THE STREET RAILWAY JOURNAL

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Twelfth Annual Meeting of the New York State Street Railway Association.

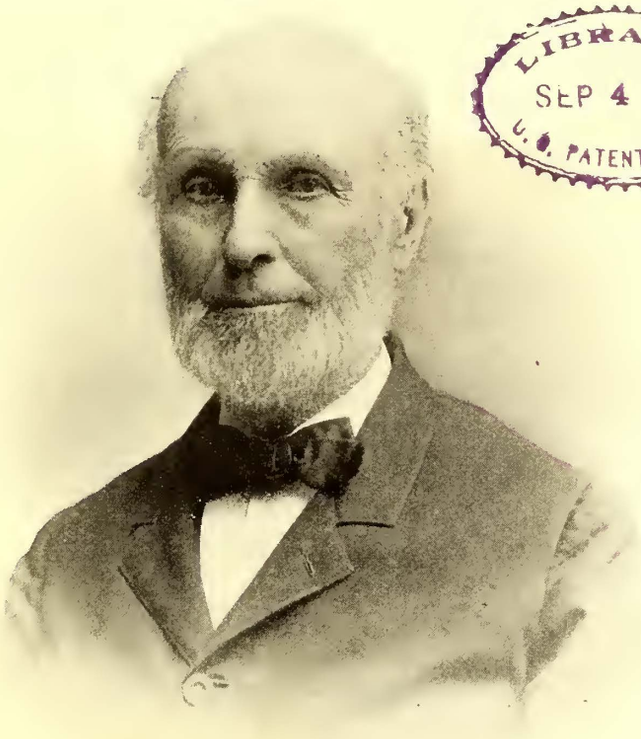
The twelfth Annual Meeting of the New York State Street Railway Association, as already announced, will be held at Syracuse on Tuesday, September 18, 1894. The place of meeting is Yates Hotel, and the Association will be called to order at 10.30 A. M. A number of street railway and supply companies have signified their intention of being represented, and an excellent meeting may be expected.

Two papers are to be read at the meeting, both of which are by engineers who are recognized as authorities upon the subjects on which they will treat, and both promise to be very interesting. The first paper will be by Maj. G. W. McNulty, at present chief engineer of construction for the work of the Metropolitan Traction Company, the subject being "Recent Improvements in Cable Traction." Major McNulty was for a long period chief engineer of the Broadway & Seventh Avenue Railway, occupying this position during the entire period of the the road's construction. We understand that Major McNulty will describe some of the new features in cable practice which have been introduced on the Broadway system with excellent results.

The second paper will be upon "Economy in Electric Power Stations," by J. B. Craven, electrical engineer of the Buffalo Railway Company. Mr. Craven has been identified with the Buffalo Railway for several years, and is conversant with the problems of station economy and management. His paper will, undoubtedly, contain many valuable and interesting facts.

The officers of the New York State Street Railway Association are: President, Daniel B. Hasbrouck, vice president of the Metropolitan Street Railway Company, New York City; first vice-president, G. Tracy Rogers, president of the Binghamton Railroad Company, Binghamton; second vice-president, James H. Moffitt, superintendent of the Syracuse Consolidated Street Railway Company, Syracuse; secretary and treasurer, William J. Richardson, secretary of the American Street Railway Association, and until recently secretary and treasurer of the Atlantic Avenue Railway Company, Brooklyn. Executive Committee: John N. Beckley, president of the Rochester Railway Company, Rochester; Daniel F. Lewis, president of the Long Island Traction Company, Brooklyn; Charles Cleminshaw, president of the Troy City Railway Company, Troy.

According to our custom, we take pleasure in presenting on this page a portrait of the president of the Association. Mr. Hasbrouck is a veteran in the street railway business, and few men are better known among the street railway managers of the State. He has been a regular attendant of the State Association meetings, and has also attended many meetings of the National Association, where his opinions when expressed have been listened to with such attention and respect that he has been termed the Nestor of the street railway business in New York. He has served in a number of official capacities with the New York State Street Railway Association during its history, and last year when vice-president, acted as chairman of the meeting in the absence of the president, C. Densmore Wyman.



DANIEL B HASBROUCK,

PRESIDENT NEW YORK STATE STREET RAILWAY ASSOCIATION.

Daniel B. Hasbrouck is a native of New York State and a resident of the city of Brooklyn. At the organization of the Houston Street, West Street & Pavonia Ferry Railroad Company, some twenty years ago, Mr. Hasbrouck was elected secretary and treasurer of the company, an office which he held continuously until the absorption of that company into the Metropolitan Street Railway Company, the operating company of the Metropolitan Traction Company's street railway system in New York. At the organization of the Metropolitan Street Railway Company, Mr. Hasbrouck was elected its vice-president, which office he now holds.

THE South Jersey Street Railway Company, of Point Pleasant, N. J., put its line in operation August 21. The work of track laying was accomplished, it is said, in nine days. The line will connect with Bayhead and Lakewood.

The New Electric Equipment of the Baltimore City Passenger Railway.

The Baltimore City Passenger Railway Company, one of the oldest and most important lines in that city, has recently completed an extensive electric equipment which has been installed under the direction and supervision of the company's engineer, A. N. Connett. The electric cars take the place of horse cars on the old Green, Yellow and Hall Springs lines of the company. The latter two lines have been merged, and both run now to the ferry terminus in South Baltimore. The Green line has been extended via McCullough Street to Druid Hill Park, where its terminus is at the Madison Avenue gate. From this park it runs to Paterson Park and then on to Canton. The Yellow line runs from Clifton Park to Ferry Bar, the extreme limit of South Baltimore; a branch of this line also extends to Northeast Baltimore. Both lines use on Baltimore Street the cable tracks of the Red and White lines. The use of both motive powers on the main artery of the city, it is thought, might be found useful if anything should happen to either motive power, as the operating cars can clear the street by pushing the disabled cars. In this way a bystander would hardly know that anything was the matter.

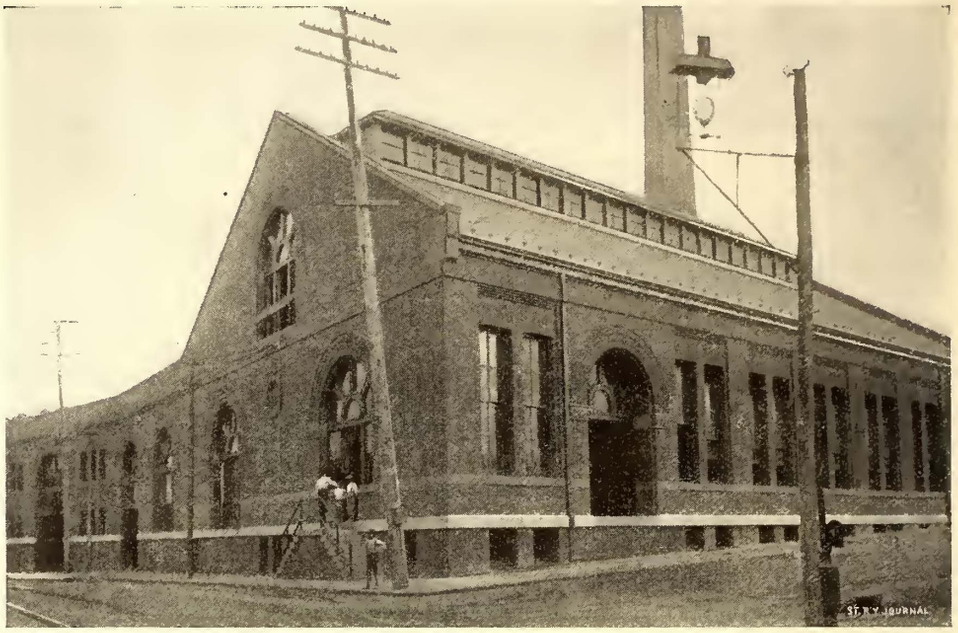


FIG. 1.—LIGHT STREET ELECTRIC POWER STATION—BALTIMORE CITY PASSENGER RAILWAY CO.

The power station, which is a very handsome structure of brick and iron with stone trimmings, is located at the corner of Light and Heath Streets, and is shown in Fig. 1. The part of the building occupied by the engines and generators is provided with a monitor roof supported by iron trusses. In the roof are a number of large windows, which furnish plenty of light and ventilation.

The engine room is shown in Fig. 4, and measures 72 × 90 ft. In addition to the windows in the monitor roof, the room is lighted on the sides by twelve large windows and two semi-circular windows over the doors. On the Light Street front the engine room floor is elevated about six feet above the street level, and is reached by a double step. The side street gradually rises as it extends back to the level with the engine floor at the rear of the building. The engines are three in number, of the high pressure, non-condensing E. P. Allis, Corliss type, with cylinders thirty inches in diameter with sixty inch stroke. The flywheels are twenty-six feet in diameter and weigh 70,000 lbs. each. Each of the engines is belted direct to a Westinghouse 500 K. W. generator by two-ply belts. These belts are fifty-four inches wide and 137 ft. long and were manufactured by the Bradford Belting Company.

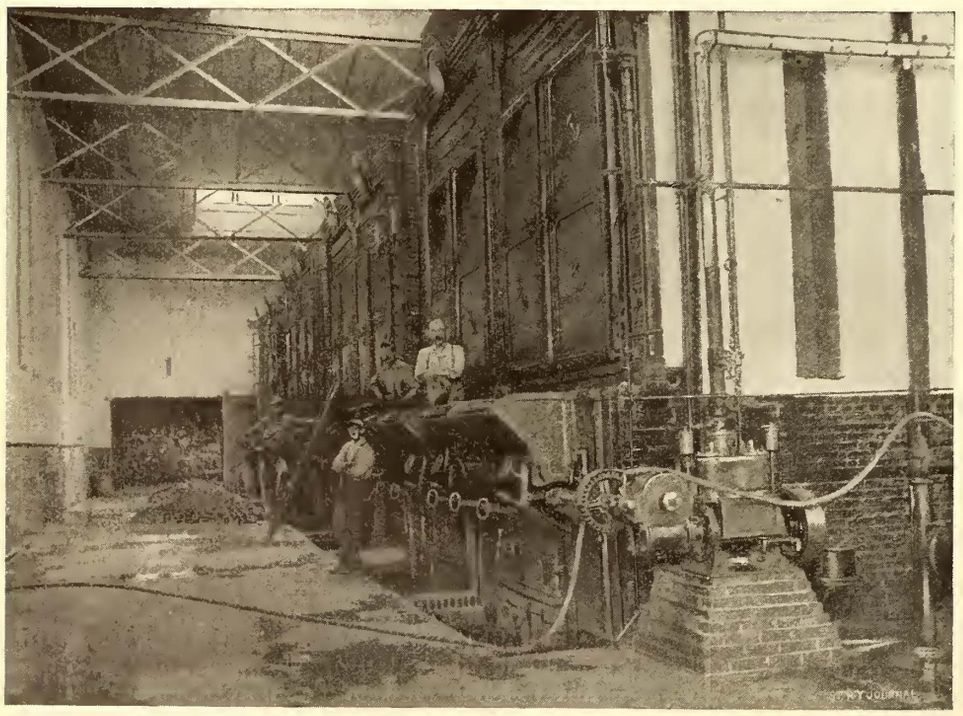


FIG. 2.—BOILER ROOM—BALTIMORE CITY PASSENGER RAILWAY CO.

As will be seen in the illustration, the engine room presents a very neat appearance. The arrangement of the machinery is such as to utilize space and at the same time afford plenty of room on all sides for the attendants. All steam piping and wiring is under the floor, which greatly facilitates the moving of the machinery in case repairs are needed. The generators and engines are tastefully decorated and numbered, and each generator is provided with a handsome brass stand containing a group of incandescent lamps. The rooms are also lighted by arc lamps.

The switchboard, which is a very attractive affair, is shown in Fig. 3, and is located in the center of the Light Street end of the upper room between the doors. It is about ten feet in height, and fourteen feet in length, and is built of white marble with polished brass ends and panel divisions. The instruments are of the Westinghouse make. There are six circuits, and each circuit is provided with an ammeter, circuit breaker and lightning arrester. An alarm gong is also provided, which sounds when any circuit breaker drops. The board is placed about three feet away from the wall of the building, which allows plenty of room for the examination of the connections.

The engine room is spanned by a seventy-two foot traveling crane of ten tons capacity, manufactured by the Maryland Steel Company. In the large additional space unoccupied in the engine room the company has located a large number of modern machine tools, this portion being separated from the engine room by a partition; space is left, however, between the top of this partition and the roof to permit the passage of the crane so as to serve both engine and machine room.

The boiler room is located in a one story building attached to the main power house. The room measures 112 × 46 ft. and is lighted by windows in the roof. The plant has a capacity of 2,000 H. P. and consists of eight 250 H. P. Campbell water tube boilers arranged in four batteries of two each. They are provided with Roney mechanical stokers which are operated by two Westinghouse engines. The front of the boiler room is on a level with the street, and as the ground gradually rises toward the rear of the building, the rear of the boiler room is considerably below the surface of the ground. Here is located the coal vault. A scale is provided for weighing the coal.

The feedwater heaters are of the Berryman make. Two De Ruycke separators, Worthington duplex pumps and Perfection purifiers complete the equipment of the boiler room. The pipes are covered with Magnesia sectional coverings, and Crosby gauges, and Pratt & Cady valves are employed.

The total length of electric track now equipped is thirteen miles of double track. The maximum grade is 5 per cent.

The rails used are a seventy-two pound Johnson girder rail section 219 on four and one-eighth miles of double track, and a ninety pound, nine inch Johnson girder on the remainder. The former is mounted on three

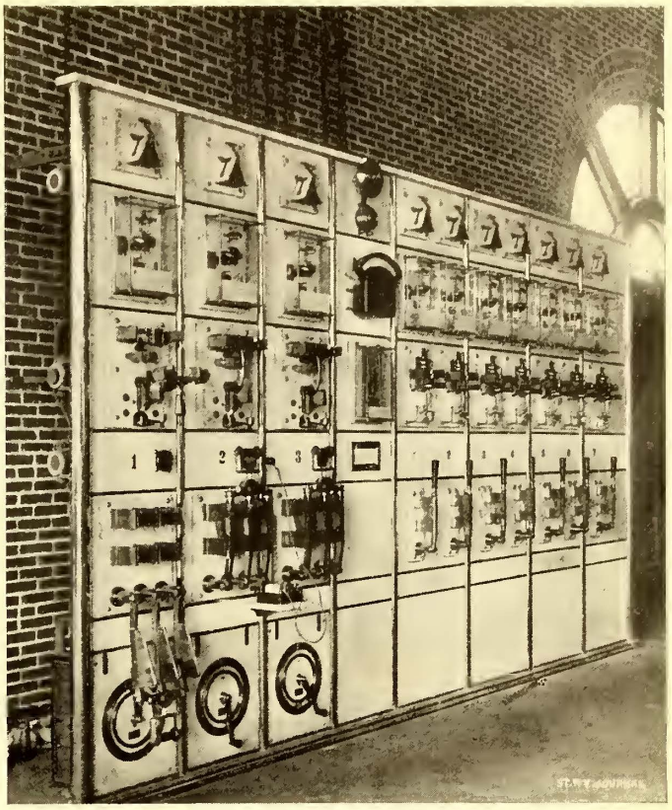


FIG. 3.—SWITCHBOARD—BALTIMORE CITY PASSENGER RAILWAY CO.

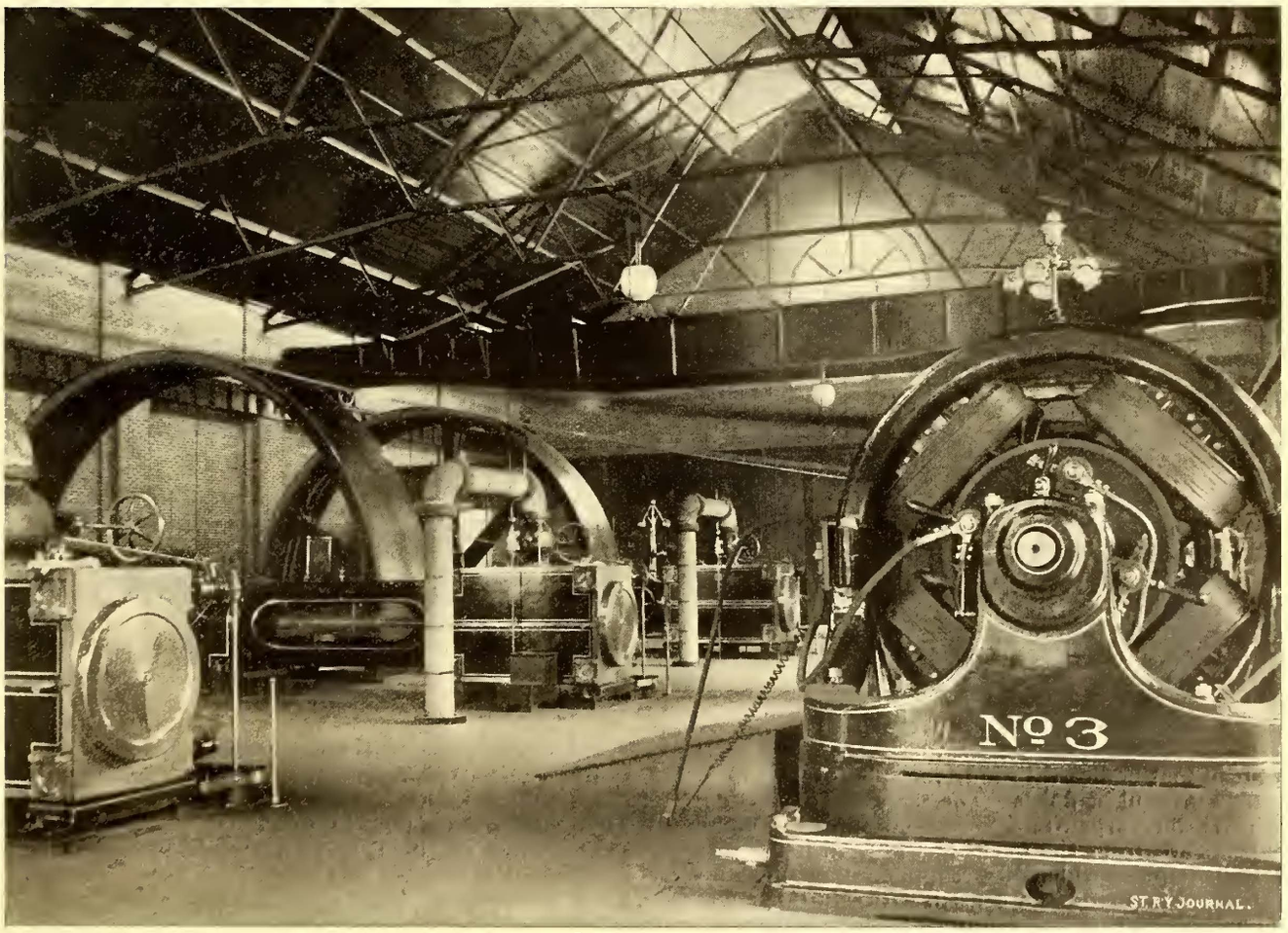


FIG. 4.—ENGINE ROOM—BALTIMORE CITY PASSENGER RAILWAY CO.

inch chairs; the latter spiked directly to the ties. Twenty-four inch joint plates are used with the seventy-two pound rail, and thirty-two inch joint plates with the ninety pound rail. The ties are 6 × 8 ins × 8 ft. and are laid thirty inches between centers. The return circuit is provided by double bonding the rails and connecting

with a supplementary of 500,000 circular mills capacity. Channel pins with tin No. 0. wire are used for bonding.

