its rapidly increasing business in electric heating appliances, and the requirements of its compressed gas lighting business have necessitated increased facilities for manufacturing. Charles A. Sheldon has resigned as assistant division superintendent of the Michigan division of the Lake Shore & Michigan Southern Railroad, to accept a position with this company. He will have charge of the compressed gas lighting department of the Consolidated Company, which is about to introduce the Pope system, interchangeable with the Pintsch throughout the United States. Mr. Sheldon is a graduate of Yale, class of 1890, and has been with the Lake Shore road since graduation, four years ago, having risen through several grades to the responsible position of assistant division superintendent. He has shown great ability in railroad matters, and his many friends will be glad to learn of the important position which he now assumes with the Consolidated Car Heating Company.

WESTERN NOTES.

The Louis K. Comstock Company, of Chicago, has opened a branch office in the Hodges Building, at Detroit, Mich.

The Partridge Carbon Company, of Sandusky, O., has issued a new catalogue giving prices and other information of its dynamos and motor brushes.

The Crescent Electric Company, of Chicago, repairers of electrical machinery, is unusually busy. This company makes a specialty of street railway work.

Messrs. Haschke & Creelman, of Chicago, manufacturers of all sizes of storage batteries, say that their business is constantly improving and the number of inquiries increasing largely.

The International Register Company, of Chicago, is in receipt of several orders from various roads for its registers which seem to be gaining rapidly in favor with street railway managers.

The Stanwood Manufacturing Company, of Chicago, is running full time on orders for the Stanwood car steps, the demand for which is constantly increasing. The shipments for the past month have been unusually large.

The McGuire Manufacturing Co., of Chicago, during October reports that it received orders for 690 of its Columbian magazine cast iron street car heaters and fourteen electrial combination snow sweepers. This looks as if the electric railways in the colder regions expect to do business this coming winter.

The Wadhams Oil & Grease Company, of Milwaukee, Wis., is sending out a "second edition" of its souvenir aluminum match boxes, which were distributed at the Atlanta Convention. The supply on hand at Atlanta was soon exhausted by the large demand for what proved to be a very useful souvenir.

F. E. Donohoe, of Chicago, Western agent for the American Electrical Works, Providence, R. I., has just closed a contract for considerably over 900,000 lbs. of wires for the West and North Side Street Railway Companies of Chicago. This is, no doubt, one of the largest orders for wire on record, and amounts, in the aggregate, to $118,000.

The Jenney Electric Motor Company, of Indianapolis, Ill., it is stated, has given up the idea of moving its plant to Springfield, O., owing to the fact that the bonus offered the company there has failed to materialize. The business of this company has greatly outgrown its present quarters, and the company has several sites now under consideration.

The Mark Railway Equipment Company, of Chicago, has just finished the delivery to the Chicago City Railway Company of some 100,000 of its double brace plates, and also a large order of joint braces for cable construction. The company reports the outlook for spring business as being very flattering. This company makes a specialty of track equipment.

The Fleming Manufacturing Company, of Fort Wayne, Ind., has issued a new catalogue, giving details of its street railway snow plows, which are designated as the "Reversible" for electric and cable roads, and the "Walkaway" for horse roads. The most striking feature of this catalogue is the list of street railroads in the United States and Canada, each using from one to twenty-five of the Fleming Company's snow plows. This list occupies no less than ten columns of the company's catalogue.

The Meaker Manufacturing Company, of Chicago, manufacturer of the well known Meaker line of registers, expects to be in its large, new shops at South Waukegan, Ill., by December 15. This company is getting out an elegant line of overhead material, consisting of trolley wire hangers, clamps, crossovers, switches, etc., which it will be prepared to offer within a very short time. The company will also manufacture a fine line of metal trimmings and other street railway and electrical specialties.

The Lodge & Davis Machine Tool Company, of Cincinnati, O., has just issued a handsome circular illustrating and describing its full line of universal and plain milling machines. The company writes that this catalogue will be sent to any address upon application. The Quincy Mining Company, of Hancock, Mich., extensive mine operators, has just placed an order with this company for an outfit of tools, including seven lathes, two full Universal radial drills, etc., to be used in repairing and manufacturing mining machinery.

The Link Belt Machinery Company, of Chicago, reports good business with the Standard boiler which it is manufacturing. Among the recent orders for this boiler are equipments for the Chamber of Commerce, Detroit, Mich.; Evanston Illuminating Company, Evanston, Ill., Northwestern Yeast Company, Chicago, Ill.; Lehigh Valley Coal Company, Wilkesbarre, Pa.; Carnegie Library, Braddock, Pa.; Pittsburgh High School, Pittsburgh, Pa., Morgan Building, Buffalo, N. Y., and the Institute for Feeble Minded, Polk, Pa.

James Leffel & Company, of Springfield, O., have recently contracted for a large equipment of wheels and connections for the Columbus (Ga.) Consolidated Street Railway Company. At the power station of this road will be installed four sixty-eight inch Samson wheels, manufactured by James Leffel & Company, giving an aggregate of 700 H. P. Other installations made by this company in street railway power houses have been at Anaconda, Mont.; Tampa, Fla., and elsewhere. The regulation of these wheels is effected by both mechanical and electrical governors, not both in the same plant, and has been found to be very close with varying load on the wheels.

Mr. Van Dorn, of the Fitzgerald-Van Dorn Company, of Lincoln, Neb., has been in Chicago some days overseeing the delivery of automatic drawbars and attachments for the motor cars of the Metropolitan Elevated. These equipments are claimed to be the largest, strongest and most compact of any ever constructed, each equipment weighing over 1,100 lbs. per car, and when coupled automatically there is only one-sixteenth of an inch play between them. The wearing parts of these couplers are more than ten times greater than on any other bar constructed. They cannot break or get out of order, and are, consequently, expected to last almost indefinitely. Mr. Van Dorn says his company has done a very satisfactory business with surface roads this year, and is well pleased with the outlook.

J. Holt Gates, of Chicago, is installing six Card motor equipments for the Elkhart & Goshen Railroad, also a Mather generator. For the Bloomington (Ill.) City Railway he holds the contract for a 100 K. W. Mather railway generator and two Card motors, and at Fremont, O., for two Card motors. The Card Electric Company's factory is now entirely completed, and in active operation. This company's series parallel controller using quick-break switches is a new departure in street railway controllers, and is giving good satisfaction. Mr. Gates reports the sale of thirty-six motors, dynamos and generators in the month of October. The Elwell-Parker Electric Company, of which he is the Western representative, makes a specialty of direct connected alternators, as well as the heaviest class of railway generators. Mr. Gates has five salesmen on the road, as well as an engineering corps, and reports business very promising.

The Elwell-Parker Electric Company, of America, has just begun business, with headquarters at Cleveland, O. The company has undertaken the manufacture of heavy electrical machinery, and has already turned out its first machine. The company's systems in England are under the control of the Electric Construction Corporation, Ltd., one of the largest concerns in that country. A specialty will be made of low period, direct connected and belted alternating current dynamos, and the equipment of overhead roads on a plan similar to that used on the Liverpool overhead road, which was equipped by the English company. This road was the first in the world to adopt electricity for the adoption of overhead trains. The company will also make large sizes of direct current generators for lighting and power work. The company has facilities for turning out several thousand horse power of machines every month. J. Holt Gates, of Chicago, has taken the Western agency.