The trolley wire employed is No. 0. The feed wire consists of eighteen miles of 500,000 circular mills wire, and six miles of No. 0000 wire, both supplied by the John A. Roebling's Sons Company. The line appliances

FIG 5.—ENTRANCE TO DRUID HILL PARK, SHOWING CABLE AND ELECTRIC SYSTEMS—BALTIMORE CITY PASSENGER RAILWAY CO.

were supplied by the New York Electrical Works. Tubular poles of six, five and four inches diameter and weighing 725 lbs. each, are used. Near the power station heavier poles, weighing 1,600 lbs. and thirty-four feet in length, are employed. The pipe sections of these poles are respectively nine, seven and six inches, and with the lighter poles were supplied by the National Tube Company.

The rolling stock of the company consists entirely of motor cars, no trail cars being employed. The cars have eighteen foot bodies with four foot platforms, and are extremely tasteful in finish. The seats are of slats covered with Wilton carpet, and Stanwood steps are employed. The cars are from the works of the J. G. Brill Company, of Philadelphia, which also supplied the trucks. Westinghouse No. 3 motors are used, with Nuttall gears and trolleys. The cars are equipped with Baltimore sand boxes, St. Louis registers, and Whitney thirty-three inch wheels. The fender in use is that known as the California type, consisting of a horizontal board tipped with rubber, and carried at the base of a vertical board. The company also has two Brill sweepers for clearing the tracks of snow in winter, and two tower wagons of its own make.

The car houses of the company for housing the electrical equipment are two in number. The principal one adjoins the power house, and measures 227 × 50 ft. There are five tracks in the building to which easy access is provided by a Hathaway transfer table. The company is about to commence the erection of another car house for the Green line, at the corner of Pennsylvania and North Avenues. The building will be 325 × 75 ft., and will contain seven tracks.

Cars for New Orleans.

The accompanying illustration is taken from a photograph of one of 226 cars which the J. G. Brill Company is building for the New Orleans Traction Company, Limited, of New Orleans, La., of which H. M. Littell is general manager.

The car body is twenty feet long over the end panels, and is seven feet eight inches wide at the belt rail. They are built with twin operating doors with drop sash. The inside finish is in cherry throughout. The decoration is known as the Italian finish, since it was designed especially for the Brill Company by an Italian artist. The window and door heads have a fancy curvature which gives the car a very attractive appearance. The decoration of the panel in a machine line and hand carved is new and distinctive. The head linings, ventilator glass, etc., are decorated to correspond with the same general style of inside finish, and the cars have an extremely handsome appearance.

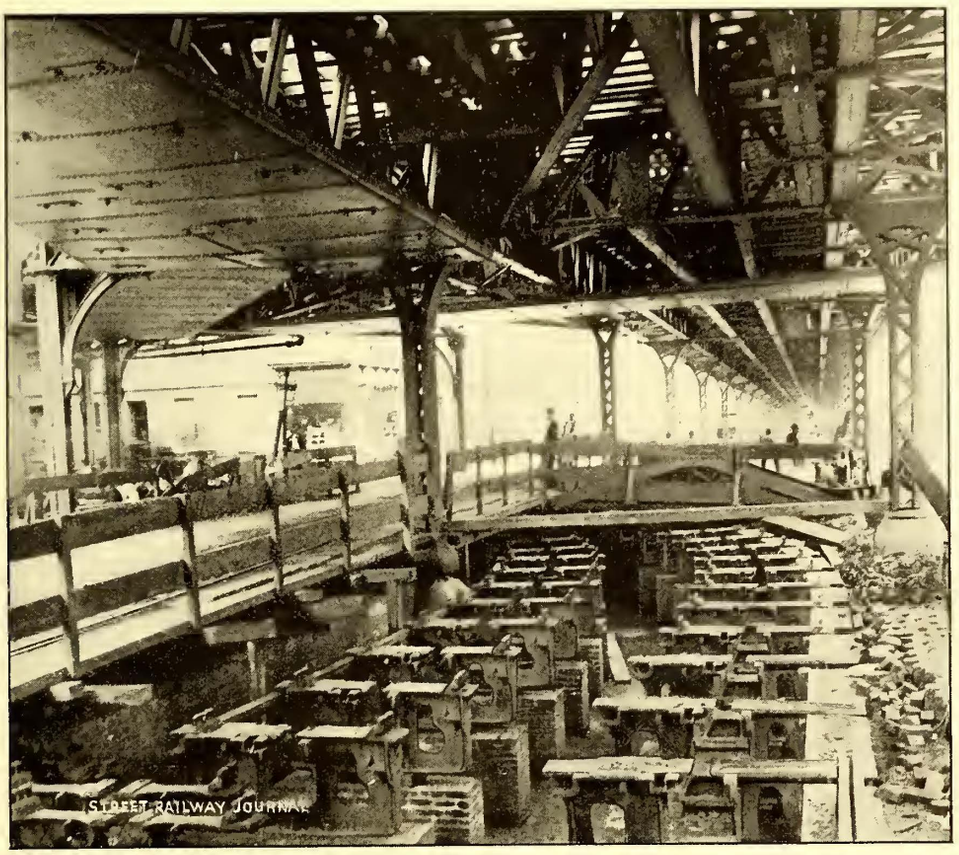
They are mounted on Brill Eureka, maximum traction, No. 22 trucks, with thirty-three inch driving wheels, and equipped with Crawford fenders. Twenty-six out of the 226 cars are now in operation in New Orleans, and are giving excellent service, and fifty more will be in operation within the next month.

CLOSED CAR FOR THE NEW ORLEANS TRACTION CO.

The Peters Avenue and Dryads Avenue lines of the New Orleans Traction Company were put in operation August 14. Twenty eight-wheeled cars are used on these divisions. The Prytania Avenue line was to have been put in operation September 1, and the rest of the tracks of this company are being completed as rapidly as possible.

The Progress of the Columbus Avenue Cable Railway, New York.

The work on the Columbus Avenue cable extension of the Metropolitan Traction Company is progressing rapidly, and it is expected that the line will be in operation by Christmas. As already mentioned, the lower section of the line, extending from Seventh Avenue and 50th Street, through 53d Street to Ninth Avenue and along that thoroughfare to 98th Street will be operated from the 50th Street power station. The work of installing the extra cable machinery at the power station is being done by the Pennsylvania Iron Works Company and is about completed. The new driving drums are sixteen feet in diameter of the solid drum type with removable rims, and are mounted on the outside ends of the original driving shafts. They are of the overhanging type, and having no outboard bearings are provided with a strut for keeping the shafts in line. They are designed for operating the cable at twelve miles per hour. The drums for operating the upper section of the Broadway road are keyed to the shaft, but will be mounted on quills, so that they can be thrown in or out of connection with the shaft by means of jaw clutches.



VIEW AT 53D STREET AND 9TH AVENUE SHOWING CURVE CONSTRUCTION.

The tension device will be similar to those now in use. The run for the tension car is 100 ft. in length, and on the frame of the carriage is mounted a reel, about which the end of the tail rope is wound. The reel is operated by a hand wheel and worm gear, and the length of the tail rope may be varied to allow for the stretch of the cable. The tension tower will be forty-five feet in height and constructed of angle iron. The weights are made semi-circular in form with a radius of fifteen inches and weigh seventy-five pounds.

On account of the limited space for the tension run between the machinery foundations and the wall of the building, it was found necessary to temporarily support the roof during the construction of the tension run. The roof is supported independent of the side walls by wrought iron columns. A novel device for this purpose, invented by Albert Carr will be employed. It consists of two wrought iron brackets riveted to the columns. These brackets rest on short section girders, which in turn are supported by piers built up of of 14 × 14 in. shoring timbers.

The outgoing rope will pass around the deflecting sheaves in the vault on 51st Street, through a blind conduit to the vault at Seventh Avenue, and thence to 98th Street, returning and entering the power station from the 50th Street side. The cable will be supplied by the Hazard Manufacturing Company, and will be 1¼ ins. in diameter. The work of placing the yokes and rails is about completed, the only work remaining to be done being the curves at Seventh and Ninth Avenues and 53d Street, and the deflection vaults at the power station.

A view of the curve construction at 53rd Street and Ninth Avenue is shown herewith. The excavation is about 140 ft. long by twenty-three feet wide, a good part through solid rock. The yokes weigh 480 lbs. each, and are placed five feet apart. They are mounted on separate brick piers, sixty in number, sixteen inches wide by five feet six inches long. As will be seen in the illustration, the outside piers are let into the side wall, while those on the inside of the curve are separated from the wall by about two feet. The height of the vault from floor to roof is six feet. It will be seen by this arrangement that easy access can be had to any part of the vault for the inspection of the curve pulleys. There will be one cable turnout, which may be extended into the car barn if necessary. An exceedingly difficult and expensive portion of the work was at the corner of Seventh Avenue and 53d Street. The excavation at this point was through solid rock, the work being more difficult than at 53d Street and Ninth Avenue as the tracks of the Broadway line had to be supported while the vault for the curve machinery was being blasted out.

The slot rails are of the Johnson No. 247 type, weighing sixty-seven pounds to the yard, and the tram rails are of the No. 249 type of the same company, and weigh eighty-five pounds to the yard.

The contractor for the street construction is John D. Crimmins, and all the work is carried on under supervision of Maj. G. W. McNulty.

Third Annual Meeting of the Pennsylvania Street Railway Association.

The third Annual meeting of the Pennsylvania Street Railway Association will be held at the Neversink Hotel, at Reading, Pa., on September 5 and 6. Papers and essays on the construction, operation and management of street railways will be read and discussed at the meeting. Street railway materials and supplies from manufacturers will be on exhibition and will be an attractive feature of the annual meeting.

Excursions will be taken over the Reading Traction Company's system and the gravity roads on Penn and Neversink Mountains. S. P. Light, the secretary of the company, writes us, extending to street railway companies of Pennsylvania and street railway supply and material men generally, a most cordial invitation to be present and to send representatives to participate in the meeting.

THE Hartford (Conn.) Street Railway Company is now at work equipping its line, and expects to have twenty-one miles in operation by the end of this season.

The Use of Storage Batteries in the Trolley Railway Plant at Zurich, Switzerland.

It seems rather strange that no electric trolley road in this country has yet tried the experiment of using storage batteries in its power station, in spite of all the advantages claimed in favor of the plan. C. O. Mailloux, who read a paper on the subject at the last convention of the American Street Railway Association, and who has been for several years a warm advocate of the plan, in various articles published in this journal, ascribes this want of enterprise to a feeling among railway managers, that each wishes "to let the other fellow try it first." If this be the case, then the hesitation of "the other fellow" may be lessened by the fact that the plan is now in use in Europe. The Oerlikon Machine Works, of Oerlikon near Zurich, have recently installed a plant upon this system in that city which is working very successfully. Some details of the road, from information supplied us by this company, will be of interest to our readers.

The central point of the street railway lines of the Zurich Electric Railway is at Circle V near the Burgwies in Hirslanden, where the power station of the company is also located. From this point the line extends through Forchstrasse to Kreutzplatz, where it divides into two divisions, one extending through Kreuzbühl and Gottfried Keller Streets, the Utoquai and Ramis Street to the Heimplatz, and the other through Klosback Asylum, and Hottinger Streets through the Heimplatz, where the two divisions connect. The total length of the line is 4.6 kilometers (2.36 miles). The grades are quite severe, the maximum of 6.48 per cent. extending a distance of 378 ft. The average grade is 1.1 per cent. The line is a single track road, with the exception of eight turnouts about thirty meters in length, as well as a short section of track upon which the cars of the Central Zurich Berg road run. The gauge is less than that of the Zurich Street Railway Company, which operates with horses—namely, one meter (39.4 ins.) instead of four feet eight and a half inches. The gauge of one meter is that generally adopted for new tramways, on account of its advantages over the other in narrow streets and on curves of short radius.

The type of rail used is the Phœnix 7 A, which has a weight of seventy-seven kilograms per running meter of complete track (seventy-eight pounds per yard). It is laid on a stone foundation without using the usual ties. The track was laid by T. H. Bertschinger, contractor of Lentzburg. The track of the Hottinger line for a considerable distance is macadamized.

The cars are from the works of the Swiss Industrial Company of Neuhausen, and are similar to those of the Zurich horse railway. They have a capacity for seating twelve passengers and standing place for from twelve to fourteen others without overcrowding. A total of twelve cars are operated, of which nine are in regular service, the other three being kept up as a reserve for use on special occasions. Each car is equipped with one four-pole Oerlikon electric motor of eighteen horse power, which is mounted on the truck in the usual way well known here in America. The gears run in grease. The engravings (Figs. 3 and 4) show the design and construction of the motor. The speed and direction of the car are controlled by a controller on each platform operated by means of a lever and gears. The two controllers have a common resistance box. The great disadvantage of the usual controlling apparatus consists in the fact that the arc, which in electric railways is usually caused upon the breaking of the current, acts very disastrously on the contact pieces, and in a short time occasions their destruction. This is remedied by making the apparatus in such way that the sparking occurs only at one place, where it is "blown out" by a small electro magnet specially provided and arranged for the purpose. The equipment includes the usual fuses and cut-out switches familiar in American practice.

The total weight of the car, empty, with electrical equipment is about 4.19 (short) tons, or, including passsengers, about 6.19 tons (of 2,000 lbs.).

With nine cars it is possible to operate on a headway of six minutes. This requires an average speed of 10.6 kilometers (6.57 miles) per hour, including stops; in other words, about one and a half times the speed of the horse cars. This service is maintained for 12.9 hours per day, and during the early morning and late evening hours—that is for 1.9 hours per day—a twelve minute service is run. An entire round trip occupies fifty-two minutes, of which eight minutes are taken up by stops,

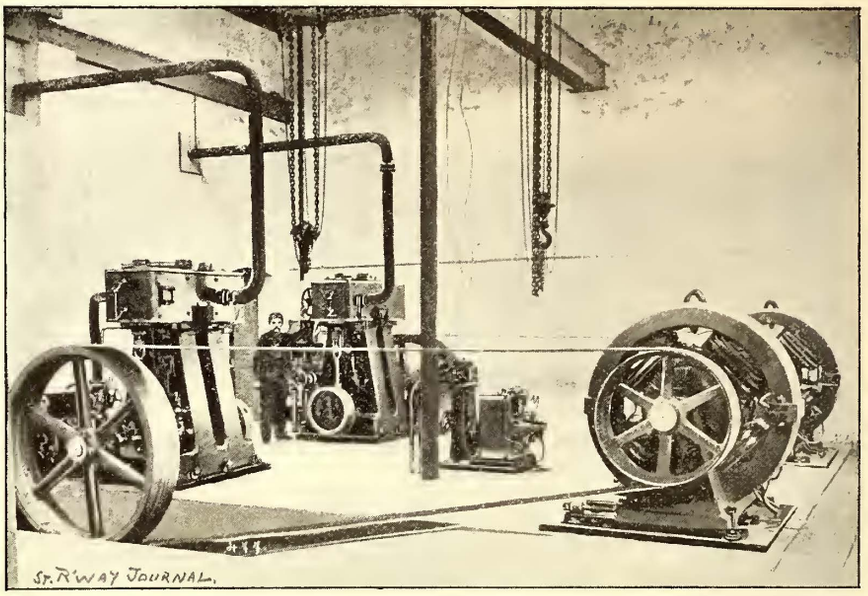


FIG. 2.—INTERIOR OF POWER STATION—ZURICH ELECTRIC RAILWAY.

FIG. 1.—VIEW AT THE KREUTZPLATZ—ZURICH ELECTRIC RAILWAY.

the stop made at each terminus consisting of one minute.

Very handsome iron poles, with or without brackets, are used within the city limits, consisting of three sections of pipe of 5, 4 and 3 ins. to 6, 5 and 4 ins. interior diameter, while on the outskirts of the city wooden poles are used. The trolley wire is of copper of seven millimeters (0.276 ins., about No. 1½ B. & S.) diameter, and is supported at a height of about five and a half meters (18 ft.) above the street, so that it does not interfere with even the highest vehicles. Span wire (steel) or bracket construction is employed, the use of each depending upon local conditions.

The trolley wire serves for the outgoing circuit, the rails being used for the return. The joints are bonded with copper bonds. A copper supplementary return of seven milimeters is laid between the rails and connected from time to time with the rail bonds, making a continuous return circuit. The outgoing circuit is divided into four insulated sections of about the same length, each supplied from the central station through a feeder of sixty square millimeters (about No. 00 B. & S.) cross section. Guard wires are also employed to protect the trolley wires from falling telephone or telegraph wires. Most of the telephone wires are run underground.

The power station, which is contained under the same roof as the car house and repair shop, is located at the end of the line in Hirslanden and is shown in plan in Fig. 5. The current is supplied, as has been already stated, by a generator and a battery of accumulators working in parallel, the batteries being located between the engine and boiler rooms.

To understand the arrangement of the storage batteries, it must be noted that the current load in stations of such small capacity undergoes uncommonly severe and quick fluctuations. It might happen, that, for a moment, namely, when perchance all the nine cars stop at one time, the current may fall down to zero, and possibly, in the next moment, it may jump to the maximum of 200 amperes. On the average the current required is around eighty to ninety amperes. It is evident that such a variable load, without the help of storage batteries, must have the most deleterious influence on the efficiency of the dynamo and engine. On the other hand, by using storage batteries, one can obtain the great advantage, that the engine and dynamo load remain almost uniform. If the power consumption on the line rises above the capacity

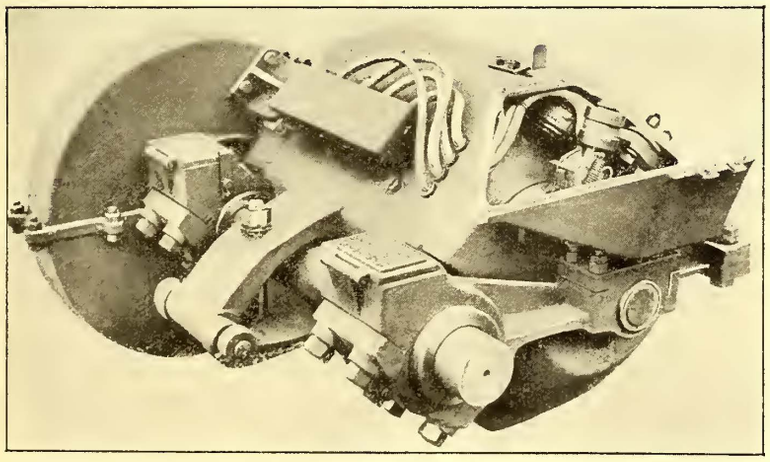


FIG. 3.—MOTOR WITH CASE CLOSED—ZURICH ELECTRIC RAILWAY.

of the generating plant, then the storage battery assists the plant; if, on the contrary, the consumption falls below the capacity of the latter, the surplus of the current produced by the dynamo flows into the storage battery and charges it. The plant, therefore, runs at its normal capacity, that is to say, under the most favorable conditions possible.

In regard to the advantages of using storage batteries in parallel with the generator, the Oerlikon Works Company submits the following computation:

"The average grade on the Zurich electric railway amounts to 1.1 per cent. The load of the car, including electrical equipment, amounts to about 3.8 (metric) tons. If we consider that the cars carry, besides the conductor and motorman, on an average one-third of their total carrying capacity, which is not estimating it too high, the average total weight per car reaches 4.4 (metric) tons. Assuming the traction co-efficient to be twelve kilograms per (metric) ton (twenty-four pounds per ton of 2,000 lbs.), the total round trip therefore requires $2 \times 4{,}600 \times 4.4 (11 + 12) = 931{,}000$ kilogrammetres. No account is taken of the reduced consumption on down grades.

"The complete trip with all stops on the way and at the end, requires fifty-two minutes; therefore with the allowance of 25 per cent. increase for starts and curves, this corresponds to an average output of $1.25 \times \frac{931{,}000}{54 \times 60 \times 75} =$ 4.75 effective H. P. per car measured at the car axle.

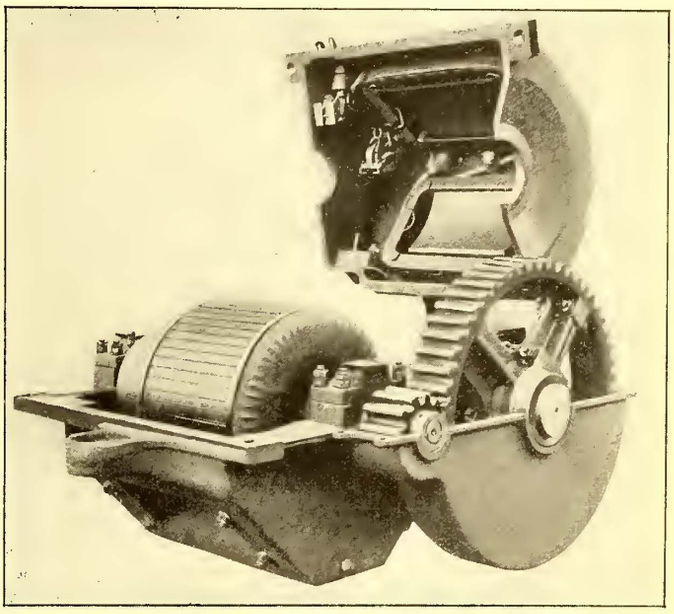


FIG. 4.—MOTOR WITH CASE OPEN—ZURICH ELECTRIC RAILWAY.

"The average loss from the steam engine to the car wheel can be taken at 35 per cent., and therefore the efficiency comes out 65 per cent.

"For a twelve minute run (five cars) we have therefore $\frac{5 \times 4.79}{0.65} = 36.8$ H. P.; and for a six minute run (nine cars) $\frac{9 \times 4.79}{0.65} = 66.3$ H. P., which is the power required at the engine flywheel; or, per day, $36.8 \times 1.9 + 66.3 \times 12.9 =$ 925 H. P. hours, for which a daily consumption of 1,350 Kgr. (2,975 lbs.) of coal or 1.46 kilos (3.22 lbs.) per H. P. hour is required.

Power stations for electric railways without storage batteries consume for this output, as demonstrated by experience, 2.5 kilos (5.51 lbs.) of coal and more (per horse power hour). In fact, there will be not less than 440 tons of coal saved per annum; while the cost for the maintenance of the battery scarcely exceeds one-seventh part of this amount saved."

The power station is equipped with the following apparatus: Two vertical, compound steam engines, each of ninety horse power, operating at 240 revolutions perminute; two Oerlikon shunt generators of sixty-six kilowatts capacity (550 volts), operating at 450 revolutions per minute, belted to the engines. Of these two pairs one only is usually in service, the other being held as a reserve. The idle pair can be put in service to relieve the other without interrupting the service of the station. It is, however, apparent that in case repairs to the storage batteries should be necessary the battery must be disconnected for a given time; in which case the reserve plant takes the place of the battery, and both machines, by switching

in the compound coil, work as compound wound dynamos.

The storage battery is located in a special room, and consists of 300 Tudor elements No. 110, of 245 ampere hours and having a maximum current rate of eighty-one amperes. It is, however, possible, without shortening the life of the batteries, to double this current for a shorter time.

The regulation of the charge or discharge of the batteries is effected by switching cells in and out of circuit by an automatic arrangement, which is the common practice in Europe. In order to recharge these regulating cells and bring them up to the proper condition and make them uniform with the rest, a small, direct-coupled generating unit is used, having a capacity of about three kilowatts, or twenty amperes at 150 and thirty amperes at 100 volts. It is found by experience that this small unit need not be operated continuously, but is only required to operate for an hour or two each day.

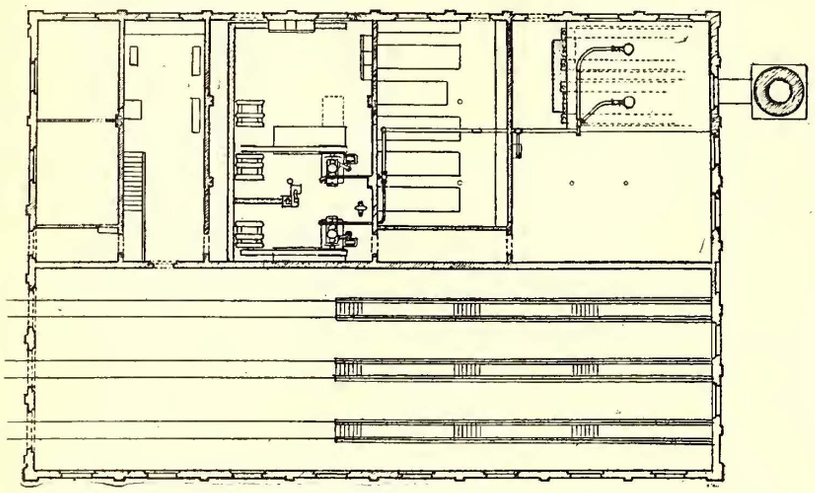


FIG. 5.—PLAN OF POWER STATION AND CAR HOUSE—ZURICH ELECTRIC RAILWAY.

The regulation, safety and control of the installation are secured by a large number of devices which are mounted on two elegant, polished marble switchboards, and so disposed that one serves for the dynamos and the other for the batteries. The steam for the plant is produced by two Galloway boilers each fifty-eight square meters (625 sq. ft.) heating surface, with two feedwater heaters; both are usually in operation, but one can carry the whole load for a short time.

A Model Electric Railway Patrol System.

The North Hudson County Railway Company, of Hoboken, N. J., whose extensive railway system has been described in former issues of the Street Railway Journal, has recently adopted a system of electric signaling in connection with its patrol service, embodying many new and novel features. The system was designed by A. K. Bonta, electrical engineer of the company. By this apparatus it is possible to send signals from any point along the line to the patrol stations of the company, and to apprise the men in charge of the exact location and nature of the trouble.

Signal boxes, similar in appearance to those in use by the fire departments, are attached to the poles supporting the trolley and feed wires, and are located about a quarter of a mile apart along the entire line. The boxes are arranged to transmit six signals which are marked in plain letters on a circular brass disk as follows:

Signal No. 1. Car off the track.
" " 2. Broken axle.
" " 3. Trolley wire down.
" " 4. Telephone call.
" " 5. Rush call.
" " 6. Special call.

Each box is numbered, and its number and location are marked on a chart located near the alarm board in the patrol station.

The motormen are provided with keys to the signal boxes, and each key is numbered and charged to the man to whom it is given. After a signal box has been opened and the message sent, the key cannot be removed from the box without a special key which can only be obtained from the office. Owing to this arrangement motormen will not be apt to send false alarms.

FIG. 1.—PATROL HOUSE—NORTH HUDSON COUNTY RAILWAY, HOBOKEN.

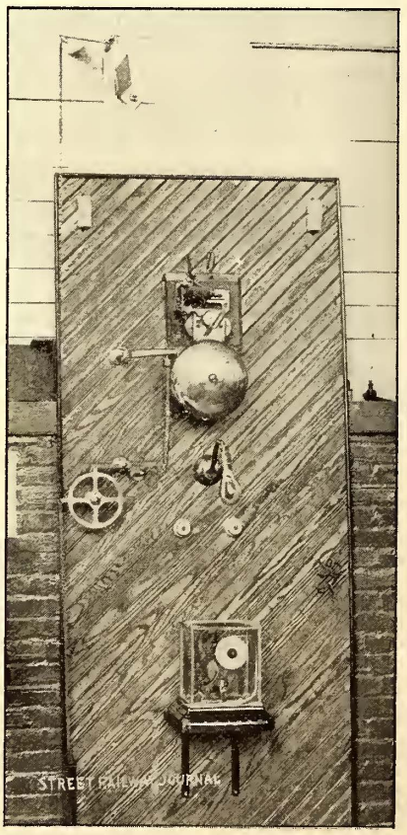


FIG. 2.—ALARM SIGNAL BOARD.

The operation of the signal boxes is extremely simple. In sending an alarm the motorman opens the box and pulls down the signal lever until the pointer on the lever is opposite the message he desires to send. He then lets the handle return automatically to the original position, when the message is transmitted to the patrol stations. Each signal consists of a certain number of strokes on a gong The number which is rung tells the location, and the number of times it is repeated indicates the nature of the trouble, according to the schedule already given. A recording instrument attached to the alarm board prints and records every signal. The dot and dash system is used, the dots representing units and the dashes tens. For example, a broken trolley wire near box No. 12 would be recorded as follows: —. . —. . —. .

An alarm sent from any signal box is recorded in every patrol station, and is answered by the station in whose district the box is located. When a patrol wagon returns, a signal is sent to the other stations, which notifies them of the return. It will be seen by this system that if a second alarm comes to a certain patrol station while the wagons of that station are out on duty from a previous call, the fact is known at the other stations, and the call is answered from the station nearest the district from which the signal is sent. There will be four patrol stations located at convenient points along the line. Two of these stations are now completed, and the others will be in operation in a short time.

The Palisade Avenue station, an exterior view of which is shown in Fig. 1, is located in the rear of the Palisade Avenue power station, at the corner of Racine and New York Avenues. The building is of wood, two stories in height, the ground plan measuring 30 × 50 ft. The interior arrangements of the station, as will be seen, are similar to the engine houses of the fire department. Each station has a patrol wagon and tower wagon, designed and built especially for the company, and provided with hydraulic jacks, blocks and tackle, and the necessary tools for any emergency. An interesting feature of the repair wagon equipment is a portable electric lighting outfit. This is supplied with current by a storage battery which is located under the seat, and is charged by the railway current while the wagon is in the station. In addition to side lights on the wagon, several extra lamps and about fifty feet of flexible lamp cord are provided. In case of an accident at night where a light underneath the car is desirable, the device is particularly valuable.

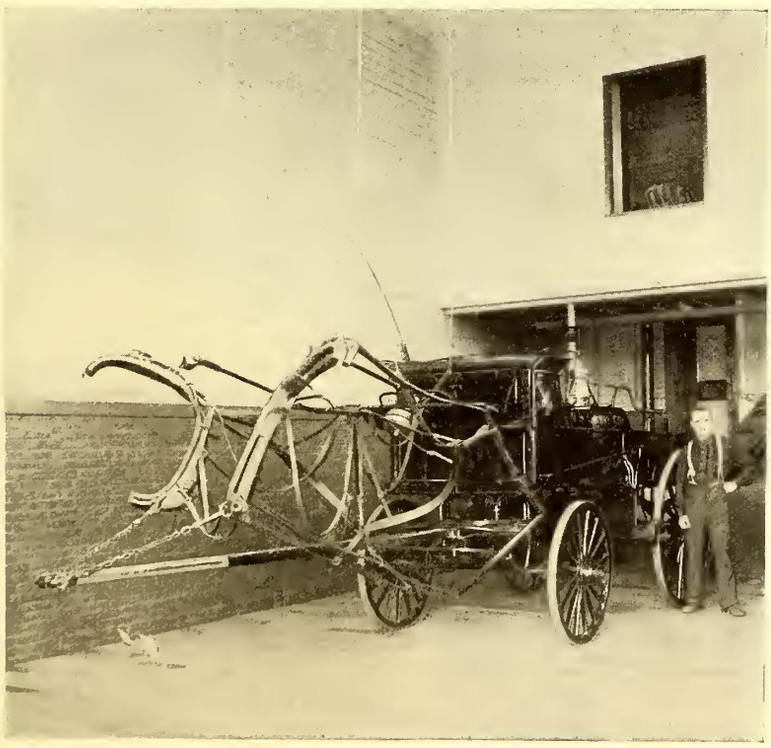


FIG. 3.—EMERGENCY WAGON—PATROL SYSTEM OF NORTH HUDSON COUNTY RAILWAY, HOBOKEN.

FIG 4.—TOWER WAGON—PATROL SYSTEM OF NORTH HUDSON COUNTY RAILWAY, HOBOKEN.

The stalls for the horses are located in the rear of and facing the patrol wagon, as shown in Fig. 3. The horses are thoroughly trained, and on the sounding of the alarm they are automatically released and immediately jump to their places. The harness is dropped by pressing a button, and by snapping the collars and reins they are ready to go. A well lighted and ventilated room on the second floor is provided for the men in charge of the station. It is eleven feet long and thirty-three feet wide, and is carpeted and comfortably furnished with beds, tables and chairs. The ground floor is reached by a wide stairway, and a brass sliding pole, similar to those used by the fire department, is used to expedite the movements of the men.

The operation of the system was witnessed recently by a representative of the STREET RAILWAY JOURNAL. An alarm was sent from a signal box four blocks distant from the patrol station, and the repair wagon was on the ground one minute and three seconds from the time of sending the alarm.

Meeting of the Maine Street Railway Association.