The McGuire Manufacturing Company, of Chicago, has orders for November delivery, which show a large improvement in street railway business throughout the country, some of the orders being from the following parties, viz: Consolidated Traction Company, Jersey City, 22 Columbian trucks and 117 of its Columbia A 1 S.; Norwalk Street Railway Company, Norwalk. Conn., 13 Columbian trucks; American Car Co., St. Louis, Mo., 12 adjustable traction trucks; Augusta Street Railway Company, Augusta, Ga., 10 A 1 suspension trucks; Allegheny Traction Company, Pittsburgh, Pa., 10 A 1 suspension trucks (being a duplicate order); Consolidated Electric Railway

Company, Los Angeles, Cal., 40 A 1 suspension bicycle trucks; the Chicago City Railway Company, 60 Columbia trucks; Northeast Street Railway, Kansas City, Mo., 10 Columbian trucks, and the Inter-County Street Railway Company, 7 trucks, 1 Columbian truck for export, 1 A 1 suspension, Walker Manufacturing Company, 6 A 1 suspension trucks, Citizens' Street Railway Company, Memphis, Tenn.; Toledo Consolidated Street Railway Company, Toledo, O., 2 combination track sweepers and snow plows; Citizens' Street Railway Company, Indianapolis, Ind., 2 combination snow plows, and the La Crosse City Railway Company, LaCrosse, 1 combination snow plow. It also reports orders for nearly 700 heaters for the month of October. This is certainly a good evidence of reviving business.

The Ohio Brass Company, of Mansfield, O., as a result of the quality and completeness of the line of its construction devices has had a steadily increasing trade for the past year, and now numbers among its patrons many electric railroads in the country. The latest two devices which this company has added to its line, viz., The Jewell trolley sling and the reversible and adjustable track brush holders bid fair to find favor among the street railway men. Both of these articles have stood the test resulting from long use, and wherever they have been tried have given satisfaction. This company reports sales of considerable size for the month of October to the following named roads: The North Chicago Street Railway, Chicago; the Sandusky, Milan & Norwalk Street Railway, Norwalk, O.; the City & Suburban Railway, Baltimore, Md.; the Syracuse Street Railway Company, Syracuse, N. Y.; the Buffalo, Kenwood & Tonawanda Electric Railway, North Tonawanda, N. Y.; the Baltimore Traction Company, Baltimore, Md.; the Lafayette Street Railway, Lafayette, Ind.; the Dunkirk & Fredonia Street Railway Company, Fredonia, N. Y.; the Galesburg Electric Motor & Power Company, Galesburg, Ill.; the Pittsburgh Electric Railway, Pittsburgh, Kan.; the Marion City Railway Company, Marion, Ind.; the Springfield Railway, Springfield, O.; the West Chicago Street Railway, Chicago, Ill,: the People's Electric Railway, Rochester, Pa.; the Charlotte Street Railway, Charlotte, N. C.; the Durango Railway & Realty Co., Durango, Colo.; the Carbondale & Forest City Passenger Railway, Carbondale, Pa.; the Market Street Railway, San Francisco, Cal.; the Shamokin & Mt. Carmel Railway, Mt. Carmel, Pa.; the Sioux City Traction Company, Sioux City, Ia.; the Pottstown Passenger Railway, Pottstown, Pa.; the Newark & South Orange Street Railway, Newark, N. J.; the Terre Haute Street Railway, Terre Haute, Ind.; the City Railway, Dayton, O.; the Fort Wayne & Belle Isle Railway, Detroit, Mich.; the Chicago General Railway Company, Chicago, Ill.; the Elyria & Lorain Electric Railway, Lorain, O.; the Metropolitan Street Railway, Kansas City, Mo.; the Middletown-Goshen Traction Company, Middletown, N. Y.; the Columbus Street Railway, Columbus, O.

List of Street Railway Patents.

U. S. Street Railway Patents Issued October 16, 1894, to Novembbr 13, 1894, Inclusive.

October 16.

Sand-Delivering Mechanism for Street Cars—Alexander Parrant, Worcester, Mass. No. 527,446.

A sand receptacle with the sliding gate and delivery chute, the gate operating lever, the contact shoe movable and sliding on the end of said lever, the lift spring attached to said lever, a cam on the wheel axle, and means for shifting said contact shoe endwise into and from engagement with said cam, for the purpose set forth.

Apparatus for Signaling the Approach of Street Cars—Garland B. St. John, Kalamazoo, Mich., assignor of one-half to Charles D. Fuller, same place. No. 527,461.

This consists of an insulated vertical wire and horizontal cross wire attached thereto, one end of which projects across the path of a trolley pole; a vertical end of wire in position to come in contact with the cross wire when the latter is swung by the car passing in one direction, and a signal wire passing through a group of signals to a ground plate at the outer end and connected with the wire at the outer end.

Snow Plow for Street Railways—Francis W. Dean, Cambridge, and William E. Mathews, Boston, assignors to the Taunton Locomotive Manufacturing Company, Taunton, Mass. No. 527,523.

A V shaped plow arranged to partially inclose the lower portion of one end of the vehicle body, and connected to said vehicle body by a system of parallel motion links; and means having provision for raising and lowering said plow from the vehicle platform, without changing the substantial parallelism of said plow relative to the railway track.

Trolley—William H. Bache, Bound Brook, N. J. No. 527,546.

The trolley has a socketed support, and a bracket consisting of two sections branched to support the trolley wheel between them, and having arms or projections together constituting a split pintle adapted to the socket of the support.

Conduit Electric Railway—Oliver B. Finn, Philadelphia, Pa. No. 527,601.

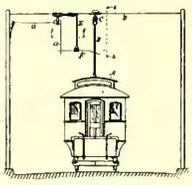
A conduit with a box having an opening in its wall, a sliding stem in said opening having a roller thereon, an insulated wire in said box having an arm rigidly connected therewith, said arm having a hooked end adapted to be engaged by a tongue on said stem, and a spring bearing against said stem.

Safety Apparatus for Street Railway Cars—James J. Andrews, Hempstead, and Theodore Mott, Far Rockaway, N. Y., No. 527,646.

The apparatus extends forward from the platform, and a trap constructed with a convex forwardly extended lower part, and concave, rearwardly extended upper part of an arm, extends downward from the said lower and convex part, with means for transversely pivoting the arm to the front of the bracket.

Railway Chair—Edward Nennstiel, Johnstown, Pa. No. 527,712.

A railway chair made of a single piece of resilient metal, which is adapted to engage with the ends of the rails as shown, said chair having a preponderance of metal above the flanges of the rails, and a curved base, the side portions which adjoin the base being thinner and of greater resiliency than the other parts of the chair.



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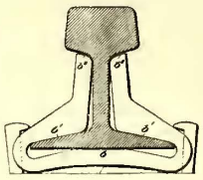

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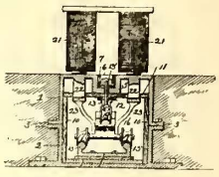


NO. 527,873.

Car Fender—Herman B. Ogden, Brooklyn, N. Y. No 527,715.

A car fender, comprising two frames hinged together and adapted to be hung on a car, a roller supported beneath the lower frame, and an extension end on the lower frame.

October 23.

Life Guard for Street Cars—John F. Ryan, Toronto, Canada. No. 527,813.

The life guard frame is pivotally connected at its rear end to the under side of the platform, which is raised by a foot lever or pedal.

Support for Trolley Wires—Frederick C. Fisk, Buffalo, N. Y. No. 527,840.

This consists of twin parts riveted together and having in their contracting inner faces similar inclined grooves, which register with each other to form an inclined passage extending entirely through their length. A sleeve is adapted to surround and carry the line wire and is provided with inclined flanged wings adapted when brought together for sliding and wedging engagement with the inclined passage between the twin parts, the whole being adapted to be secured to an insulating bell.

Transformer System for Electric Railways—Maurice Hutin and Maurice Leblanc, Paris, France, assignor to the Société Anonyme pour la Transmission de la Force par l'Électricité, same place. No. 527,857.

Power is transmitted from a primary circuit or line to a secondary circuit by electric induction. The intermediation of a closed magnetic circuit between the primary and secondary is dispensed with, by generating in the primary circuit an alternating current of high frequency, and suppressing the self-induction of the secondary coil which is within inductive proximity to said primary by means specified.

Closed Conduit Electric Railway—James F. McLaughlin, Philadelphia, Pa. No. 527,873.

The closed conduit is provided with a central exposed conductor, and an interior main or supply conductor. A traveling electro-magnet straddles the exposed conductor, and a trolley in the conduit establishes the circuit between the main and exposed conductors, and carries an armature in operative relation to the magnet.