The midsummer meeting of the Maine Street Railroad Association was held at Rockland, Thursday, August 16. The meeting was called to order at 10 A. M. After the transaction of business, the delegates boarded the cars of the Rockland, Thomaston & Camden Street Railway Company, which took them to the Bay Point Hotel, where an elaborate repast was served and a most enjoyable time was had. By the courtesy of the Maine Central Railroad the use of a special car was tendered the Association, to transport delegates from Portland.

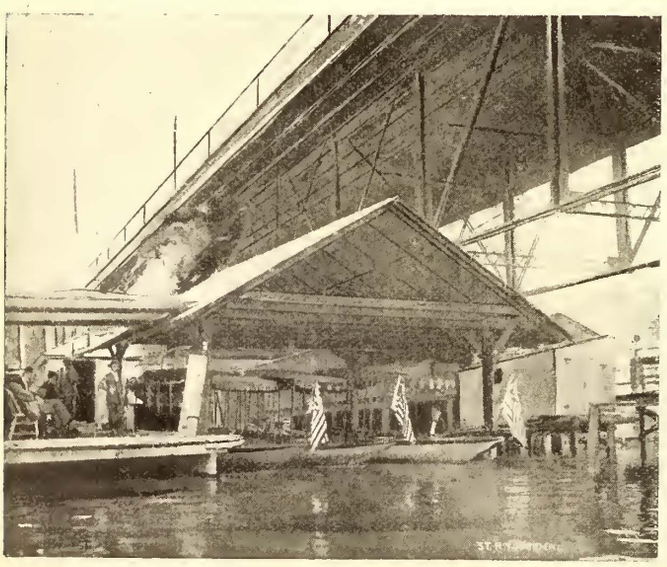
Electric Launches in Milwaukee.

We have mentioned a number of instances in which electric launches operated by storage batteries have been used in connection with electric roads. It is the usual custom to store the batteries for these launches by the

ELECTRIC LAUNCH ON THE MILWAUKEE RIVER.

railway current, and to operate them on a lake or river at the terminus of some division of the railway as an attraction to pleasure seekers.

Three of the launches used at the World's Fair, Chicago, were purchased by the Milwaukee Electric Launch Company, and are now in use in that city at the end of the Cambridge Avenue line. The stockholders of the Electric Launch Company, include a number interested in the Milwaukee Street Railway, and the electrican of the road, O. M Rau, is manager of the Launch Company. A trip of four miles is made by the launches, and twenty-five cents is charged for the round trip. The managers state



STORING STATION FOR LAUNCHES—MILWAUKEE.

that this departure has proved very popular, and that it has added materially to the traffic on the electric division serving this point.

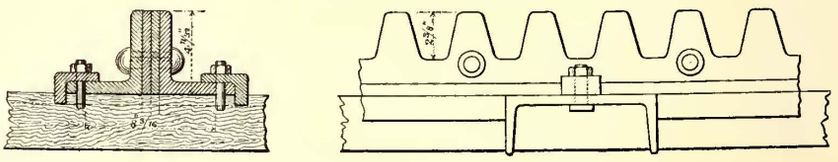
The Pottsville (Pa.) & Reading Railway Company, was organized August 23. C. H. Barritt, of Wayne, Pa., is president.

The S. Ellero-Saltino Rack Railway.

There are several mountain railways in Italy constructed on the principle of simple adhesion, with gradients as steep as 6 or 7 per cent., and there are many on the cable system combined with the rack rail. The S. Ellero-Saltino Railway is the first constructed there with the central rack only. On April 18, 1892, the Italian Government granted a concession, and the work, begun in the middle of May, was completed, and the line was open for traffic in four months after its commencement. Starting from S. Ellero, 366 ft. above sea level, on the Rome-Florence railway, about seventeen miles from Florence, the line which is intended almost solely for tourist traffic, ascends to Saltino, 3,131 ft. above sea level, a total of five miles, the steepest grade being 1 in 4.55. An interesting description of the railway was given in a paper read recently before the English Institution of Civil Engineers, by J. E. Caccia.

According to Mr. Caccia, the difference between this and other lines which have been constructed on this principle is the rack rail itself, the invention of Count Joseph Telfener. Rack rails have been made of cast iron (Blenkinsop system); wrought iron ladder arrangement (Riggenbach system); and steel (Abt system); or, as used on the Mount Pilatus railway, a double row of vertical cogs, milled out of solid steel bars. The Abt was, of course, a great improvement on the Riggenbach system, owing to the difficulty and cost of accurate construction of the ladder rack, although this system possesses greater lateral strength and stiffness. The Telfener rack rail (Figs. 1 and 2) is much like the Abt, but cheaper and simpler in construction, of Siemens-Martin steel. It consists of two L bars and intermediate steel bars.

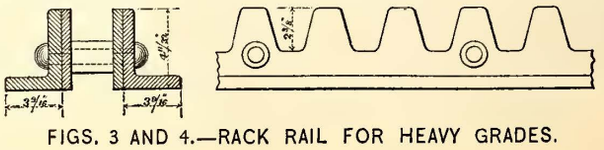
On lengths where the gradient does not exceed 12 in



FIGS. 1 AND 2.—TELFENER RACK RAIL.

100, the rack is formed of the two L bars riveted together, On lengths with grades over 12 in 100 and up to 22 in 100, the rack has the same L bars, but in addition two intermediate plates, the four thicknesses being riveted together (Fig. 1); so that, besides giving to the toothed line greater resistance in these lengths, it increases the width of the teeth, and by that means a greater gearing space is obtained, which is especially desirable on sharp curves. The dimensions of the rack are: Height of L bar, 4⅜ ins.; width at base, 7⅛ ins.; thickness of L bar, $\frac{11}{16}$ in. The dimensions of the plates between the L bars are: Height of plate, 4⅜ ins.; thickness of plate, $\frac{9}{16}$ in.

This rack rail may also be strengthened in the following ways: 1. By giving a greater height to the intermediate plates and grooving them into the longitudinal sleeper. 2. (Figs. 3 and 4) the L bar and plates, instead of being united, may be placed with a certain space between, as in the Abt system, using tubular distance pieces, and obtaining by that means a double or triple rack; this rack has the disadvantage that it cannot be placed in steps as in the Abt system, but the wheel is larger, and therefore able to grasp three teeth at a time. It was specified in the contract that the plates of the rack should have a resistance of 31 to 38 tons per square inch. and a shearing strain of 15 per cent. It was also required that each tooth



FIGS. 3 AND 4.—RACK RAIL FOR HEAVY GRADES.

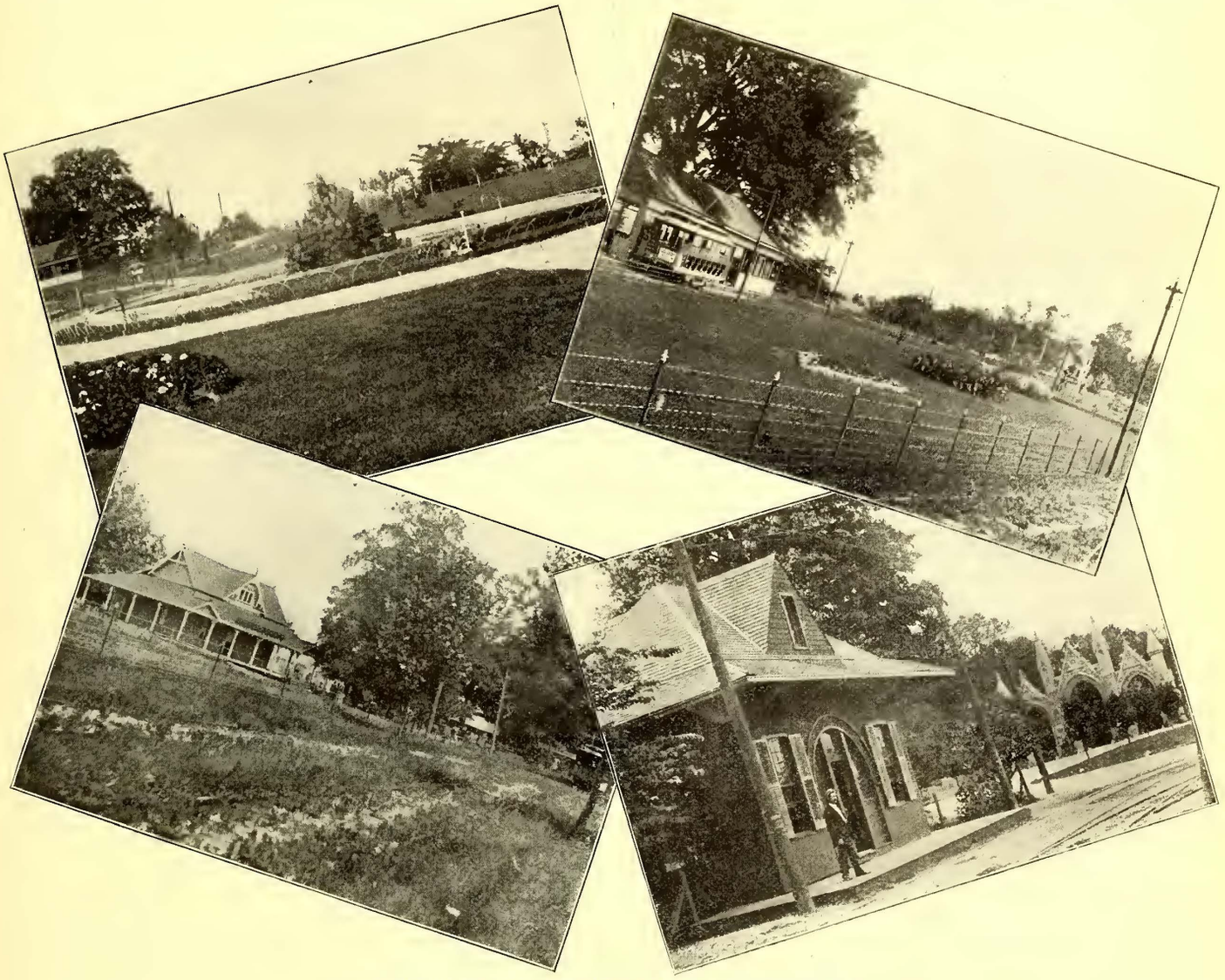
of the compound rack rail should support a weight of 78.73 tons on an incline of 22 per cent. The cost of the rack complete was approximately $3.25 per lineal yard,

which is considerably less than that of the Riggenbach or Abt rack.

The trains run at 5½ miles per hour on grades up to 15 per cent, and 4⅓ miles per hour on grades from 15 to 22 per cent.; so that the entire length of line, 4.97 miles, is traversed in fifty-seven minutes.

The Park of the Citizens' Street Railway Company, Indianapolis, Ind.

A description was given in our last issue of the plant of the Citizens' Street Railway Company of Indianapolis, and mention was made of the fine park which the company owns. It is located about five miles from the city, and is at the terminus of two or three of the company's lines.



PARK VIEWS—CITIZENS' STREET RAILWAY, INDIANAPOLIS.

We present in a group on this page three views taken in this park which is tastefully laid out and forms a very attractive outing spot. The fourth view, that in the lower left hand corner of the group, shows a station of the company and entrance to one of the cemeteries of the city.

These engravings, besides being interesting in themselves, show a growing tendency of street railway companies to establish parks or other pleasure resorts at the termini of their lines. The number of pleasure seekers which can be attracted to patronize the cars running to such resorts is often very large, and the added business created by the establishment of such pleasure resorts will often be found to pay a very large percentage on their cost of establishment.

The park of the Citizens' Street Railway Company at Indianapolis is ornamented with flower beds, tropical plants, and the turf and walks are carefully kept, making a most attractive resort. The usual attractions of a dancing pavilion, swings and merry-go-rounds are provided, and an excellent restaurant is located on the grounds. The company carries free a number of children for the Fresh Air Mission, of Indianapolis, to a building near the park devoted to this charity.

Progress in Europe of Gas Motors for Street Railways.

Some experiments covering a number of months have been made in Dresden, Germany, with the Lührig gas motor for street railway service. Although of somewhat complicated construction, this car worked successfully at a net cost of operation, it is claimed, far below that of electric or horse railways. Through the death of the inventor and other circumstances, the field of experiment has been transferred to England, where the Lührig patents have been acquired by a syndicate, and the car has undergone, during the past four or five months, material modifications.

According to a recent report submitted the State Department at Washington, by Frank H. Mason, United States Consul, at Frankfort, a car of this improved type is now worked regularly on the lines of a tramway company at Croydon, near London, and has attracted expert attention from all parts of Great Britain. But one gas engine is used, the two cylinders of which are set facing each other, and both working to the same crank. The engine is located under the seat on one side of the car; the other end of the driving shaft, which extends across beneath the floor of the vehicle, carrying a heavy flywheel, which steadies and regulates the motion of the en-

gine. By this improvement, the number of working parts, and, therefore, the weight, cost, and wear and tear of the motor have been greatly reduced.

The motor is designed to run at a constant speed and is arranged to be thrown in and out of connection with the car axle by means of friction clutches. A variation in speed is secured by the use of two sets of gearing, either of which can be used, one being arranged for a speed of four and the other for eight miles per hour. The gas engine, of course, is equipped with a governor.

Ordinary street gas is used, condensed to a pressure of ten atmospheres, and the reservoirs under the floor of the car, which can be filled through a flexible pipe within the time required to change horses, carry gas enough for a run of eight or ten miles. The consumption of gas by a loaded car is stated to be twenty-five cubic feet per mile, which costs two cents at Croydon, where the experiment is being tried.

All the machinery is enclosed, the motor lying under one seat and the wheels and clutches under the floor of the car. The latter carries twenty-eight passengers in all and makes a very fair speed. With the slow gear in action, it will readily mount an incline of 1 in 23, with a short piece of 1 in 16, and in coming down, it can be stopped by the brakes in its own length. It also goes round a curve of thirty-five feet radius on a 1 in 27 grade. Its weight, when filled with passengers, is five and a half tons.

Mr. Mason states that a special motor car of the type above described, combining all the improvements thus far made is now being constructed in England, to be carried to the United States for exhibition and trial in October.

The Steam Plant of the Fair Haven & Westville Street Railway Company.

The Fair Haven & Westville Railway Company, of New Haven, Conn., has practically completed all its track and overhead equipment, and upon completion of its power station operations will be commenced. The power house of the company is located on Grand Avenue, near Mill River. It is of brick with stone trimmings, and the roof will be supported on iron trusses. The station presented a very busy appearance during a recent visit of a representative of the Street Railway Journal with President Parmalee. The engine equipment will consist at present of three Reynolds-Corliss engines of the cross compound type, with cylinder dimensions 16 and 30 ins. × 36 in. stroke. They will be direct connected to Westinghouse multipolar generators. The steam generating plant will consist of Manning boilers, six being installed at present, and Allis condensers will be used. The stack will be 140 ft. in height.

The company is also erecting a new car house which will measure 90 × 225 ft., and will have a capacity of sixty-four cars. The first equipment of cars which will be put in operation will consist of twenty-four from the works of Jackson & Sharp. These will be mounted on Bemis trucks and equipped with Westinghouse motors. The plans of the power station were drawn up by Sheaff & Jaastad, of Boston. The railway company is doing its own construction.

Gardner, Mass., will soon have a model electric road connecting it with West Gardner. A 160 H. P. Mather multipolar generator will be employed in the power station, and Westinghouse motors will be used on the cars. The latter are from the works of Jackson & Sharp, Wilmington, Del., and are claimed to be as handsome as any in the state. The body is painted a dark red with lettering in gold leaf. The seats are of ash and reversible, and the top of the car is finished in maple. All the cars are equipped with roller curtains. The closed cars are painted yellow on the body, except on the center panel which is painted white, the lettering being in silver with a black border. Double doors meeting in the center are used. The interior of these cars is finished in cherry and antique oak with hand carving at either end.

The Manchester (England) Tramways.

Of all the horse street railways in operation in England, where the electric street railway has hardly yet been able to make much headway, that operated by the Manchester Carriage & Tramways Company is, perhaps, as perfect an example of a model city street railway system as could be found anywhere, not even excepting the very excellent one which caters to the traveling propensities of the Parisians.

Manchester, or Cottonopolis, as its nickname goes, is a city of over 700,000 inhabitants, standing upon the banks of the River Irwell, just above its confluence with the River Mersey. It is a city of tall factory chimneys, which from early morning until night breathe out the smoke and fumes from the soft coal burnt in the furnaces, and help to form a heavy smoky fog which rivals in intensity and unpleasantness that of London. It is a very thriving city of the pushing, go ahead type, and since the opening of the ship canal, which gives it an opening direct to the sea, he would be a bold man who would dare to stand in the open places of the town and publicly proclaim that it is not the second city of Great Britain and the metropolis of the North. The population is on the increase, the city is blessed with a good municipal government, and everything points to a rapid extension to meet the changed conditions which the opening of the canal has brought about.

The first omnibus which was run in Manchester, plied between Pendleton and the town, and the fare charged was sixpence or twelve cents. The success of the venture soon brought others into the field, and in a short time 'busses began to run from the town to Cheetham Hill, Rusholme, Fallowfield, Didsbury, Newton Heath and Harpurhey, all outlying suburbs at that time, but now part and parcel of the busy city which has absorbed them.

In 1852, a certain Robert McEwan started a new line, and as a new competitor in the field his omnibuses were much superior to anything that had gone before. They were larger, more commodious, had no doors, were each drawn by three horses, carried about fifty passengers, and the fare was fixed at twopence, or four cents.

In 1861, a tramway line was laid down in Salford, but the venture did not prove remunerative. In 1865, the largest 'bus owners, tired of an internecine warfare in which all were sufferers, pooled their interests and formed a company known as the City of Manchester Carriage Company; but not until 1877, twelve years afterwards, was the first genuine street car railway laid down. This ran from the Woolpack at Pendleton to the Grove Inn at Higher Broughton, and proved a marked success.

In 1880, the present Manchester Carriage & Tramways Company was organized out of the old Carriage Company, and the entire system for passenger traction began to assume an air of rapid development. It now covers a total length of over fifty miles spread over an area thirty miles in circumference.

The terminus of all the lines is in Piccadilly in front of the City Hall. To this point all the lines from the many different suburbs and quarters converge, and the constant movement presents a lively and ever changing scene.

The laying of the permanent way is undertaken by the municipality, the operating company paying a certain annual percentage or rental upon the outlay. The rails are of the channeled girder type, weighing about sixty-five pounds to the yard, and are laid upon ties set in concrete, the rails being bolted together at intervals. The roadway is formed of squared, grey granite blocks. This substantial method of construction has the advantage of lessening the cost of road maintenance, and is characteristic of all municipal work in England.

The cars are large and roomy four-wheeled vehicles, having seats for passengers both inside and out, a stairway leading from the platform to the roof, allowing of access to the latter. Some of these cars are double enders and are provided with two stairways, one from each platform. In addition to the tram cars there are a number of 'busses,

each drawn by a single horse, which are chiefly employed for the short distance services. The total number of cars and 'busses is 550, and, during the period of twelve months, carry a population equal in the aggregate to the entire population of the United Kingdom and the Channel Islands.

The largest cars weigh two and a half tons when empty, and nearly double that when loaded. The small, single horse vehicles weigh about one and a half tons. Each bears an initial letter to indicate the line upon which it is operated. In addition to the cars and 'busses, the company makes and uses a very large stock of carriages, cabs and other vehicles for private as well as public use. It provides complete turnouts for many of the wealthiest people in the city who find that for a sum about equal to what they would have to expend to keep up a stable of their own, they can get all that such an establishment could provide without the care and worry it would entail. Altogether the company owns 1,024 vehicles.

On account of the level condition of the Mancastrian roads, the majority of the cars are hauled by two horses, but for those running long distances three are found necessary. The number of horses in the company's stud at the time of the last inventory was 4,732. The principal stables are at Pendleton, where are also located the car shops. The stables are conveniently constructed, are well ventilated and under constant inspection, and kept scrupulously clean. The horses are kept in excellent condition, and those used in the carriages are, of course, of good breed, indistinguishable from those of the best private stables. The ordinary life of the car horse is five to six years, although some have been in the harness from ten to fourteen, and even more years. They are worked from twelve to fourteen miles a day, and receive as feed sixteen pounds of corn and the same weight of chopped hay mixed with beans, etc. For some time past the horses have been fed upon Canadian and American hay, and have thriven upon it in a remarkable manner. A first class veterinary hospital adjoins the stables. The stud is under the care of Mr. Guest, traffic manager of the company, who has been with the omnibus companies since 1848.

Opposite the stables is the car construction shop, where the cars are built and repairs effected. This shop is fitted up in elaborate style with all kinds of woodworking machines. The foundry is spacious and contains some eighteen or twenty forges as well as a large steam hammer and hydraulic presses. The erecting shop is also a spacious room in which the cars are assembled, the parts coming in at one end and the finished cars running out at the other.

The fares on the cars are collected by fare boxes each passenger depositing his own fare, the conductor having nothing whatsoever to do with it. The box is self registering, and although the price of the box is high—$15—it very speedily pays for itself.

The advertising on the outside of the cars, is not as prevalent in Manchester as in many other English towns, although indulged in to some extent. There appears to exist a sentiment against it similar to that which obtains here.

VIEW IN MANCHESTER, ENGLAND, SHOWING COMMON TERMINUS OF MOST OF THE STREET RAILWAY LINES.

The company has a capital of £500,000 or $2,500,000. Its last statement claims an increase in net revenue of £11,277 or $56,386 during the six months ending August 31, 1893, as compared with the preceding period. The company has been singularly free from actions for damages, only £800, or $4,000, having been paid during the half year just mentioned. The net profit for this period was £28,847 or $144,235, and this was divided into 5½ per cent. dividend for the half year, in addition to 2½ per cent. on the preferred stock, £5,000 being carried over to the reserve which now amounts to £25,000. The lands, buildings, cars and machinery owned by the company are valued at £275,026 or $1,375,130, and the rolling stock, horses, etc, £194,484 or $972,420. The amount of fares received was £214,573 or $1,072,865, and the hire of cabs and carriages reached a total of over $100,000. Only £36 or $180 was expended in legal fees.

The chairman of the board of directors is Alderman John King, J. P., and the secretary of the company is Mr. J. Collings. The central offices are located at 37 Piccadilly, Manchester.

The Hoosick Falls Railway.

By J. H. Vail.

In a town or city of moderate population the successful development and operation of an electric railway depends upon at least three important factors:

1. The selection of a locality having a class of people who will avail themselves of good rapid transit facilities.

2. The construction and equipment of a road and system on the basis of true economy, *i. e.*, substantial material and workmanship well adapted to the peculiarities of the local conditions, the capitalization and bonded indebtedness being within the limits of sound business investments.

3. Practical, intelligent and economical business management catering to the wants of the traveling public by offering good accommodations and rapid transit, polite employes and all the great and small features that place the public in complete sympathy and harmony with the railway company.

The Hoosick Railway Company, at Hoosick Falls, N. Y., thirty miles northeast of Troy, on the line of the Fitchburg Railroad, has been designed and equipped with a full appreciation of the foregoing rules. It is now operating over about five and a half miles of line, the initial regular passenger trips being made on July 13. Passing through the principal streets of Hoosick Falls, the line extends to North Hoosick and Walloomsac, the intervening territory being well built up with residences of a good class.

The track consists of forty eight pound T rail, with the usual form of four-bolt angle plate joint. The rails rest upon ties of standard dimensions, two feet between centers, and are bonded with No. 0000 copper wire. There are several grades worth mentioning; one is on the large radius curve approaching the North Hoosick Bridge, and is between 7 and 8 per cent.; another of 9 per cent. is encountered on Classic Street in Hoosick Falls.

The overhead construction consists of both span and bracket work, the former being employed within the city limits of Hoosick Falls. The No. 00 trolley wire is used throughout, paralleled by a main of like capacity. The No. 00 trolley wire is yet something of an innovation, but has proven itself to be a step forward, as the results obtained from its use are more than proportionately better than the service offered with the standard No. 0 wire. Tests of electrical pressure over the entire line give very satisfactory results, the electro-motive force ranging from 475 to 500 volts throughout the system, giving an average of about 487. Both track and overhead line were built by the Worcester Construction Company, of Worcester, Mass.

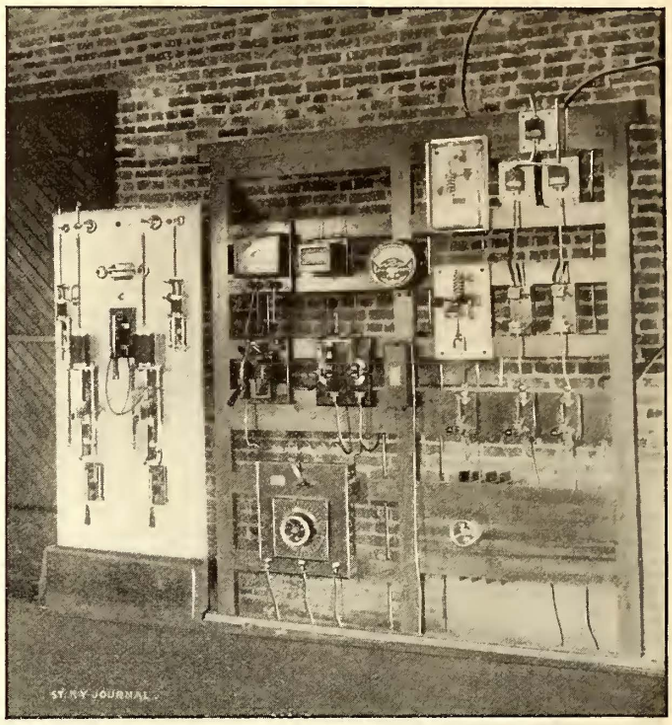


FIG. 2.—SWITCHBOARD—HOOSICK FALLS ELECTRIC RAILWAY.

A new iron bridge, built and erected by the Boston Bridge Company, spans the North Hoosick River at North Hoosick. This bridge is shown on the opposite page.

The rolling stock consists of three eighteen foot, closed motor cars, three ten bench, open motor cars, two open trail cars and one snow plow. The motor equipments consist of two twenty-five horse power motors per car, two series multiple controllers, a starting rheostat, a fuse block, a lightning arrester and a main cut-out switch. The controllers are of the latest design, embodying a number of novel features. They are giving excellent satisfaction, and are apparently an improvement on all past manufactures.

The motors are of the four pole, iron clad type, with a thoroughly water and dust tight casing to protect all vital parts. The armatures are of the toothed drum type, the coils being machine wound and interchangeable, as are also the coils of the fields. Mica is liberally used in the insulating of all the coils, and those of the fields have a protective winding to guard against mechanical injury. All insulation is tested with a 5,000 volt, alternating current. All parts are readily accessible for purposes of inspection and repairs. The loosening of two bolts allows the lower half of the field to be lowered. The bearings are of babbit metal, lubricated with grease.

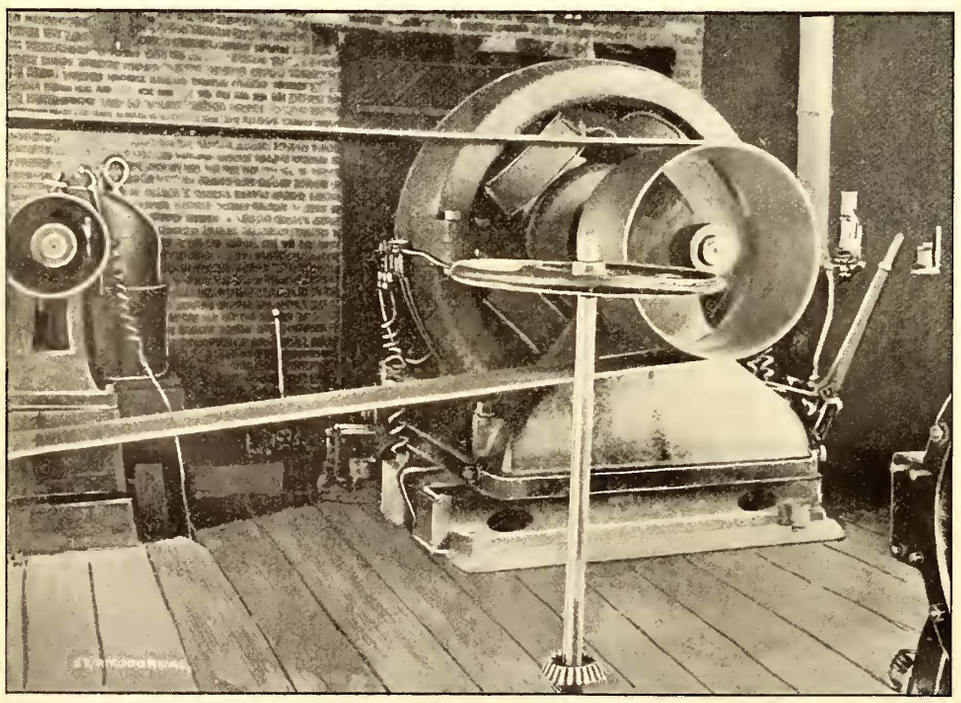


FIG. 1.—INTERIOR OF POWER STATION—HOOSICK FALLS ELECTRIC RAILWAY.

The gears are detachable and run in oil. The shaft is unusually heavy, with extra long journals, and is well protected with steel thrust collars.

The method of suspension is ingenious and entirely novel and fulfills perfectly the conditions necessary for eliminating the rapid deterioration of the rail joints, due to the usual heavy hammer blow. As the motor rides freely on springs adjusting themselves to varying conditions, no part of the machinery is subject to undue strain or shock of any description. The motor is of as light weight as is consistent with extremely strong mechanical construction and maximum efficiency. Apparently, every pound of material has been placed to the utmost advantage.

The motors have operated so perfectly ever since the road was started that there has been no necessity for removing any of the parts, a simple, daily cleaning being all that is required. These equipments are of the Walker Manufacturing Company's make, type No. 5. They are absolutely free from fault, either electrical or mechanical.

VIEWS ON THE LINE OF THE HOOSICK FALLS RAILWAY.

It is found that in operating the cars for high speed service, the motors are comparatively cool when returned to the car house after an eighteen hours' continuous run, the heating effect being far less pronounced than during the first week or two of service, when a slower schedule was in force.

The motive power is obtained from the station of the Hoosick Falls Electric Light Company, which is located one-half mile from the center of the railway system, the feeder wires being carried on a pole line to the main of the trolley line. The station is driven by water power, with an auxiliary steam plant to insure additional reliability in the event of low water or other accident to the water power. In the station is a 100 K W., multipolar generator built by the Walker Manufacturing Company. Its design is a model of beauty and strength. The field frame is cast in two pieces. The magnets are of the iron clad type, with pole pieces of soft laminated iron cast into the yoke.

The armature is of large diameter of very low resistance and ample radiating surface. It is of the iron clad, drum type, the core being built up of punched plates of the best quality of armature iron. These plates are insulated with enamel and compressed into a solid core. The insulation of the winding is most thorough, being composed of mica combined with fibrous material of great durability. Like that of the motors, this insulation is tested with a 5,000 volt alternating current. The machinery as a whole is highly efficient, and because of the rapid and perfect circulation of air, is unusually cool in operation. It easily stands a 50 per cent. overload without injury or sparking. The shaft is very heavy, with large bearings of the ball and socket, self-oiling type, lined with best quality babbit metal.

The car house is a frame building 36 × 100 ft., with two car pits and planked floor throughout. An extension is made on one side near the front end as a store room and office for the motormen and conductors. A handsome cupola, with flagstaff, surmounts the front end of the car house. The car house is sixteen feet in the clear under the trusses, thus permitting the trolley poles to assume a nearly vertical position when the cars are stored in the building. An interesting feature of the electrical station equipment is the Barber electric water wheel regulator, a brief description of which may prove interesting. It consists of two sets of solenoids and resistances, one set of which is almost continually in service to meet changes of load from one up to fifty amperes, while the second set is thrown in to compensate for changes between fifty and 200 amperes. These resistances are thrown into circuit automatically when the load is taken off the line, thus furnishing an artificial load, which steadies the water wheel and maintains the speed of the generator constant during all the sudden fluctuations of load peculiar to electric railway service.

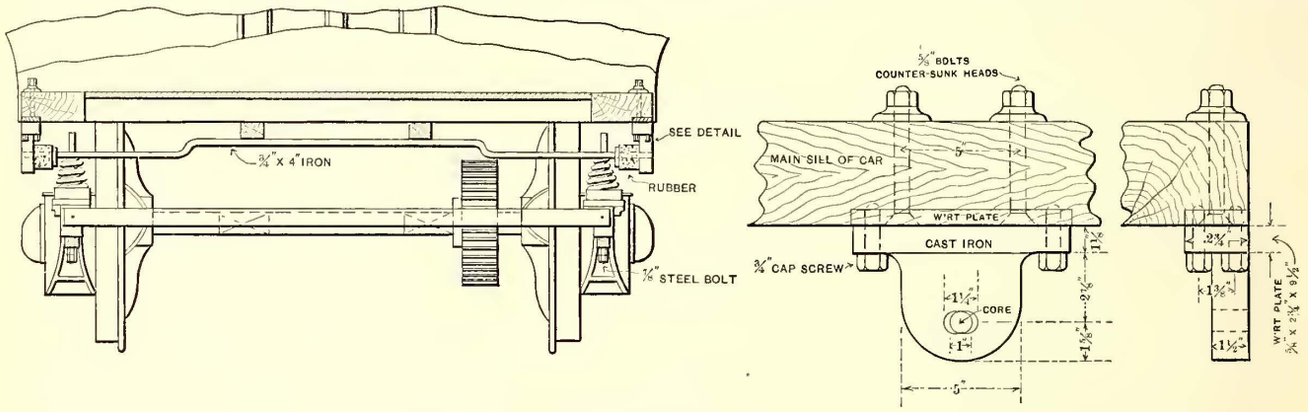
The entire equipment of the road, aside from the track and overhead system, was furnished and installed by the Electrical & Mechanical Engineering & Trading Company, of New York. This includes car barn, cars, trucks, motors, generator and switchboard.

The road has been most successful since the first day of starting, the first thirty days' business showing the patronage of 38,114 passengers. As a financial investment, there is every promise that the Hoosick Railway will be highly satisfactory. This comparatively small road, serving a population of between 9,000 and 10,000, is a most excellent illustration of the possibility of economically installing and operating an electric railway in such a way as to show handsome returns on the investment, even when the actual population of the locality is small.

It has frequently been stated that small roads will not pay, but there can be no question of this character if sound judgment and practical engineering experiences are applied, together with an appreciation of and a readiness to conform to the needs of the traveling public. During the early weeks of the operation of the road the round trip was made in forty minutes, schedule time; but, anticipating any requests on the part of the patrons for a quicker schedule, the management some days since reduced the round trip to thirty minutes. The sudden upward jump in the daily receipts of the road when the new schedule went into effect should prove a most impressive object lesson to managers of small roads everywhere.

Ingenious Device For Reducing Jolting.