Closed Conduit Electric Railway—James F. McLaughlin, Philadelphia, Pa. No. 527,874.

Electro-magnets are hung from a motor car and pivoted to tilt in the direction of the line of travel and also at right angles thereto.

Electric Motor for Railway Cars—Norman C. Bassett, Lynn, assignor to the General Electric Company, Boston, Mass. No. 527,927.

The motor is centered upon an axle of the vehicle, trunnions are placed upon the outside of the motor vertically in line with its center of gravity, and longitudinal yokes are supported by the wheel base of the vehicle to which yokes said trunnions are pivotally connected.

Switch Actuating Mechanism—Adam Matz, Cincinnati, O. No. 528,005.

The switch consists of a switch tongue, a pivoted tripping lever therefor and connected thereto, a locking pawl for said lever, under spring tension, a tripping dog, carried by the car, and means on the car, connected to said dog, for throwing the same into or out of engagement with the trip lever, or pawl.

Car Fender—Henry P. Weale, Boston, assignor of two-thirds to George L. Richards and Henry E. Turner, Malden, Mass. No. 528,048.

A life guard apparatus comprising a support on the car pivoted to swing in a horizontal plane, a fender pivoted to said support forward of the latter's center of oscillation so as to swing vertically, and means for moving said fender up and down comprising a vertically sliding and rotatable rod stationarily located on the car and having a slotted arm, and devices carried by the horizontally swinging support including a rod engaging said slotted arm.

Car Fender—Sylvanus D. Wright, New York. No. 528,057.

A car fender, comprising a movable screen frame, means for lowering the same, and spring pressed side wings loosely connected with the sides of the said screen frame and adapted to be unlocked on the downward movement of the screen frame.

TROLLEY WIRE SWITCH PLATE—Gustavus A. Huben, Springfield, O. No. 528,101.

A trolley switch with a metallic frame, having an enlarged mouth or opening, and a trolley wire entering the same, and elastic cushions arranged on each side of said trolley wire.

OCTOBER 30.

TROLLEY CATCHER—Woodson D. Cobb, Fort Worth, Tex. No. 528,149.

This is a pivotal trolley wheel with a spring actuated supporting frame, a catch for connecting the pole to said frame, a trip arranged at the free end of the pole for engagement with a trolley wire upon the dismounting of the trolley wheel from said wire, and connections between the trip and said catch.

CONDUIT ELECTRIC RAILWAY—Julius L. Hornig, St. Louis, Mo., assignor of one-half to Theodore H. Wurmb, same place. No. 528,205.

This is a combination of a main conductor, a continuous insulated holder for said conductor, a detachable trolley carried by said vehicle and guided by said conductor holder, a contact carried by said trolley and suitable electrical connections.

CAR FENDER—William G. Kerr, Providence, R. I. No. 528,298.

Guides are adjustably secured to a car body, shanks are movable in said guides, and a fender having side arms is pivoted to said shank to move vertically. There are means for supporting the fender in the plane of said shanks, and a device for depressing the forward end of the fender.

CABLE GRIPPER—James Whitall, Chicago, Ill. No. 528,313.

There is a suitable frame having a cam, a gripping jaw engaged by the cam and capable of moving relatively thereto in the direction of the length of the cable, said jaw having a yielding friction pad adapted to engage the cable, and rollers adapted to engage and bite the cable when the friction pad is compressed.

CONDUIT SYSTEM FOR ELECTRIC RAILWAYS—John B. Linn, Cleveland, O., assignor of one-half to Oliver S. Kelly, Springfield, O. No. 528,330.

A slot rail is formed of beams having a groove therein, a conductor is in the bottom of said groove and a channel iron is in the top of said groove. Contacting boxes are arranged between said beams and are also provided with grooves to form a continuation of the grooved slot rail.

GRIPPER FOR CABLE RAILWAYS—Benjamin Brownstein, Philadelpnia, Pa. No. 528,359.

The grippers consist of sections joined together to move laterally, and there are oppositely arranged spring actuated jointed rods on the sections to restore them to alignment and a lever to operate the jaws.

CLOSED CONDUIT ELECTRIC RAILWAY—James F. McLaughlin, Philadelphia, Pa. No. 528.379.

This is a closed conduit with a main or supply conductor housed therein, a sectional working conductor composed of sections in the conduit, and exposed sections seated in the top of the conduit and electrically connected to the sections in the conduit, and magnetically operated switches pivoted to the main conductor, formed with switch plates in operative relation to the underground sections of the working conductor and with armatures close to the top of the conduit.

SAFETY DEVICE FOR ELECTRIC CARS—John M. Kelly, Rochester, N. Y. 528,438.

This is a fender hinged at its rear end to the car, and a pivoted catch adapted to be connected with the free or forward end of the fender, said catch located in position and adapted to be operated by the foot of the motorman to drop the fender.

CLOSED CONDUIT FOR ELECTRIC RAILWAYS—William E. Stearns, Berlin, Conn., assignor by direct and mesne assignments, of one-third to David L. Bradt, John P. Coghlin and Frank O. Plummer, Worcester, Mass.

This is the combination of a compressible resilient insulating envelope, an electric conductor inclosed therein, and a traveling trolley plate having a downwardly extending perforated offset portion for shedding water, said plate carrying a series of trolley wheels co-operating with said conductor.

NOVEMBER 6.

TROLLEY WIRE CLIP—J. W. Perry, Philadelphia, Pa. No. 528,561.

A simple clip detachably connected to the wire. May be released without disturbing same.

STORAGE BATTERY—C. J. Reed, Philadelphia, Pa. Nos. 528,647–528,648.

Constructed in such manner that the electrodes of opposite polarity will be located as closely as possible without actual contact. Also the provision of means whereby, on the disintegration of active material, there will be little or no liabilily of the short circuiting of adjacent plates. Also to provide a battery having a maximum surface or area in as small or compact space as possible.

TROLLEY CATCHER—A. S. Osborn, Rochester, N. Y. No. 528,685.

The trolley when accidentally detached from conducting wire is automatically drawn down beneath the same, so as to escape contact with span wires.

INSULATING COMPOUND—Oscar Stiles, Omaha, Neb. No. 528,744.

A material more especially adapted to provide an insulating cover for wires, bars, or plates used in electrical appliances and to provide same with an insulated coating.

FENDER AND BRAKE FOR STREET CARS—J. S. Detrick, Baltimore, Md. No. 528,766.

The car is automatically stopped independently of the ordinary brake mechanism.

TROLLEY LINE BREAKER—C. H. Dey and J. M. Anderson, Boston, Mass, No. 528,767.

A trolley line breaker or insulating joint of a construction capable of being replaced in part, while the electric current is on the trolley line.

BOND FOR ELECTRIC RAILWAYS—H. B. Nichols and F. H. Lincoln, Philadelphia, Pa. No. 528,788.

The objects are to provide a simple and effective air and water tight joint or connections of a bond with rails for electric traction purposes and to provide a bonding joint for the rails of electric railways, in which the members are readily applied to rails, and metallic matter in molten condition is introduced and permitted to expand to establish air and water tight connection of bond wire with rails.

MOTOR FOR STREET CARS—H. S. Park, Chicago, Ill. No. 528,796.

A motor in which excessive weight for motor car will be avoided and a motor of nominal power only is needed for the propulsion. A secondary motor accumulates power when car stops or is running slowly and such power is applied to assist in starting car.

RAILWAY CAR—C. H. Barrows, Willimantic, Conn. No. 528,845.

The propelling mechanism is constructed in a manner to exert the required traction power for propulsion of car with a current from a comparatively light battery.

RAILWAY ELECTRIC SWITCH—W. V. Ash and J. H. Ash, Newark, N. J. No. 528,898.

The object is to provide mechanism by which a car approaching a switch in the rails may automatically throw the switch if it is improperly placed, hold it locked while passing over it, and afterwards release it and return it to its normal position.

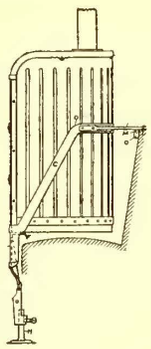
NOVEMBER 13.

TROLLEY—B. F. Lare and C. M. Greer. No. 528,949.

Very simple and efficient fork.

INTERSECTING ELECTRIC RAILWAY TRACK—Mark Lowd, Salem, Mass. No. 528,959.

The object is to produce a crossing adapted for electric railways, in which the current is conveyed to the car by discontinuous conductor sections which are energized in succession by the movement of the car along the track.



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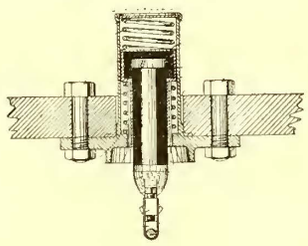

NO. 529,058.

ELECTRIC RAILWAY SWITCH—R. A. Baldwin, South Norwalk, Conn. No. 529,011.

Switching apparatus for automatically moving the switch point of a railway track upon the approach of a car.

CAR FENDER—J. McCarthy, Newark, N. J. 529,041.

The fender or guard is horizontal and has a reciprocating sliding motion.

CAR FENDER—F. D. Weber, Brooklyn, N. Y. No. 529,052.

Consists of a fender attached to the car frame in front of the truck, on a level with the car platform. Has a lower auxiliary fender or receiver extending in front of the upper fender.

TROLLEY WIRE HANGER—J. M. Anderson. No. 529,058.

Used to suspend wires under bridges.

STREET CAR HEATER—M. K. Bowen, Chicago, Ill. No. 529,158.

Stove and casing are supported above the seat.

CAR FENDER—E. B. Graff, Baltimore, Md. No. 529,260.

Adapted to fit either end of a car. Has cushions, springs and light reception bed.

STREET CAR FENDER—H. C. Kennedy and G. W. Roletter, Philadelphia, Pa. No. 529,275.

Made V shape. Carried below the platform. Does not project beyond the same. Throws the object to either side.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. THE STREET RAILWAY PUBLISHING COMPANY, HAVEMEYER BUILDING, NEW YORK.

What is Thought of Our Souvenir Edition.

"IT is a striking example of the wonderful development of trade journalism in this country."—*Pacific Electrician.*

The Souvenir number of the STREET RAILWAY JOURNAL was certainly one of the handsomest and most complete trade journals ever issued from the press.—*Electric Power.*

"THE STREET RAILWAY JOURNAL has made its tenth anniversary the occasion for issuing a special number, containing an account of the Atlanta meeting of the American Street Railway Association. The number shows very great enterprise on the part of the owners of this publication."—*Locomotive Engineering.*

"LANGUAGE would fail us in the attempt to describe the magnificence of the souvenir number. All that the arts of photography, engraving, press work and coated paper can do has apparently been done to add to the splendor of this number. Altogether this achievement of our contemporary indicates prosperity, for which congratulations are in order."—*American Engineer and Railroad Journal.*

"OUR enterprising contemporary, the STREET RAILWAY JOURNAL, has lately issued a splendid example of artistic typography in the shape of a souvenir number, published in honor of its tenth anniversary, and of the Atlanta meeting of the American Street Railway Association. * * * * The whole forms a body of rare and useful information, indicative of the substantial character of trade journalism."—*Scientific American.*

"A SUPERB number is issued by the STREET RAILWAY JOURNAL, of New York City, in honor of its tenth anniversary and of the Thirteenth Annual Convention of the American Street Railway Association, held last week at Atlanta, Ga. The prosperous appearance of this journal evidences that its able and faithful labors in its special field have not been unappreciated. It also presents further testimony of the enduring and substantial character of legitimate trade journalism."—*Manufacturers' Record.*

"THE souvenir number of the STREET RAILWAY JOURNAL, which was published in honor of the tenth anniversary of that journal, is undoubtedly the largest and most elaborate number ever issued. The articles it contains are interesting and timely. The illustrations, which are numerous, are excellent in every respect. Considerable space is devoted to the American Street Railway Association and Atlanta, where its thirteenth annual convention has just been held. The street railways of the Southern cities are described and illustrated, some thirty pages being taken up".—*Electrical Industries.*

"THE STREET RAILWAY JOURNAL made the occasion of the Convention at Atlanta last month the excuse for issuing a souvenir number that reflected great credit upon the publishers, and that gave to those attending that Convention a great deal of valuable information. This issue also marked the tenth anniversary of the JOURNAL'S publication. The JOURNAL is always handsome, always interesting and always prosperous, but this issue was especially attractive. The excellence of its reading matter and illustrations was equaled only by the artistic display of its advertising pages and its general typographical appearance, which is saying much."—*Inventive Age.*

"MANY of our readers, no doubt, have seen and appreciated the souvenir number of our esteemed contemporary, the STREET RAILWAY JOURNAL, issued last month, in honor of its tenth anniversary, and of the Atlanta meeting of the American Street Railway Association. The number was a brilliant triumph of enterprise and the printer's art, and none are more heartily pleased with the success of the special effort than the *Car*. It was in itself a compliment to the trade the STREET RAILWAY JOURNAL so ably represents, and the *Car* is proud and happy in being connected with that special field of commercial enterprise that makes such an achievement possible by its generous support."—*Car.*

"THE STREET RAILWAY JOURNAL issued a souvenir number, October, 17, in honor of its tenth anniversary and of the Atlanta meeting of the American Street Railway Association. It contains a sixteen page article on Atlanta, a ten page article on the Association, a thirty page article on the street railway systems of Southern cities and a twenty page article on the history of the street railway industry. All of these are handsomely illustrated, the number containing over 400 illustrations, among which are more than 125 portraits of street railway men. The number contains 122 pages, and altogether is very creditable to the enterprise of the publishers."—*National Car and Locomotive Builder.*

"THE STREET RAILWAY JOURNAL commemorates its tenth anniversary and the Atlanta meeting of the American Street Railway Association with a souvenir number that is really remarkable as an artistic production. It is printed on plate paper throughout and most beautifully illustrated with half-tone engravings. Its reading pages are full of interesting matter, and the issue will be a valuable one to preserve for reference. In every way it is the finest example we have ever seen of the printers' and engravers' art, and illustrates the substantial character of trade journalism. Among the many features contained in the reading pages is a short history of the street railway industry, which is fully illustrated.—*Electrical Age.*

"THE STREET RAILWAY JOURNAL, of New York, celebrates its tenth anniversary by issuing a souvenir number of some 120 pages profusely illustrated. The first twenty-five pages are devoted to the American Street Railway Association, which held its thirteenth annual convention in Atlanta, Ga., this week, and to views of that city. A tour is then made of the most prominent Southern cities, and a few pages illustrative of the street railway system of each are given. A history of the journal itself follows, and after that comes "A Short History of the Street Railway Industry," which is very comprehensive. In all respects it is a very worthy effort, and will, no doubt, be appreciated by the street railway men of the country."—*Railway Review.*

"THE magnificent mammoth souvenir of the STREET RAILWAY JOURNAL, celebrating its tenth anniversary, contains 122 large quarto pages of reading matter, plus ninety-two pages of advertising, exclusive of cover. A large part of this space is occupied with matter pertaining to the annual convention of the American Street Railway Association, accompanied by portraits and brief personal sketches of the men who are most prominent in the organization. Other articles describing the city of Atlanta and other Southern cities, with a catalogue of the exhibits, a list of applicants for space and the amount of space awarded to each, the leading articles all handsomely illustrated (there are over 400 of these illustrations), make this one of the most remarkable numbers ever issued in the history of trade journalism.

"A history of street railways is another feature of this souvenir number that ought not to be missed in these reviews, but justice can not be done to it in the space here afforded. In an elegantly illustrated article of 14,000 words, the writer has presented a more comprehensive epitome of the origin and progress of the great street railway industry, than has been put in print in any serial publication. The first street railway car ever built is illustrated, and from this to the modern street car and the electro-motor of to-day, a great many rapid steps are reviewed."—*Engineering Magazine.*

SOME FOREIGN COMMENTS.