An ingenious device for reducing the jolting of a car, caused when going around curves and when passing on and off switches, has recently been invented by S. Roy Wright, superintendent of the West End Street Railway, of Denver, Colo., and is illustrated by the engravings on this page. For winter service this company employs sixteen and eighteen foot cars, mounted on rigid trucks, but they have been found very unsatisfactory to the patrons, on account of jolting at the points mentioned. At one time it seemed as if it would be better to suspend the use of the cars and employ the thirty-six foot, double truck cars which were much easier at such points, but were longer than required.



NOVEL METHOD FOR REDUCING JOLTING OF CARS.

After careful study, the company concluded that it could overcome this objection by means of the device shown, and has done so beyond its expectations. As an eighteen foot car has two feet more swing than a sixteen foot car, the trial was made with an eighteen foot car first, and the results showed that the latter rounded curves and passed over switches with almost as little jolting and oscillation as the thirty-six foot, double truck cars.

As will be seen, the invention consists essentially of the interposition of a spring bar four inches wide and three-quarters of an inch thick between the truck springs and the sills of the car. The ends of this bar rest on a cast iron frame bolted to the main sills, a rubber buffer three-eighths of an inch in diameter being inserted next to the casting.

In the engraving a Bemis truck is used, but the device can be adapted to any make of truck, swivel or otherwise, and it is claimed will add materially to the life of car bodies. When it is necessary to take the truck from under the car for repairs, this can be done by simply disconnecting the motor and jacking up the car.

This car has been in daily service for a little over five months without requiring any repairs at all.

Cable Construction on the Columbia Railway, Washington.

The latest railway company to decide upon the equipment of its line with cable power is the Columbia Railway Company, of Washington, D. C. This company owns six miles of track which extends from the Treasury, 15th Street and New York Avenue, along New York Avenue, Massachusetts Avenue and H Street to the boundary N. E. The officers are: President, R. T. Baker; vice-president, E. G. Davis; secretary and treasurer, James B. Adams; superintendent, Wm. C. Bateler. The company decided in favor of the cable system in the early part of June of the present year, and on the 15th of the same month Wm. B. Upton was appointed engineer. The contract for street work was awarded to E. Saxton on July 20, and active work of construction will commence October 1. In the mean time the preliminary work of making the necessary changes in the gas and water pipes is in progress, as well as that of sewers, electric light and telephone conduits.

The roadbed construction will have tubes, 18 × 38 ins., built of Portland cement concrete. Eighty-six pound Johnson girder or grooved wheel rails, and Z type of slot will be used; ninety-two pound, new section Johnson curve rail will be employed on all curves. The yokes will be quite similar to those employed on the Washington & Georgetown Railway, and will be spaced five feet center to center, and weigh 350 lbs. each. Particular attention will be given to the rail joints, and these will be located on the rail seats and clamped down by means of four one inch hook bolts; they will also be spliced with heavy bars having six one inch bolts. The carrier pulleys will be fourteen inches in diameter with chilled face and will be spaced thirty feet between centers, running on babbit bearings attached to the yokes. All the traps and hatches, as well as the slot rails, will be level with the top of the wheel rails, and no projections will be allowed, so that fenders, which will be of a new form, can set close to the pavement. There are but very few curves and these are all easy, being not over twenty-four degrees deflection in any case, and the sharpest 150 ft. radius. The curve pulleys twenty-four inches diameter will be mounted on adjustable hangers.

There is very little special work outside of street railway and steam railroad crossings. The company will have one under cable crossing at 7th Street, that of the Washington & Georgetown Company. In all, the company will have two and three-quarters miles of cable construction, double track, and expects to have it completed before winter, with the exception of the buildings.

The plans of the power house and also that of the car house are nearing completion. These buildings will be on the east end of the line on property now owned by the company and at present used for stables. The power house is to be 80 ft. front by 200 ft. deep and one story in height. It will be built of brick and iron with tinned roofs. The latest and most improved machinery will be used, including rope drive, two simple engines of about 200 H. P. each, a battery of water tube boilers, mechanical stokers, coal handling machinery, electric light plant, improved tension regulating device, winding out reels, machine shop and everything necessary to make the same a complete and model plant. Only one cable is required and this will be one and a quarter inches in diameter, running nine miles per hour.

The car house will adjoin the power house, but there will be a twelve foot alley between. It will be built of brick and iron, covering a ground space of 128 × 200 ft. The front part will have all the company's offices, and will be two stories, the balance, or car shed proper, being but one story.

The company expects to make the contract for the power house September 1, and the car house October 1; all the contracts for machinery to be made in the meantime, the intention being to have the road ready for operations early the coming year.

The company has not yet decided the style of equipment to be employed, but it will be either the train system or the long, single car such as used on the Broadway line of New York. In either case both summer and winter cars of a first class make will be provided. It is calculated that the road will cost $450,000 when completed. Vitrified brick paving is being seriously considered in place of asphalt, as the latter has been found to be very troublesome in making repairs of track.

T Rail Construction in Paved Streets.

The T has always been a popular rail section with many managers, and it is interesting to note that there seems to be no difficulty in laying the rail in paved streets, and at the same time avoiding any obstruction to vehicular traffic. We have already illustrated in these columns sections of track in different cities showing method of paving to T rails. In our July issue the method of use in Memphis, Tenn., was shown, and in earlier issues that employed at Terre Haute, Ind.; Denver, Colo., and other cities. We publish below the results of a recent investigation made by the STREET RAILWAY JOURNAL upon the construction adopted at other points.

The Twin City Rapid Transit Company of Minneapolis and St. Paul, Minn., employs both the T and the ordinary girder rail. The height of the rail, in the T rail portion, is five and three-fourths inches, and most of the paving in the cities is of the same height, although in

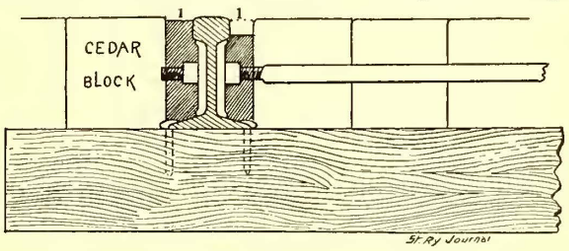


FIG. 1.—METHOD OF PAVING TO T RAIL IN MINNEAPOLIS.

some places a six inch block is used. A filling block of wood is used on each side of the rail, and this is sawed down to fit the side of the rail, leaving one inch to one and a half inches exposed on the top. This leaves a perfectly smooth line for the pavers to work against. The paving as put in is giving good satisfaction, both to the railroad company and the city.

In Des Moines, Ia., the Shanghai T rail is used, and the method of track construction differs from that adopted at St. Paul and Minneapolis, as will be seen in Fig. 2. Brick paving is used, and this is brought up flush to the head of the rail on the outside, and set just low enough on the inside to allow room for the rail flange.

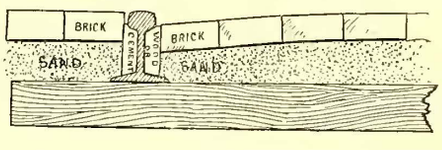


FIG. 2.—SECTION OF T RAIL CONSTRUCTION IN DES MOINES.

The space under the head of the rail is filled in with either wood or cement. The city authorities are so well pleased with the construction that they have insisted that the company shall use this rail hereafter on every new track laid in newly paved streets.

In Gloversville, N. Y., a six inch T rail is employed by the Cayadutta Electric Railroad Company in a street paved with cobble stones. A plank is laid edgewise on the inside of the rail. Mr. Frenyear, general manager of the company, tells us that he does not think the plank any advantage, provided the paving is properly done, but the company was compelled to use it by the terms of its franchise. The cobble paving to the outside of the rail makes a good joint. The T rail chairs are spiked directly to the ties.

In Covington, Ky., the only track construction with T rail on paved streets belonging to the South Covington & Cincinnati Street Railway Company is on the bridge

approaches, and was described in our June issue. The rail is four and a half inches in height, and the paving blocks are three and a half inches in thickness, leaving the rail one inch above the pavement. The superintendent of the company is of the opinion that a fifty-five or sixty pound T rail paved with properly constructed brick, makes the best kind of a roadway, both for the interests of the street railways and of the municipal authorities.

In Denver, on the line of the Denver Tramway Company, and in Salt Lake City, on the line of the Salt Lake City Railroad Company, two methods of construction are employed. One is to cut the paving block to fit the rail, and the other, which answers almost as well and is somewhat cheaper, is to run a strip of oak about two inches wide parallel to the rail on the gauge side and pave to this. The sections of rails used on these lines were illustrated in our September, 1893, issue. The T rail has a broad, flat head, so that little difficulty is experienced in turning out when a wagon or carriage wheel gets into the flangeway.

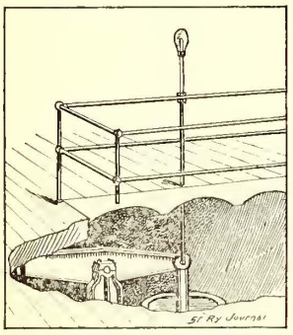
In Port Huron, Mich., all the tracks are laid with a forty-five pound T rail mounted on 5 × 5 in. pine stringers which are supported on ties. The space on the outside of the rail, between the rail head and flange, is filled with a 2 × 2 in. pine strip, the pavement laid against this, the top being made flush with the top of the rail. On the inner side of the rail the space is filled with a 2 × 2 in oak strip, laid about one inch below the top of the rail, and the pavement laid against it, and crowning to the center between rails to the top of the rails. The track gives good satisfaction when used in newly paved streets.

In Springfield, O., a fifty pound rail is used with brick pavements. The bricks are laid close to the head of the the rail, on the outside of the track, level with the top of the rail, and on the inside half an inch below the top.

Kinks in Station and Railway Practice.

AN INGENIOUS AIR PUMP INDICATOR.

A simple air pump indicator, designed by Mr. Goodwin, chief engineer of the power station of the Atlantic Avenue Railway, of Brooklyn, N. Y., is shown in the accompanying illustration.



AIR PUMP INDICATOR.

The condensing pumps, which are located in the basement, are of the single bucket type arranged on either end of a walking beam. The indicator consists of a piece of quarter inch pipe, about ten feet in length, attached to one end of the walking beam of the pump, and extends through the floor to the engine room above. An incandescent lamp is attached to the upper end of the rod. The lamp wires run through the rod, and are attached to a flexible lamp cord in the basement. A guide, through which the lamp rod moves, is secured to the railing surrounding the belt pit.

The lamp moves up and down with the motion of the air pump, and is readily seen from any part of the engine room.

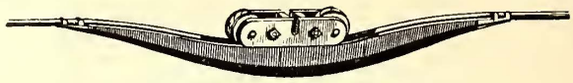
A NEW TROLLEY SECTION INSULATOR.

A simple and effective trolley section insulator has been designed by A. K. Bonta, of the North Hudson Railway Company, of Hoboken, N. J.

The device consists of two 1½ × ½ ins. wrought iron bars, about ten inches in length, held together by bolts, on which are porcelain insulators, and a wooden insulator about twenty-four inches in length, of a slightly curved shape. This latter has on its upper side two projections by which it is attached to the wrought iron link by bolts.

A tongue is formed on the under side of the wooden insulator, which serves to guide the trolley wheel. The ends are protected by copper caps. The caps have lips which are clinched around the trolley wire, holding it firmly to the insulator.

The device is very simple and can be easily made by any good mechanic. These insulators have been in use



TROLLEY WIRE SECTION INSULATOR.

on various lines of the company for some time, and have given excellent satisfaction.

TIMELY SUGGESTIONS ON PRACTICAL SUBJECTS.

Noisy Cars—Some of the noises made by street cars are due not only to the rattling of the window sash, but the rattling of the glass in the sash. To stop this the window glass can be laid in putty when placed in the frames, as practiced by some manufacturers at present. To stop the rattling of the window sash, a spring can be placed between the sash and the post in such a manner as to stop all noise.

The placing of car bodies on rubber washers is an effective and most excellent remedy for noisy cars, and will be found an easy way of avoiding this trouble when other methods fail.

Poor Shop Work.—Many electric cars are entirely too light in construction. To make rapid speed, quick starts and stops, electric roads require a strongly built car, well braced with iron straps and rods, so that there will be no racking out of shape of the car body.

In many car bodies there is a lack of proper tying together of the floor frames, and sometimes even no tie straps are used from the side and corner posts to the floor sills. To have a strong car there should be at least six iron carlins used, tying together and bracing the upper deck as well as the lower deck of the car. The breaking of considerable window glass is often due, to a considerable extent, to the racking condition of the cars.

Lack of Standards.—Standardizing the parts of all car appliances should, of course, be the aim of every company, but it is not always advantageous, especially with the electrical appliances, to endeavor to keep too closely to any single set of such standards. Much, especially with the detail parts, is still in an experimental state, and to arbitrarily decide to use only certain fixtures in all work might prevent the use of economical and more efficient devices.

Dirty Rails.—While we do not know absolutely the amount of power (electrical) saved by having a clean rail, it will probably run above 18 or 20 per cent. Whether the saving secured by clean rails would justify the expense of using extra sweepers in muddy seasons is yet to be determined. The writer is of the impression that it will not pay from a power saving point, as it will take at least 10 or 12 per cent, or over half of the power saved, to use in cleaning the mud from the rails.

Snow Plows.—Electric railroad companies in cities where there is much of a snow fall in winter, should have at least one good electric snow plow for every fifteen miles of track, as plows will often nearly pay for themselves in a short time by keeping the other cars going. The plows should not be too light in weight and should have a power capacity considerably in excess of the maximum required at any time.

The half yearly report of the City & South London Electric Railway shows a gradual improvement, the dividend on the ordinary stock being 1 per cent. instead of ⅝ as in the past. The deep tunnel system will succeed if extensions can only be carried out. The total revenue amounts to £24,295, against £23,159 in the corresponding half of 1893, while the expenditure stands at £14,990 against £14,964. The train mileage has increased from 217,664 to 227,363.

A new street railway between Galt and Preston, Ontario, was put in operation last month.

The Insurance Problem.

BY EDWARD E. HIGGINS.

Fire insurance rates have been generally raised within the past two years to a point where they have become—particularly to electric light and street railway companies—a serious charge upon earnings. The underwriters claim that they are doing business at a loss, and that increase of rates is unavoidable. The insured are indignant at what they believe to be the unreasonable demands of the underwriters and are trying in every possible way to excite competition, and to place their insurance at the old rates. A careful study of the situation is timely and important, if we are to determine how far the underwriters are justified in their increased demands, and what means can be taken to bring about a lower cost of insurance.

The National Board of Fire Underwriters of the United States, is an association of eighty-four leading American and English stock companies, and is the parent of the numerous local boards in various parts of the country. The Association is organized:

1st. To establish and maintain, as far as practical, a system of uniform rates of premium; to gather such information and statistics as may tend to that result, and and to promote harmony, correct practices and sound underwriting.

2d. To organize and sustain local boards of fire underwriters and to establish and maintain a uniform rate of compensation to agents and brokers.

3d. To repress incendiarism and arson by combining in suitable measures for the apprehension, conviction, and punishment of criminals guilty of that crime.

4th. To devise and give effect to measures for the protection of the common interests, and the promotion of such laws and regulations as will secure stability and solidity to capital enployed in the business of fire insurance, and protect it against oppressive, unjust, and discriminative legislation.

Whatever may be urged against similar associations or "Trusts," in commercial industries, it must be admitted that the enormous interests * dependent upon the prosecution of the insurance business on a sound and conservative basis justify an organization of underwriters. Such unrestrained competition as would affect the permanent solvency of insurance companies cannot be permitted. It is true that the great power of this combination might be abused, but any tendency in this direction is held in check by the publicity of the business, by outside competition, and by the very number of its independent, profit seeking members, who cannot be wholly restrained from rate cutting, secret rebates, etc.

In its report of May 10, 1894, the National Board of Underwriters furnishes the following general exhibit of the American business of 39 New York State insurance companies, 181 insurance companies of other States and 24 foreign companies. From this and other statistical matter contained in the report, it is found that for every $100 of premiums earned in 1893, these (stock) companies paid out for losses by fire $66.93—the largest percentage loss since 1871 and 1872, the years of the Chicago and Boston fires—and for commissions, salaries and other expenses, exclusive of dividends on stock, $34.84, a heavy expense percentage, but one somewhat less than the average of the last ten years. In other words, the sum of the fire losses and the expenses, actually exceeded the premium income by 1.77 per cent., so that in order to pay stock dividends (slightly less than usual, averaging for 220 American companies 9.58 per cent, as against average of 10.55 of last thirty-three years) the companies were obliged to use all their income from investments, and to encroach upon their surplus. *This disastrous result has been caused by a succession of steadily increasing fire loss ratios, dating from 1890.

What are the causes of this increasing fire loss? The companies themselves contend that electricity is their greatest enemy,† and it must be admitted, even by those of us who are most interested in proving to the contrary, that great care must be taken in the installation of electrical machinery and plants, if we are to prevent a decided increase in the real fire hazard, and that there has certainly been much careless and ignorant work done, especially in the early days of the industry. But there is another important influence at work in the insurance field, tending to reduce the profits of the stock companies—an influence which the latter are hardly disposed to recognize in public, but which is privately causing them much anxiety. The best, or "preferred" risks are being largely withdrawn from the rolls of the stock companies, and are being placed with the "factory mutual" companies, so called, whose methods, presently to be explained, are in many respects superior to those of the stock companies. By this process of separation the average quality of the risks remaining with the latter is probably deteriorate from year to year, and an increased percentage of fire loss is naturally to be expected.