"THE STREET RAILWAY JOURNAL.—On the occasion of the tenth anniversary of its publication, and that of the Atlanta Convention of the American Street Railway Association, this important, voluminous and really admirable journal has published a unique number, containing a splendid résumé of the scientific, technical and industrial progress made by street railways, all brought up to the latest date.

"This issue, in addition to setting forth many modifications of apparatus, systems and of various installations, also presents to the reader photographs and biographical sketches of the various inventors, promoters and managers in the industry. Ordinary praise is not sufficient for such a publication, but we can truly say that it is equal to the best that can be hoped for in the line of typographical art and expert scientific and business editorship."—*L' Elettricità* (Milan).

"THE above facts we take from the STREET RAILWAY JOURNAL, which celebrates the tenth year of its existence by a souvenir number which must excite the admiration of all journalists, in whatever part of the world they may be situated. This issue contains 122 pages of matter and 105 pages of advertisements. It is printed throughout (editorial matter and advertisements) on thick glazed paper. Both the typography and the illustrations are of the very highest quality, and are unapproached by any technical journal in this country. The whole issue is a reflex of the activity, enterprise and success that marks the American street railroad of to-day. In spite of very serious difficulties, and not a few mistakes, the electric tramway has crowded out all competitors, and is now the prominent feature of American social life. By its aid the citizen deserts the tenement house of the town and speeds at the rate of twelve to twenty miles an hour to a suburban home, where he can live a healthier and a purer life. A new industry and a new source of investment have arisen, and it is not strange that it should support a monthly journal of great artistic merit. The number before us is intimately connected with the meeting of the American Street Railway Association at Atlanta, and contains a large number of portraits of prominent members. It is noticeable how many of these are young men who appear to have risen on the flowing tide and attained positions which, in this country at least, are usually occupied by their seniors."—*Engineering* (London).

"OUR cousins 'across the pond' give us good example and many a hint on many a subject, and on none more than that of journalism and periodical literature. I have before me the Souvenir number of the STREET RAILWAY JOURNAL, New York, It celebrates the tenth anniversary of its existence in a veritable *édition de luxe*, abounding in smart letterpress, interesting and artistic illustrations and attractive advertisements. The present number is devoted especially to blowing that excellent and melodious instrument, its own trumpet—a performance which its merit fully justifies—and to a description of the Thirteenth Annual Convention of the American Street Railway Association, at Atlanta, Ga.

"It does not, however, confine itself to these congenial subjects, but gives a most interesting sketch of the progress of street railways in the States from 1832—when the first passenger street car was launched on the iron road in New York—to the present time. It does *not* forget to remind us that, compared with the progress of the industry in America, England's tortoise-like advance has been almost imperceptible, and it very justly lays this at the door of the 'famous Act of Parliament,' passed in 1870, 'which has done so much to retard the development of street railroading in the mother country.'

"Ah well! Brother Jonathan, we move—slowly, no doubt, but we *do* move—and in spite of the disastrous decision of the House of Lords as to the proper interpretation of the said Act, the next ten years will, I venture to prophesy, show as much comparative progress in electric traction here as the last decade has witnessed in America.

"I only wish we had a 'Street Railway Journal' to help wake things."—*Lightning* (London).

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany Railway	100	1,250,000	Q. Feb.	1½	1893	116	116½
Watervleit Turnpike & R. R. Co.	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany Railway, 1st Mort.	1865	34,000	J. & J.	5	1905	101½	.....
" " " 3d Mort.	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort.	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort.	1888	38,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	388,000	J. & J.	5	1930	103½	.....
" " " Debenture.	1891	200,000	M. & N.	6	1901	117	.....
Watervliet Turnpike & R. R., 1st Mort.	1889	350,000	M. & N.	6	1919	111	113
Watervliet Turnpike & R. R., 2d Mort.	1889	150,000	M. & N.	6	1919	111	112
North & East Greenbush Horse R. R. Co.	1892	30,000	M. & N.	5	1911	.....	.....

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	2,500,000	Sem-an	4	... .	71½	72
City & Suburban Ry. Co.	50	3,000,000	.....	1	.....	47	48
Central Pass. Ry. Co.	50	300,000	.....	...	.....	70	71
Balto. Traction Co. (Cable).	25	5,000,000	Quart.	1	.....	16¾	17

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort.	1892	500,000	.....	5	.....	110	111
City & Sub. Ry. Co. gen. mort	.....	3,000,000	J. & D.	5	1922	111	111¼
Balto. Traction Co. (Cable).	1889	1,500,000	M. & N.	5	1929	107¼	107¾
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D.	5	1942	107¾	108
" " "	1891	1,250,000	M. & S.	6	1901	104	104½
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	112	112½

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange, Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.	50	$6,400,000	J. & J.	4	1887	84	85
West End Com'n.	50	9,085,000	J. & J.	3	1890-1892	59	60

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	166	.....
Brooklyn Traction Co., pref.	100	3,000,000	.....	...	1893	72	.....
" " common.	100	6,000,000	.....	...	1893	15	.....
Coney Island & Brooklyn R. R. Co.	100	500,000	Oct. 1.	4	.....	.....	150
Long Island Traction Co.	100	30,000,000			1893	12	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co.	1893	3,000,000	.. ..	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	103	.....
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	.....	107
South Brooklyn Central R. R. Co., 2d ..	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	113	115

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Nov. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.	50	$100,000	J. & J.	0	.....	.....	73
Enterprise Ry. Co.	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co.	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 108 LaSalle Street, Chicago, Ill., Nov. 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	325	330
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	264	265
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	131¾	132½

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	101½	101¾
Chicago Passenger	1883	400,000	F. & A.	6	1903	109½	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	100¼	100½
North Chicago Street 1st mort	.....	2,413,000	J. & J.	5	1906	.....	103½
West Chicago Street	.....	4,100,000	M. & N.	5	.....	103	103½
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	100	101½
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	103	103½

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$8,250,000	Q.—J.	5	.....	108¼	108½
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	108½	108½
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry.	100	500,000	.....	...	.....	.....	60
" " " Pref.	100	100,000	.....	6	.....	.....	99½
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....		.....	26	27

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati St. Ry.	.....	50,000	J. & J.	7	July, 1895	101½	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	99¼	100
	.....	150,000	J. & J.	5	.....	100¾	101¼
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	110½	111½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	105	105½
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	.....	108
" " " "	.....	300,000	J. & J.	6	Jan. 1914	.....	106
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	90
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati.	.....	250,000	M. & S.	6	Mar. 1912	114	115
S. Cov. & Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	114	115
Cin., Newport & Cov. 5's	.....	3,000,000	J. & J.	5	.....	94½	95

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co.	100	12,000,000	.....	....	1893	51¾	52
The Cleveland City Ry. Co.	100	8,000,000	.....	....	1893	60	65

BONDS.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	100	102⅜
" " City " "	1893	2,349,000	.....			100	102

DETROIT STOCKS.—Corrected by Cameron Currie & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. Mackintosh & Co., Bankers, Holyoke, Mass., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	210	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	150	160

LOUISVILLE STOCKS AND BONDS.—Corrected by Almstedt Bros. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Nov. 21.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$2,000,000	A. & O.	5	Jan. 1891	90	91
Louisville St. Ry. Co., com....	100	4,000,000	.....	...	Jan. 1891	35	36

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	103	103½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	116	117
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	116	117
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. Warren & Co., Bankers and Brokers, New Haven, Conn. Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$600,000	J. & J.	4	.....	45	47
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	.....	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

Bonds.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
New Haven Street Ry. Co.....	1894	600,000	J. & J.	5	Jan. 1919	.....	100
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Winchester Ave. R. R. Co. Deb.	1894	100,000	M. & S.	6	Mar. 1909	100	.....
Bridgeport Traction Co.....	1893	2,000,000	J. & J.	5	July, 1923	95	100
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by George Le Sassier, 188 Common Street, New Orleans, La., Nov. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.....	100	1,200,000	Quart.	1½	1867	120½	122
Crescent City R. Co.....	100	1,150,000	"	3	.866	75	.....
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	38	42
New Orleans City & Lake Co.	100	1,500,000	Quart.	2½	1860	105	110
Orleans R. R. Co.....	50	185,000	"	2	1868	30	40
St. Charles Street R. R. Co..	50	600,000	"	2½	1866	57	59

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	101½	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	101	.....
do do new	1886	40,000	M & N	6	1896	101½	.....
do do	1893	2,000,000	J & J	6	1943	90	93
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	117	120
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	95	95½
St. Charles Street R. R. Co...	1881	105,000	J & D	6	'95-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by Gordon Strathy & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	157½	157½
" " (new stock)	50	2,000,000	.....	...	May, 94.	155½	156

Bonds.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by James McGovern & Co. 6 Wall St., New York, Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	29	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	183½	186
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	162	165
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	165	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	136	140
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4½	.....	310	320
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	47	52
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	300
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	139	141
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	205	210
Third Avenue.....	100	5,000,000	M.—N.	4½	.....	186	187
23d St.....	100	600,000	Q.—F.	2½	.....	300	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	145	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	160

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	110	113
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	106	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	106	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	107	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	105	.....
Broadway Consolidated.....	.....	7,650,000	J. & J.	5	 1943	112	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	111	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	119	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	110	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	100	101
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	.....	53
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	7,000,000	J. & J.	5	Jan., 1937	119¼	119½
23d Street.....	.....	250,000	M. & N.	7	May, 1893	100	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb, 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by Huhn & Glendinning 143 South Fourth st. (Bullitt Building), Philadelphia, Nov. 20. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	272	274
Continental.....	50	1,000,000	J.—J.	6	1873	128	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	329	331
Germantown.....	50	1,500,000	Q.—J.	2¼	1858	112	113
Green & Coates...	50	500,000	Q.—J.	3	1858	126½	128
Hestonville...	50	2,050,000	.....	...	1859	62½	63
Lombard & South.....	25	500,000	A.—O.	8	1861	90	91
People's Traction Co.....	50	10,000,000	.....	...	.....	55	55½
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	165	166
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	81	82
*Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	104½	104¾
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	230	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	215	216
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	230	231
Union.....	50	1,250,000	J.—J.	9½	1864	195	200
West Philadelphia...	50	750,000	J.—J.	10	1857	195	200
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	107½	108
Baltimore Traction.....	25	5,000,000	.....	1	1889	16¾	17
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co. *Ex. Allotments.	50	3,000,000	J.—J.	...	.....	12⅝	12¾

Bonds.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	107¼	108¾
" " Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	103½	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort..... ...	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	**Date of Issue**	**Am't Out-stand-ing.**	**Inter'st Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 306 Times Bldg., Pittsburgh, Pa., Nov. 22. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	...	.....	20½	21
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	59	60¾
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	14¼	14
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	....	63½
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	...	.....	21	21⅝
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	38½	39
West End R. R. Co.	50	1,000,000	J. & J.	1	.....	21	.....
Second Avenue R. R. Co.	50	1,000,000	J. & J.	2	.....	50	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.. ..	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	100,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	27	27¼
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	1927	106	.....
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	105	106
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	95	95½
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	103½	104
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	102	102¾
Second Ave. Electric R. R. Co		500,000	J. & J.	5	1923	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.		500,000	J. & J.	5	1922	104	.....
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	.....
Suburban Rapid Transit.	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	. ...	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	200,000	J. & J.	6	1910–19	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS Bankers, Providence, Nov. 19.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	.. ..	.....
BONDS.	**Date of Issue**	**Amo'nt Out-stand'g**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
United Traction & Electric Co.	1893	8,060,000	M & S	5	1993	95	100
Newport St. Ry. Co.	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Nov. 19.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	38	39
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	65½	66½
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	12	15
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	46	47
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	84	86
do do Common.	100	4,000,000	.....	...	1892	24	25
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	80	82
do do Common.	100	3,000,000	.....	...	1892	15	17
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	32	34
BONDS.	**Date of Issue**	**Amount Out standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid**	**Ask'd**
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	98	99
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	101	102
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	95
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	100	101
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	97	98
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	89	90

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Nov. 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	...	.....	100	105
Geary St., Park & Occan R.R. Co	100	1,000,000	Monthly	...	.....	85	100
Market Street Cable Co.	.....	18,750,000	.....	...	.....	38⅝	39
Oakland, S. L. & Haywards.	.....	.....	.....	...	.....	.....	100
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	12¾
Sutter St. R. R. Co.	.....	2,000,000	Quart'ly	...	.....	.....	.....
Bonds.	**Date of Issue**	**Am't Out-stand-ing.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Cal. St. Cable R. R.	.....	.....	J. & J.	5	.....	107½	.....
Geary St., Park & Ocean.	.....	650,000	A. & O.	5	.....	104	106½
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	120	.....
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	116	116½
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	112	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	93	100
Powell Street R. R.	.....	700,000	M. & S.	6	1912	107	.....
Sutter St. Cable Co.	.....	900,000	M. & N.	5	.. ..	104½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Broker, Rialto Building, 218 N. 4th St., Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	60	62
Citizens'	100	1,500,000	Oct. '93	4	1887	80	90
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	135
Lindell	100	2,500,000	.....	...	1890	106	108
Missouri.	100	2,000,000	Q.—J.	2	1891	200	210
People's.	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis.	100	2,000,000	J. & J.	3½	1890	148	150
Fourth Street & Arsenal.	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban.	100	2,500,000	... .	...	1891	22½	23
Southern, Pfd.	.....	800,000	Jan. '94	3	.....	80	85
" Com.	.....	700,000	.....	...	.....	15	25
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	98	100
Citizens' Cable.	1887	1,500,000	J. & J.	6	1907	105	107
Fourth St. & Arsenal.	1888	50,000	J. & J.	6	1898–1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	102	103
Missouri Cable.	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	99	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable.	1889	800,000	J. & J.	6	1898–1914	90	95
St. Louis Cable.	1890	1,500,000	M. & N.	5	1900–1910	101	103
Union Depot.	1890	4,000,000	A. & O.	6	1900–1910	105	106
Southern.	1884	200,000	M. & N.	6	1904	103	105
Southern.	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban.	1891	1,400,000	F. & A.	5	1921	85	87
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	40	60

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Nov. 21. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	280	.....
Metropolitan R. R.	50	750,000	Q. J.	2	1864	80	.....
Columbia R. R.	50	400,000	Q. M.	1	1870	59	.....
Belt R.R.	50	500,000	Q. J.	...	1875	....	35
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	33	40
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	35
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Wash'tf & Geo'tn conv't. 1st.	'83-'99	3,000,000	J. & J.	6	1899-1929	130	140
" " " 2d.	.....	500,000	J. & J.	6	1903–1943	130	140
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	103	103½
Belt	.....	500,000	J. & J.	6	1921	80	85
Metropolitan R. R. convert.	.....	200,000	J. & J.	5	1901	102	105

Financial.

THE Syracuse & East Side Railway Company has increased its capital stock from $200,000 to $250,000. The liabilities of the company amount to $135,000.

$ $ $

THE North Side Street Railway Company, of Fort Worth, Tex., was sold November 20, by order of the court, to the Fort Worth Street Railway Company.

THE Globe Street Railway Company, of Fall River, carried 4,718,671 passengers during the year ending September 30, 1894, as against 4,475,720 for the previous year.

$ $ $

THE Tonawanda Street Railway and Tonawanda Electric Railway are being consolidated under the name of the Buffalo, Tonawanda & Niagara Falls Electric Railroad Company.

$ $ $

THE receiver of the Flushing & College Point Electric Railroad Company is seeking to interest capital, and to reorganize the company on the basis of extensions in Flushing Village.