Admitting that these losing conditions now prevail, it is evident that the underwriters—if they are to continue present dividends without encroaching upon surplus—must either take action to reduce the fire loss, or must decrease expenses, or must raise premiums. As a matter of fact, they are trying to adopt all three of these methods. Their rules governing the undertaking of risks and seeking to regulate the business of the insured are becoming more and more stringent, and have become in many cases, a positive annoyance, although these rules are even now seriously defective in that they do not go to the bottom of the matter and absolutely compel radical changes of building construction as a condition of assuming risks. The companies do not find it easy to cut down expenses, since a large part of these expenses are in liberal commissions to agents‡, paid generally under long time contracts, and by means of which the companies have been able to secure the best agency talent. The companies have, therefore, generally determined to raise the premiums, but it is a noteworthy fact, as pointed out in the underwriters' reports, that their best efforts in this direction have so far met with such stubborn resistance on the part of the insured, that the average rate of premium obtained by the 244 associated companies was but $.8671

TABLE SHOWING THE COMBINED EXPERIENCE OF AMERICAN AND FOREIGN FIRE INSURANCE COMPANIES DOING BUSINESS IN THE UNITED STATES—1860 TO 1893, INCLUSIVE.

Year.	Average No. of Cos. for each Period.	Rates of Losses to each $100 of Premiums.	Rates of Losses to each $100 of Risks Written.	Average Rate of Premium on each $100 of Risks.	Percentage Expenses to Premiums Received.
1860–'65.....	136	58.51	.4007	.6848	28.86
1866–'70.....	163	57.79	.5044	.8728	32.12
1871–'75.....	177	62.56	.5899	.9430	30.81
1876–'80.....	280	54.14	.4336	.8007	35.34
1881–'85.....	293	58.36	.4943	.8469	34.25
1886–'90.....	295	57.55	.5008	.8701	35.57
1891.....	258	61.23	.4956	.8094	36.60
1892.....	251	62.08	.5267	8485	35.93
1893.....	244	66.93	.5904	8671	34.84
Aggregate...	—	59.04	.5020	.8502	34.06

* The fire policies underwritten in the United States in 1893, by 244 companies aggregated $15,566,7[illegible],643.

*Figures compiled from last annual statements of 36 New York companies, 56 companies of other states and 19 foreign companies, show a reduction of over $8,000,000, in their aggregate net surplus, as compared with that of one year previous, and of nearly $14,000,000 as compared with January 1, 1891. (From President's address, N. B. F. U.)

†Concurrent action regarding our present greatest enemy—electricity—seems to be imperatively demanded. The companies as a unit should provide and enforce for the whole field more strenuous rules than any yet perfected for the installation of all plants, wiring, etc., for the use of electricity in all its forms. There has been plenty of evidence during the past ninety days that fires caused by electricity are growing alarmingly frequent, and inspections show that but few buildings in any community are safely wired, and that perfect insulation is rarely secured. I am convinced that the companies must for their salvation adopt at the earliest possible moment plans and methods that will compel the assured to substitute without delay the most modern wiring and safeguards, or be relieved of fire insurance protection. This great and increasing danger cannot be ignored. It threatens the very life of fire insurance companies. How can we meet it by joint and uniform action? (President's address, N. B. F. U.)

‡Averaging in 1893, 18.59 per cent. of the premiums received for 127 American and foreign companies.

per $100 in 1893, as against $.8485 in 1892, and $.8094 in 1891. (See table.)

"Factory mutual" insurance companies were originally organized in order to resist the attempts of the stock companies to charge excessive premiums upon factories which had been—for those days—most thoroughly and carefully protected against fire loss. These companies are primarily an association of mill owners, who agree to insure themselves. In doing this, it is evidently for the interest of each and all to adopt such methods of mill construction and such apparatus for the prompt extinguishment of fire as to reduce the hazard to a minimum, since losses by fire are a direct burden upon the mill owners themselves, not upon an outside, profit seeking corporation. Each "member" has a voice in the management of his company, and no new members are admitted whose mills do not come up to the high standards specified. The mill owners, through their agents, the company's officers, are constantly studying the causes of fire, discovering remedies and improvements in construction and in hundreds of ways reducing the real fire hazard. The expenses of the company are at a minimum, consisting almost entirely in officers' and inspectors' salaries, and in moderate office rentals, etc., as there are no commissions to be paid to agents for new business, and no expensive branch offices to be kept up.

The results of this wise and enlightened policy have been with the best "mutual" companies most remarkable. Note the following statements taken from a recent report of one of the oldest and most prominent factory mutual companies, which underwrites nearly one-fifth of the total insurance of this character:

Amount at risk, December 31, 1891, $93,528,991.
Premiums received during 1891, $766,361 = $.8194 per $100.
Losses incurred during 1891, $296,430 = 38.7% of premiums.
Premiums returned " " 482,025 = 62.9% " "
Average net cost of insurance written $.316 per $100.

Total number of fire claims 92, as follows:

51	of	less than		$100.
22	"	from	$100 to	500.
8	"	"	500 "	1,000.
2	"	"	1,000 "	2,500.
6	"	"	2,500 "	5,000.
1	"			8,564.
1	"			25,992.
1	"			225,000.

These are preferred risks indeed. We find an avererage *gross* premium rate slightly less than the average *net* rates obtained by the stock companies, 62.9 per cent. of these gross rates being returned, however, to the company's members in the form of rebates or dividends. The fire loss is but 38.7 per cent. of the gross premiums received, as against 66.9 per cent. in the experience of the stock companies. And, finally, the expenses of this particular mutual company are nearly or quite met by the interest on the premiums received and on the company's investments, and amount to hardly 5 per cent. of the gross premiums received, while, as has been seen, commissions and expenses eat up about 35 per cent. of the total premium income of the stock companies. In other words, the mutual companies are doing business on the theory of preventing fires, rather than insuring against them, and insuring it at cost, and they have certainly pointed out the ways and means of greatly reducing the country's immense and disastrous fire waste.

Now the improved methods of the factory mutual companies are entirely applicable to street railway insurable property, and will bring about a reduction of the fire hazard to nearly or quite as low a point as has been reached by the cotton factories, mills, etc., although there is an additional risk involved in the spark generating power of electrical plants, possibly somewhat greater than that caused by the necessary accumulation of inflammable material in cotton mills. The insurable property of a street railway is but a fraction of its gross "plant" and consists usually of one or more power stations with their boilers, engines and dynamos; one or more car houses with their contents, a large proportion of which are out on the road for about eighteen hours out of the twenty-four; and sundry miscellaneous buildings, repair shops, etc.

The street railway power stations are, with few exceptions, constructed of brick, and at an original expense which should have produced the very best results. Unfortunately, however, electric railroad architectural and engineering methods are young, and the best practice in the experience of kindred industries has been too often overlooked, so that grave mistakes of design and construction have frequently been made. The most usual error has been that of designing stations too small for what have turned out to be the requirements of service, and the result has been the overcrowding of machinery and other serious inconveniences. A great deal of inflammable material in the form of useless and expensive "gingerbread work" is often found, and must surely be removed if lower rates are expected. A street railway power station should be, wherever possible, a one story building constructed of brick. Ventilator shafts, flues, concealed air spaces in walls, floors or roofs, and wood sheathing of all kinds should be conspicuously absent. In this case, the highest art calls for a severely simple interior consisting of plain or painted brick walls, substantial wooden flooring with asbestos paper between the planks and the (matched) floorboards, iron roof structures, and with everything "meant for business," not planned to attract visitors. If a basement is necessary, its floor should be of concrete, and it should never be used for the storage of miscellaneous supplies. Where there is no basement, the floor planks should be laid directly on the ground if dry, or upon a flooring of ashes or sand topped with a coating of coal tar concrete, the engine and dynamo foundation being of course carried as low as may be found necessary. The boiler room should be separated from the engine and dynamo room by a brick wall, all openings of which should be protected by heavy fire doors constucted of wood completely lined with tin. Where it is necessary to build power stations with two or more floors, all openings from room to room, or from floor to floor should be avoided or protected by fire doors, the idea being to localize fires at their origin and prevent them from spreading to other parts of the building. Chimney or smoke stacks should not, of course, touch wood at any point when passing through floors or roofs.

Nearly all the real danger of fire from electrical causes in railway power stations is found at the dynamo switchboard, and by far the greater part of this special danger may be avoided by placing the switches, meters, automatic cut-outs and all other appliances, except the feeder switches, in the ground circuit instead of—as is usually done— in the trolley circuit. By this arrangement trolley lines and feeders would pass to the positive pole of the dynamos through the feeder switches only, and if the latter are placed in a sufficiently isolated position, "grounds" can be made almost impossible. An incidental advantage of this arrangement is found in the reduced danger from "shocks" in handling the controlling apparatus, since all parts of the main switchboard apparatus are firmly grounded and at the "potential" of the station floors and the negative bus bar. The switchboard should be made of incombustible material, preferably, perhaps, of vertical and horizontal T or L iron beams, supporting slabs of slate or marble, on which the apparatus is mounted. This arrangement provides for air insulation and makes it possible to instantly detect any incipient fire in the rear of the switchboard.

The car houses should also be one story brick buildings of the simplest and plainest construction. Means should be provided for quickly emptying the car house in case of fire, and this feature if well carried out will effect a material reduction in rates. Where land can be obtained in the rear of the car house at a reasonable cost, it would perhaps be well to continue the car house tracks outside the building into such a lot, and to build the tracks at a slight grade, so that the car house can be more quickly emptied in case of fire than is possible with the complicated switching arrangement usually found in

front leading to the street. The extra tracks at the rear of the car house can be used, if desired, for some kinds of repair work or for other purposes not inconsistent with the object just stated. In considering the desirability of making such an additional investment for land in any particular case, the interest on the investment should, of course, be compared with the saving in insurance, and a decision made accordingly.

Repair shops from an insurance point of view should not be directly connected with either the power station or the car houses. This is not always possible or convenient, however, and a brick repair shop forming an L on the car house, and separated from the latter by fire doors will not ordinarily be seriously objected to by the underwriters.

A source of danger of some importance is found in the use of the electric lights and motors in railroad companies' buildings, the current from which is taken directly from the trolley wire and returned to the dynamos through the ground. During the operating hours, when there is usually a constant attendance in the buildings, the hazard is not serious. When the plant is shut down it becomes of course nil. The underwriters have little reason, therefore, to demand an increase of rates on this account, provided that their specifications for wiring are carefully followed.

The fire extinguishing apparatus should be of the most complete and practical character, and *must always be kept in readiness for use.* An immense number of small fires have been put out, and can be put out in their first stages by a bucketful of water rightly applied. The first necessity is then, plenty of buckets of water placed around the room and kept full. Several coils of hose connected to a water pipe system which is kept constantly under pressure, from the city water mains if possible, and if not, from duplicate steam pumps supplied by the main boilers is the next important feature of the "apparatus in chief." Automatic sprinklers are hardly of as general application in power stations and car houses as in cotton factories, principally because of the danger of leakage and of short circuiting the dynamos. Nevertheless, they can be applied in repair shops and the supply rooms to excellent advantage. Thermo-electric alarms are useful in places. There should be, of course, a regular watchman on duty whenever the plant is shut down, and the value of his services should be checked by a watchman's clock. With these, and other precautions specified in detail by the underwriters, it is probable that an electric railway plant can be profitably insured on "mutual" principles, at a net rate not exceeding $.50 per $100, and by a stock company at a rate not exceeding $1.25 per $100.

Those companies who have already built their plants and made their mistakes have it in their power to correct the latter to a very large extent, and at a price which need not be prohibitive. The "gingerbread work" must be removed and the floors thoroughly cleaned *and kept clean*; all oily waste and inflammable supplies of every kind removed to an outside or L building, and every similar precaution taken to honestly keep the fire hazard at a minimum. The cure for the present difficulties of the insurance situation is not found in bitter combat with the underwriters, nor in desperate efforts to obtain competitive rates lower than those fixed by the experience of the sounder companies. Low rates, when not justified by real absence of fire risk, may help into insolvency the companies which assume such risks, and not only may premiums have to be paid twice over, but an actual fire loss of large proportions may precipitate insurance failures and cause repudiation of matured claims. The real remedy is for the assured to join hands with the underwriters in the attempt to make each plant a "preferred risk." If the underwriters should unwisely (and very improbably) refuse to recognize the right of any electric railway plant to demand preferred rates, however excellent its construction or means of preventing fires, a remedy for this real injustice is self insurance through mutual companies organized to take only the best selected risks in the street railway field.

Notes From England.

(*From our London Correspondent.*)

Perhaps no announcement could fill the American street railway man or even the average American city dweller with more astonishment than this, that there exists in this metropolis a body called the West End Tramway Opposition Association. Probably some of your readers will have heard of it before and of its activity, too often successful, in opposing Parliamentary bills for the construction of tramways in the West End of London. Of late the association has been very wide awake in view of proposals to make the tramway system of London something more than a laughing stock to the rest of England. The association seems to be animated by purely aristocratic, selfish feelings, for because streets would be rendered a little less pleasant for the elegant vehicles of the wealthy classes the general public have to suffer. Any street railway man from the States coming here and making a tour of observation in the West End of London, would be amazed at the miles upon miles of magnificent, straight, busy thoroughfares where there are no tramways.

A committee of Leeds Town Council has recently visited Newcastle and Edinburgh, and as a result it appears to view with great favor the working of the cable tramways in the latter city and the proposals for adopting cab e traction in the former. It may be said that it is now practically settled that the cable system will be introduced at an early date in the hilly city of Newcastle. In Edinburgh also, though no definite date has been yet fixed for beginning the work, there seems every likelihood that the Town Council will not very much longer delay starting a cable installation on the lines it has leased to Messrs. Dick, Kerr & Company.

That gigantic experiment in municipal working, the Town Council of Glasgow operating the tramways themselves, has now been started, with what success time will show. The Council has to compete with omnibuses which the dispossessed tramway company has put on the streets.

We have at length and for the first time in this country, got accounts of the working of a line on the trolley wire system. This is the South Staffordshire electric tramway. It appears that during 1893 the running expenses and repairs amounted to only 8.12 cents per car mile, against 8.44 cents for the same items on the Birmingham cable line and from fifteen to seventeen cents on various steam lines. This is a very favorable result should it continue.

The work of construction on the Waterloo & City Railway has now commenced, and it is expected to occupy three years. This will be the second railway in London on the deep tunnel system. The work has been begun by sinking a shaft in the bed of the Thames. When the proper depth has been reached the tunnels will be driven in both directions, and all the excavated material will be brought up the shaft in the river and taken away on barges. There will be no street interference whatever.

The decision given in the end of July by the House of Lords in the appeals by the London and the Edinburgh Street Tramways Companies is exciting the greatest interest all over the country. Briefly put, the judgment affirms the view of the courts below, that when a local authority buys a tramway all that it has to pay under the provisions of the Tramways Act of 1870 is the sum for which the tramway could be constructed, less an allowance for depreciation, but plus an allowance for preliminary expenses, and for the fact that the tramway has been successfully constructed and is in working condition. Thus the contention of the companies that they were entitled to a capitalized rental value is wholly shut out. This will be very bad for the companies owning prosperous lines, but probably will be to the advantage of the owners of routes which are worked at a loss, for in the latter cases there could be no rental value. The fear, however, is that local authorities will only buy up the profitable lines and leave the others in the hands of the unfortunate companies.

Practical Notes on Rope Driving—Part IV.

By M. E.

Having in the previous issues briefly reviewed the primary considerations to which attention must be given in planning rope driving installations, we propose to devote the concluding article of the series to a cursory discussion of the causes of loss of efficiency in this system of power transmission, to a few remarks on the relative merits of the two systems of rope driving, and to some general concluding notes on the subject.

So far as dynamo driving is concerned, the following causes of loss of efficiency require to be considered: (1) Stiffness or resistance to bending of the ropes. (2) Loss of power incurred by the ropes entering and leaving the grooves. (3) Elastic "slip" or "creep." (4) Differential driving effect when a number of independent ropes are used. (5) Excessive initial tension causing an abnormal loss due to journal friction and also increasing (2).

(1) *Stiffness of Ropes.*—The resistance to bending of a rope will be greater than that of a belt of equal power; one reason for this being that the depth in the plane of bending is much greater in the former case than in the latter. The increase, however, does not by any means follow in a similar proportion, since in bending the rope accommodates itself to the radius of the curve, partially by pure bending, but also by the sliding of one strand upon another, and, to a smaller extent, by a similar action among the fibres of each strand. It is seen, therefore, that the degree to which the rope is twisted as well as the lubrication of the fibres, etc., will greatly influence the amount of this resistance, and incidentally the life of the rope, since the wear of the rope is principally that due to the internal chafing and bending of the fibres. The arc of contact, the angle of the groove and the tensions on the two sides of the rope all influence the resistance to bending; but the size of the rope and the pulley are by far the more important factors. Obviously the smaller the rope and the larger the pulley the less will be the loss due to stiffness. The amount of power lost, however, may vary considerably under different circumstances. Quite recently M. Fauquier experimentally investigated this point in connection with the driving of a 200 H. P. dynamo. He finds that in the particular case cited, the loss of power due to stiffness was 5.25 per cent. of the power transmitted. This result is, in the writer's opinion, somewhat above the average, for although various estimates place this loss between 2 and 12 per cent., he considers from 3 to 4 per cent. should not be exceeded with reasonable proportions of pulley and rope diameter.