$ $ $

THE trustees of the Street Railway & Illuminating Properties, of Boston, have purchased and canceled 586 shares of preferred stock, paying an average price of $102.35. This makes a total of 17,693 shares purchased to date.

$ $ $

THE Worcester Consolidated Street Railway Company reports as follows for the month of October: Gross earnings $32,379.64 against $25,110.90 last year; operating expenses, $16,482.61, against $22,-340.32; net income, $15,897.03 against $2,770.58, an increase of $13,126.45.

$ $ $

THE Citizens' Traction Company, of Pittsburgh, Pa., reports a net income of $182,587.56 for the year ending October 31, 1894, against $189,098 for the previous year, this year's earnings being equal to 6.086 per cent. on the capital stock. The present officers and directors were re-elected.

$ $ $

THE Chicago General Street Railway Company reports operations for six months ending October 31, as follows: Gross receipts, $34,779.95; operating expenses (including suspense account), $18,-404.23; net income and cash on hand, $16,395.72; number of cars operated in May and June, five, the remaining four months seven, on four miles of double track.

$ $ $

THE report of the Eighth Avenue Railroad Company, of New York City, for the quarter ending September 30, shows: Gross earnings from operations, $204,511; operating expenses, $145,652; net earnings, $58,858; other incomes, $6,907; gross income, $65,766; fixed charges, $23,750; net income, $42,016; cash on hand, $26,131; profit and loss, surplus, $29,000.

$ $ $

THE New England Street Railway Company reports gross passenger receipts for October, of $18,070, as against $15,668 last year, an increase of $2,402. The gross receipts for the ten months and three days ending November 3, were $205,631, as against $191,102 last year, an increase of $14,529. These figures cover the operation of the company's New Haven and Plymouth lines.

$ $ $

THE annual report of the Worcester (Mass.), Leicester & Spencer Street Railway Company, for the year ending September 30, shows gross receipts of $77,862.30; operating expenses, $50,847.20; salaries, office expenses and fixed charges, $14,286.14; net earnings, $12,728.96. The company has paid in dividends during the year, $18,750, has carried 1,586,843 passengers, and its cars have run 296,490 miles.

$ $ $

THE Cayadutta Electric Railroad Company reports for the ten months ending April 30 (when the road was leased to the Fonda, Johnstown & Gloversville Railroad Company) as follows: Gross earnings from operation, $51,019; operating expenses, $39,012; net earnings, $12,006; fixed charges, $24,092; deficit for the year. $12,086. Total, $12,504; cash on hand, $389; betterments, $61,596.

$ $ $

IT is reported that prominent stockholders of the Metropolitan Elevated Railway Company, of Chicago, have acquired control of the Chicago & South Side (Alley Elevated) Company. It is locally believed that the North and West Side Companies are behind this matter, and that they will use the Alley Elevated road to secure connections to the South Side, thus competing in the territory of the Chicago City Railway Company.

$ $ $

FOR the quarter ending September 30, the Central Cross Town Railroad Company, New York, reports: Gross earnings from operation, $125,318; operating expenses, $94,161; net earnings, $31,156; other income, $1,190; gross income $32,547; fixed charges, $26,-254; net income, $6,092; cash on hand, $22,288; profit and loss (surplus), $10,723. The net income for the same quarter last year was $6,313.

$ $ $

FOR the quarter ending September 30, the Second Avenue Railroad Company, of New York City, reports: Gross earnings from operation, $284,593; operating expenses, $190,853; net earnings, $93,740; other income, $625; gross income, $94,365; fixed charges, $44,-169; net income, $50,196; cash on hand, $77,561; profit and loss (surplus), $61,459. The net income for the same quarter last year was $55.099.

THE Metropolitan Railroad Company, of Washington, D. C., has decided to bond its property in the sum of $1,700,000 for the purpose of defraying the expenses incident to the construction of an underground electric system throughout its lines. It is said that the system to be used is that of the General Electric Company, which is claimed to be a decided improvement over the Buda-Pesth system of underground conduits, and which has already been adopted by the Metropolitan Street Railway Company, of New York, on its Lexington Avenue lines.

$ $ $

THE property of the Northeast Railway Company, of Kansas City, is to be sold to pay bonds issued in 1889. The Jarvis-Conklin Mortgage Trust Company has a judgment for $292,702.60, with interest and costs. On November 1, 1889, the railway company gave the plaintiffs $260,000 in 6 per cent., twenty year bonds, secured by mortgage and by a large amount of real estate in Kansas City. It was stipulated that if at any time the interest were not paid within three months after it was due the property should be sold.

$ $ $

THE annual report of the Worcester (Mass.) Consolidated Street Railway Company for the year ending September 30, 1894, shows gross earnings of $354,999.55 against $337,657.32, last year, and operating expenses of $284,214.92, leaving a net income of $70,784.63. Deductions from earnings are: Interest, $27,621.42; taxes, $15,613.56; rentals, $2,243.54; total, $45,478.52; net income, $25,306.11. The total number of passengers carried during the year was 7,293,410, against 7,192,883 last year. The number of miles run during 1893–1894 was 1,434,887, against 1,208,854, the year previous.

$ $ $

MESSRS. HAMBLETON & COMPANY, of Baltimore, Md., say of the Baltimore Traction Company: "The earnings are daily increasing, and the management has instituted rigid economies, without in any way affecting the efficiency of the system, and net results are very satisfactory. The company earned in October, $89,989.56, gross, against $83,765.56 for the same month last year, and the net earnings show an increase of $12,490. * * * * The lines of the company's North Baltimore division are showing wonderful gains. * * * This division is earning $50,000 per annum over fixed charges."

$ $ $

THE Ottawa (Ont.) Electric Railway Company has decided to issue $187,700 of new capital stock, in addition to its present capital of $625,600, the proceeds to be used to cancel the floating indebtedness, and to provide for extensions of the system. Present stockholders will have the right of subscribing to the new stock at par on or before December 15, the amount undertaken to be sold by the directors to the highest bidders. There appears to be no question about the stockholders eagerly taking the new issue, as the present stock is changing hands at from 165 to 180 per share, and the company paid 8 per cent. dividends in 1893-1894. The company has no funded indebtedness.

$ $ $

THE Third Avenue Railroad Company, of New York City, reports for the two years ending October 31, 1893 and 1894, as follows: Received from car passengers in 1894, $2,007,804.83; in 1893, $1,653,-539.33; increase, $354,265.50. Operating expenses in 1894, $1,070,-965.66; in 1893, $1,188,235.01; decrease, $117,269.35. Other income, $26,633.11 in 1894, and $92,303.13 in 1893; decrease, $65,670.02. Gross income in 1894, $964,472.28; in 1893, $557,607.45; increase, $405,864.-83. Taxes and bond interest in 1894, $328,467.74; in 1893, $248,539.-30; increase, $79,928.44. Net income in 1894, $635,004.54; 1893, $309,068.15; increase, $325,936.39. Dividends, 1894, $560,000; 1893, $240,000; increase, $320,000. Surplus, 1894, $75,004.54; 1893, $69,-068.15. The report is signed by Alfred Lazarus, secretary. The company has declared a dividend of 4 per cent. on its capital stock, payable November 28.

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THE *Daily Stockholder* (Phila.) announces that Vice-President Frank Thompson and Director A. J. Cassatt, Clement A. Griscom and Wm. Elkins, of the Pennsylvania Railroad Company, and P. A. B. Widener, president of the Philadelphia Traction Company, will be in the directory of the Consolidated Traction Company, of New Jersey, upon its proposed reorganization this month, and that the remaining members of the Board will be Thomas Dolan, of Philadelphia, president of the United Gas Improvement Company; John D. Crimmins, John I. Waterbury, president of the Manhattan Trust Company, and Thomas F. Ryan, treasurer of the Metropolitan Traction Company, all of New York; E. F. C. Young and B. M. Shanley, of Jersey City; and Gen. W. J. Sewell, of Camden. This board will be one of great financial strength, and it may reasonably be inferred that the interests of the Pennsylvania Railroad Company and the Consolidated Traction Company, in New Jersey, will not henceforth be antagonistic.

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THE Manhattan Railway Company reports that for the quarter ending September 30, the gross earnings of all the elevated railroad lines in this city aggregated $2,049,810, a decrease of $329,610, as compared with the corresponding period of a year ago. The gross operating expenses were $1,250,635, and the net earnings were $799,175, a decrease of $279,439. After payment of all fixed charges there remains a surplus of $176,448, which is a decrease from the surplus of

a year ago of $292,467. The company's balance sheet shows: Assets —Cost of road, $55,030,610; cost of leases, $14,014,000; other permanent investments, real estate, $2,381,929; supplies on hand, $283,710; due by agents, $13; due by others, $10,166; due by companies and individuals, $26,573; cash on hand, $393,818; leases on call, $640,000; estate Jay Gould, secretaryship, $300,000; sundries, $37,588. Total, $73,118,409 Liabilities—Consolidated capital stock, $30,000,000; funded debt, $36,078; interest on funded debt due and accrued, $414,946; dividends unpaid, $18,862; due for wages and supplies, taxes, etc., $796,758; due companies and individuals, $30,246, convertible bond certificates, $88,035; Manhattan 4 per cent. bonds, special account, $300,000; profit and loss (surplus), $5,349,644. Total, $73,118,409.

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It is reported that all the street railway and electric lighting interests of Toledo, O., are to be consolidated, Charles A. Coffin, president of the General Electric Company, and Norman B. Ream, vice-president of the Toledo Consolidated Street Railway Company, being the principal parties behind the consolidation. Local papers state that the various companies will go into combination on the following basis:

Consolidated Street Railway Company	$3,000,000
Toledo Electric Street Railway Company	1,400,000
Toledo Electric Company	350,000
Western Electric Company	200,000
Total	$4,950,000

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It is stated that the new organization will have a capital stock of $5,000,000. The proposition is to do away with all but two power houses, one for power and one for lighting.

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THE reports of the two railroad companies which comprise the Brooklyn Traction Company system, for the quarter ending September 30, are as follows:

ATLANTIC AVENUE.

	1894.	1893.
Gross earnings	$252,275.87	$234,227.07
Operating expenses	158,571.63	160,758.07
Net earnings	93,704.14	73,489.00
Income from other sources	22,773.42	19,463.15
Gross income	116,477.56	92,952.15
Fixed charges (including taxes).	71,781.79	50,908.78
Net income	44,695.77	42,043.39

BROOKLYN, BATH & WEST END.

	1894.	1893.
Gross earnings	$58,572.77	$53,698.18
Operating expenses	26,080.61	28,876.85
Net earnings	32,492.16	
Income from other sources	980.38	
Gross income	33,472.54	24,821.33
Fixed charges (including taxes).	15,251.62	10,908.84
Net income	18,220.92	13,908.84

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THE Metropolitan Traction Company has issued a statement of the company's condition on October 1, 1894, which shows capital stock issued, $27,301,650; net cash in bank and due in open accounts from other companies, $3,362,532; balance represented by investments in stocks and bonds of other companies controlled and operated by the Metropolitan Traction Company, $23,939,018; total, $27,301,650. The Metropolitan Street Railroad alone is earning 5 per cent. on investments. The company owns the Columbus & Ninth Avenue cable road, the Lexington Avenue cable road and the Lenox Avenue underground electric road. The Columbus Avenue road will, it is said, be operated as a through cable road by November 15, in connection with the Broadway road. Both the Lexington Avenue and the Lenox Avenue roads are being built, and will probably be finished before the first of the year. When the lines are completed the company will own and control 143 miles of road. The 120 miles in operation show an increase in net earnings for September last over September, 1893, of over $50,000. The bonds and stocks of these companies in the treasury of the Metropolitan Traction Company are: Columbus & Ninth Avenue first mortgage 5 per cent. bonds, $3,000,000; Columbus & Ninth Avenue capital stock, $3,000,000; Lexington Avenue & Pavonia Ferry Railroad Company's first mortgage 5 per cent. bonds, $5,000,000, and $5,000,000 capital stock of the same company, making a total of $16,000,000.

Reorganization in Savannah.

The Savannah Electric Railway Company has announced the following plan of reorganization: $600,000 5 per cent. bonds will be issued to take up the $800,000 of 6 per cent. bonds now on the property; $250,000 of new 5s together with 25 per cent. of the company's common stock, and 25 per cent. of stock of the Brush Electric Light Company will be exchanged for the $250,000 6 per cent. bonds of the Savannah Electric Railway Company. The $250,000 of the Savannah Street Railway Company's bonds will be exchanged at par for the new 5s, and the $300,000 on the consolidated property will receive 25 per cent. in the new bonds. The surplus bonds and the Brush Electric Light stock will be used to pay all outstanding obligations. The present management will remain in control.

Street Railway Traffic in New York City.

The tabulation of the annual reports of the New York City and Brooklyn surface and elevated railroad companies reveals a number of interesting facts. It appears that the adoption of the cable and electricity upon the surface lines has brought about an increase of speed which (perhaps in connection with the much more brilliant lighting systems of gas and electricity) has drawn an immense amount of traffic away from the elevated lines. The Manhattan Railway Company has lost nearly 20,000,000 passengers and $1,000,000 in gross earnings, a very large part of which went to the credit of the Metropolitan Street Railway Company and to the Third Avenue Railroad Company.

Nearly all the surface railways operated by horses showed a decrease during the year, owing partly to the hard times and partly to competition of improved motive powers.

In Brooklyn the elevated roads lost about 8,000,000 passengers, while the surface lines gained nearly as many, although the total traffic, both of New York City and Brooklyn, showed some decrease over that of the previous year, owing, doubtless, to the financial troubles.

A Nickel Plated Road.

"Are the rails and engines all nickel plated?" is asked, time and again, by parties who are contemplating a trip West over this now famous and popular route. "If not, where did it get its name of Nickel Plate?" That is the question! Where did it get its name? It has justly earned its great popularity by reason of its smooth roadbed, elegant equipment, superb dining cars, fast time, and above all, by its giving to the public the *lowest rates* of any *first class* line between the East and West. Popular low rate excursions are of frequent occurrence, and every attention is shown its patrons for their comfort and pleasure. Through palace sleeping cars are run between Boston, New York and Chicago, over the Fitchburg, West Shore and Nickel Plate roads. All information as to *low* rates, through sleeping cars, etc., may be obtained of your nearest ticket agent, or by addressing F. J. Moore, General Agent, Nickel Plate Road, 23 Exchange Street Buffalo, N. Y. ***

Do You Like Comfort When You Travel?

During the period covered by the World's Fair, the Lake Shore & Michigan Southern Railway came into great prominence as the route of the Exposition Flyers. These were the fastest long distance trains ever placed in service on any line of railway. They made the run from Chicago to New York in the remarkable time of twenty hours. Great importance attached to this event. The eyes of the railroad and the traveling world watched the performance of these trains; newspapers devoted columns to, and poetry and stories were written about them. They were recognized as one of the leading features in connection with the great Columbian Exposition. They aptly and powerfully illustrated the merits of this great line as a passenger route.

Long ago the United States Government recognized and selected the Lake Shore as the best route over which to run the famous White Mail Trains, the fastest service of this nature in the world.

A vigilant management, a perfect roadbed, double tracks, and absence of grades and curves have made possible the operation of this high class of service.

Thus it comes about that the Lake Shore takes rank among travelers as the most comfortable of American railways. It is a line used by persons desiring a prompt and reliable service, and who like comfort and elegance in their travels.

A. J. Smith, Gen'l Pass. & Ticket Agent, Cleveland, O.

N. B.—Wagner Vestibule Sleeping Cars without change between Chicago, Cleveland, Buffalo, New York and Boston. Elegant Dining Car service. ***