(2) *Loss Due to Ropes Entering and Leaving the Grooves.*—The amount of power lost by the compressing of the rope as it enters the groove and by releasing the rope therefrom, is probably not so great as generally supposed. It will evidently be greater with acute angled grooves, but its amount will also greatly depend upon the degree of slack side tension allowed as well as on the smoothness of the pulley grooves and the lubrication of the rope. The speed has also an important influence, since the centrifugal action induced by the rope being deflected around the pulley prevents the rope sinking as far into the groove as it otherwise would, thereby lessening the loss referred to.

(3) *Elastic Slip.*—The loss of power in this case results from the loss of velocity due to the elasticity of the rope, and should rarely exceed 1 per cent. It may be regarded as the power continuously absorbed by stretching the rope on the driving side.

(4) *Differential Driving Effect.*—Advocates of the continuous system of rope driving regard this as the principal defect of the separate system. When a number of separate ropes are employed to transmit power from one grooved pulley to another, it is evident that unless each individual member of the set acts in unison with the others in every respect, loss of power will follow. Among the causes which tend to disturb the equality of driving are: (*a*) Differences in size of the ropes; (*b*) of the pulley grooves, and (*c*) differences in tension due to variation in the length of the ropes. All or any of these tend to cause variation in the driving efforts of the several ropes, and thus result in a loss of efficiency due to what the writer has termed the "differential driving effect."

The difference in size of the various ropes cause those which are larger to ride higher in the groove than the others, and if—as is usual in dynamo driving—the driving pulley is the larger, the larger ropes will tend to drive the dynamo at a lower rate than will the others. Thus, if the difference in diameter between two ropes is such that the contact lines or "pitch circles" of the ropes and pulley grooves differ by a quarter of an inch, and we take a driving pulley, D, of sixty inches and a driven pulley, *d*, of thirty inches, measured at the pitch lines of smaller ropes—the velocity ratio due to the latter will be $\frac{60}{30} = 2$. But for the larger rope, the velocity ratio will be $\frac{60.25}{30.25} = 1.991$. The difference is not great, but quite sufficient to disturb the equality of driving effect. The same remark applies to difference in the diameters of the pulley grooves. It is evident that to avoid this loss, only ropes of the same diameter and make should be used in a set. The independent or separate system has the advantage of providing against breakdown, but if one worn out rope is replaced by a new, and therefore a larger one, it may frequently occur that this advantage of the system will prove a somewhat costly one. As a rule, however, the failure of one rope of an original set may be taken as indicating the necessity for an entire renewal.

The effect of variation in length of the ropes, and therefore in the tensions in the sides of each, is probably overrated. It is, of course, advisable to have the ropes all of the same length and all uniformly spliced, but in practice it is impossible to avoid some little difference in this respect. The variation in length will affect the slack side tension to a much greater extent than it will that of the tight side; but as the latter is that mainly concerned in the power transmission, it follows that unless the difference is considerable, the loss cannot be very material. As the number of ropes used is greater, the loss due to differential driving effect will be greater, but under ordinary conditions it should certainly not exceed about 3 per cent.

(5) *Loss Due to Excessive Initial Tension.*—This last source of loss is frequently very much in evidence in vertical drives with independent ropes, but in many short, horizontal drives the ropes are also much too tightly stretched over the pulleys. This is doubly disadvantageous, since it not only leads to increased journal friction, but also increases the loss by wedging the rope into the grooves, previously referred to. With overloaded ropes and pulleys differing considerably in diameter, this ultra-tightness can scarcely be avoided, but the life of the ropes under these conditions is, needless to say, only a fraction of what it would be under reasonably favorable circumstances. With dynamos set in sliding beds, the position of the machine can be readily adjusted, so that little more tension is imposed on the ropes than is necessary to prevent slipping under the greatest fluctuation of load likely to occur.

Axial Rotation of Ropes.—It is a somewhat remarkable fact, that of a set of ropes—apparently of exactly similar make, length and general conditions—some will persist in revolving axially while working, while others will speedily conform to the V-shaped groove and assume a somewhat similar section. Various theories have been propounded to account for this action, but none supply a rational explanation. As to the influence of this action on the wear of the rope, there is some difference of opinion. It is certain that the rope turns partially while it is in contact with the pulley, so that it is clear power is lost in this way, and the wear of the outside of the rope must be greater to some extent. On the other hand, if the rope becomes permanently flattened at the sides, the external wear will be practically confined to these parts, but probably the internal wear will be less as the bending takes place constantly in the same plane. On the whole,

it would appear desirable to prevent axial rotation as far as possible.

Comparison of Rope Driving Systems.—Much of what has been said in the foregoing applies equally well to the continuous system of rope driving as to the separate rope arrangement. The disadvantages of the latter system have been alluded to, and it now remains to briefly discuss the relative advantages of the two methods of driving. Among the disadvantages of the continuous system must be reckoned the risk of breakdown which means, in this case, total stoppage until a new splice is made or a new rope installed. In the separate rope system, the failure of one rope throws only a slightly additional load on the other ropes for the time being. In the continuous system, the unroving of the splice may work havoc in all directions, but with a separate rope, it usually draws out, until the defective rope is so elongated as to become useless as a transmitter of power.

Theoretically the continuous system is by far the most perfect of the two, since the tension on the slack side of the rope can be readily adjusted by altering the weight of the tension carriage. The several wraps of rope are under uniform conditions, and there can be no possible loss by differential driving effect, provided the grooves in each pulley are similar in form and size.

The erroneous theory of coil friction is frequently propounded in connection with the continuous system of rope driving, it being claimed that the resistance to slipping is enormously increased by reason of the successive wrapping of the rope, the idea being that the pulleys are in much the same position as a windlass or capstan employed to haul heavy weights, with only a small tension on the discharging end of the rope. The cases are, however, by no means similar, for in the first the pulley having the least frictional grip will tend to slip, *as a whole*, under the several wraps of rope, while in the second, the whole load is applied at one point on one of the wraps. As a matter of fact, the driving effort of each wrap is similar to that of each rope in the separate system, but in the former the slack side tension can be more accurately regulated, and the tensions throughout more evenly maintained.

It is not readily apparent why the use of winder pulleys and other complicated expedients should enter as largely as they do into the various arrangements of rope driving employed in this country. If winder pulleys are really necessary to the success of the continuous system, the fact may be taken as evidence of the practical superiority of the separate rope system, for no difficulty arising from insufficient frictional grip is experienced with the latter arrangement. At best, winder pulleys are costly adjuncts, and their use should be avoided; if used they should not, of course, be smaller than the smallest of the transmission pulleys. The friction of this idler pulley must detract from the efficiency of the transmission, but a more serious objection is the greater loss of power due to the larger number of bendings, as well as that due to the rope entering and leaving the supplementary set of grooves. The arrangement calls for a proportionately greater length of rope, so that the wear per unit length is probably not much increased if the pulley is as large as desirable. A much wider and, therefore, a more expensive dynamo pulley is required, and a greater amount of space is occupied when a winder pulley is used—disadvantages of moment for the service now considered. It may be taken that when trouble is experienced owing to insufficient grip on the small pulley, the other expedients, mentioned in a previous article, for increasing the frictional grip, are preferable to the use of winder pulleys. If the former devices fail, the rope is overloaded, and more working wraps should be used if satisfactory working and durability are to obtained.

When the length of drive is small and the continuous system is adopted, the width, W, and pitch, P, of the pulley grooves, given in Article III, should be increased somewhat to prevent the rope chafing on entering and leaving the grooves. The form of tension device adopted should be one which does not entail any reverse bendings of the rope, and the tension pulley should be as large as conveniently possible. The amount of weight necessary for the tension device can be best ascertained by experience, as much will depend upon the speed of the rope and other circumstances which cannot be readily taken into account by any simple rule.

Finally, it may be said that for short drives, such as are frequently necessary in dynamo driving, the continuous system appears to possess some advantage over the separate rope system; but since immunity from breakdown is of such primary importance in this service, it is very questionable whether the slight gain in efficiency is not more than offset by the increased risk of failure.

Splicing Ropes.—Much of the success of rope driving gear depends upon the care bestowed upon the splicing of the ropes. The result of an attempt by the inexperienced to splice transmission rope is generally a thick place in the rope, which necessarily produces a jerky and uneven motion, while the rope is rapidly worn and frayed at this part. A good splice should be scarcely distinguishable from the other part of the rope after it has been working for a few days. It is difficult to explain the *modus operandi* of splicing a driving rope, and the aid of an experienced splicer should be brought into requisition whenever possible. For driving separate dynamos with independent ropes, and with the position of the machine adjustable, the ropes may frequently be ordered ready spliced from the makers, but in this case measurements must be very carefully given. Each rope is placed in the groove of the dynamo pulley and also securely lashed to the driving pulley, on to which it is carefully shipped. The length of splice in feet for from one inch to two inch ropes may be six times the diameter of the rope in inches. Thus for a one and a half inch rope the splice would be nine feet long. For the smaller sizes eight times the rope diameter in inches may be taken as representing the advisable length of the splice in feet.

Care of Ropes.—The life of the rope and the general success of the transmission depend in no small degree upon the care bestowed upon the ropes when first set to work, and their subsequent treatment. It is recommended that cotton rope when received from the makers should be uncoiled and stretched, if possible, for a few hours. If this is not convenient, they should be uncoiled and placed in a warm room for a day or so, especially if they are already spliced. Care should be taken that the ropes in running do not come in contact with any obstruction such as shafts, beams, walls or columns. Chafing of the exterior of the rope, caused in this way, often passes unnoticed until the damage done assumes serious proportions. Similarly, contact between different ropes of a set is to be avoided, while in the continuous system, care should be taken to see that the rope has ample clearance in passing through the tension carriage, and also that the tension wheel is set at the correct angle to receive and deliver the rope with the least risk of side chafing in the groove. Large installations of rope driving gear are generally fitted with a simple form of "detector" arrangement, which gives indication of any fraying of the strands. One device consists of a light pine rod held lightly by end contact and placed close to the face of the rope wheel. The striking of the rod by a frayed strand is sufficient to release it, and in falling it may be arranged to operate on the governor of the engine or to complete an electrical circuit and ring a bell, etc.

Lubrication.—Opinion cannot be said to be unanimous with regard to the amount of lubrication necessary for driving ropes. Some makers of ropes hold that the internal lubrication of plumbago and tallow supplied during the manufacture of the rope is sufficient, and that additional treatment is unnecessary. There is little doubt, however, that a moderate amount of external lubrication is beneficial in all cases, and if the ropes work near the ceiling of a hot room or if the atmosphere generally is hot and dry, more frequent applications of some rope composition will be found of advantage.

Life of Ropes.—The life of manilla and cotton ropes is of very variable amount, for, as will have been gathered from what has previously been said, almost everything depends upon the conditions under which the installation

is operated. Cases have been of only too frequent occurrence where, either from ignorance or wilful disregard of the rules dictated by good practice, the ropes have failed after running a few months. On the other hand, under the most favorable conditions, eight years may be taken as the life of a manilla rope. The life of cotton ropes is, on the best showing, greater than this, ten or twelve years being a usual estimate, although many cases have been known of ropes lasting for sixteen and eighteen years when large pulleys have been used, and the ropes only moderately loaded. These two factors, *i. e.*, the proportion of rope to pulley diameter, and the working stress, may be regarded as primarily determining the life of a rope, but as we have pointed out, many minor matters are not without influence.

Cost of Rope Driving Plant.—The initial cost of manilla driving rope may be taken at from 30 to 40 per cent. of the equivalent belting necessary to transmit the power. In first cost, cotton rope may be taken at double the cost of manilla, but as it is more durable, the difference is not ultimately very appreciable. There are other considerations to be taken into account, however, in comparing rope with belt driving. Assuming the life of the belts to be no greater than that of the rope, we have to take account of the greater cost of rope pulleys which, when containing a large number of grooves, will show a substantial increase. Labor will also cost more in the case of rope driving than with belting, for almost any unskilled hand can be entrusted to joint up a belt, while the services of an experienced splicer are required to splice a rope. Needless to say, the splicing of a set of ropes will occupy considerably more of the expensive man's time. Nevertheless, after making due allowance for these items, rope driving will be found to be the less costly system of power transmission, always providing that the conditions are reasonably favorable to its success, and that due attention is given to the several points which have been briefly touched upon in these notes.

In conclusion, we give in Table IX, a number of practical examples of rope transmissions, which are all giving good results. As will be seen, the power transmitted is in most instances somewhat less than that given by Table VI. The latter may, however, be taken as agreeing closely with the best *recent* practice in separate rope driving by cotton ropes.

TABLE IX. Practical Examples of Rope Driving.

(Separate Ropes of Cotton).

Amount of Power Transmitted. I.H.P.	Diameter of Rope.	Number of Ropes.	Speed of Rope in Feet per Minute.	Driving Force in lbs. = $\frac{\text{H. P.}}{\text{V}} \times 33{,}000$.
250	2 ins.	8	3,395	306
270	"	8	3,015	369
340	"	10	3,510	320
380	"	15	3,450	238
400	"	14	3,455	273
460	"	14	4,100	266
600	"	20	3,775	262
690	"	18	4,570	276
850	"	22	3 540	360
150	1¾ ins.	8	3,015	206
200	"	9	3,950	185
200	"	10	3,265	202
290	"	10	3,345	286
300	"	14	3,000	235
400	"	16	4,140	199
560	"	18	3 955	175
600	"	20	3,770	263
800	"	26	4,100	250
130	1⅝ ins.	3	5,654	252
250	"	9	3,770	245
340	"	12	4 000	234
395	"	15	4,095	255
600	"	20	3,960	250
650	"	17	4,705	266
750	"	24	4,200	245
100	1½ ins.	5	2,640	250
200	"	7	3,700	254
340	"	15	5,045	148
380	"	15	4,805	177
425	"	15	5,020	185
585	"	19	4,800	213
685	"	22	4,800	213
700	"	22	4,520	232
60	1¼ ins.	6	2,825	117
100	"	6	3,770	145
180	"	8	4,400	169
230	"	12	4,500	140
290	"	14	4.500	152
400	"	19	4,400	157

Ascertaining the Speed of Trolley Cars.

By James F. Hobart.

Since the introduction of street cars propelled by electricity, a good deal of time and thought has been expended in considering the speed of cars at any given time or place. In their efforts to provide rapid transit facilities for the public, friction occasionally occurs between the street railway company and the local authorities regarding the speed attained. It is very easy for a board of aldermen or selectmen to issue an edict that a certain speed per hour shall not be exceeded inside of certain limits, but it is quite another thing for the honorable boards mentioned to prove that a car ran faster than allowed, or for the street railway company to prove that the car was running within speed limits. Here occurs the friction referred to, especially in case of accident, when the matter has been carried into court.

There is a method whereby any car can have its exact speed readily determined, either by a passenger on the car, or by a person beside the tracks. Even at a distance of several feet and out of sight of the car, the determination can be made within a very few feet per minute. The method indicated, is by measuring the musical note, or "purr" emitted by the motor gearing. The noise made by an electric car, especially when starting up, or when climbing a grade, is well known, and has ceased to excite even notice from the passengers. But in this noise lies the possibility of accurate speed determination. The faster the car is moving, the higher the pitch of the tone, or musical note, produced by the motor gearing.

The manner in which the musical tone is produced is as follows: Whenever a number of vibrations of the atmosphere (or of metal or liquid as well) are made in regular and uniform order, such vibrations are received by the ear one after the other in succession as made, and if a sufficient interval intervenes between the waves of sound (which may be caused by blows of a hammer, puffs of steam, strokes of a bell or other means) each wave will be received by the ear as a separate and distinct sound. But if the sound waves come closer together, they are blended into a sustained musical note. A lantern whirled about the head of a trainman seems a circle of fire. The reason is that a certain characteristic of the eye, called "persistence of vision," causes the image of the lantern at each point in the circle to be retained by the eye about the one-sixtieth part of a second. Various optical devices have their foundation in this peculiarity of vision.

The same thing occurs with sound and the human ear. That organ cannot get rid of an impression caused by a sound wave under a certain length of time. The ear cannot drop instantly each sound wave received. It requires about one-thirtieth part of a second to get rid of one impression, and if another is received before that time has elapsed, the result will be a running together of the two sound waves (apparent, not real) and they seem to the listener to become a sustained musical (or otherwise) tone of even intensity as long as the sound impulses are continued regularly.

The lowest key on a seven octave piano is $\overline{\overline{\overline{C}}}$, and is formed by about thirty-three vibrations, on sound waves, being received by the ear per second. "Middle" C requires about 264 vibrations per second. Frequently a steam fire engine, when running very fast, is observed

to yield a very pronounced, though sonorous, musical tone. That is because the exhaust puffs come so fast that the ear cannot separate them. Assuming that thirty puffs per second is the limit of comprehension by the ear, the engine must be running at least $30 \times 60 \div 2 = 900$ revolutions per minute. (Divide by two, because there are two exhaust puffs per revolution.) If the engine is running faster, the pitch of the resulting note will be higher. A person with a good, quick ear and a musical education will have no difficulty in ascertaining the exact pitch of the tone formed by a fire engine's exhaust. If he determines said pitch to be $\overline{C}$ below the base cleff he knows that the engine is running at the rate of 1,980 revolutions per minute. He figures thus because he knows that $\overline{C}$ is formed by sixty-six vibrations per second, and $66 \times 60 \div 2 = 1{,}890$.

The tone produced by the street car motor is caused by the teeth of the gear striking those of the pinion, or *vice versa*. On the motor gear generally in use at the present time there are sixty-four teeth. It makes no difference how many teeth there are in the pinion. That gear may be large or small; no difference will be made in the speed calculations, because a cog of the pinion must meet with each and every cog in the gear, and after sixty-four cogs have struck sixty-four cogs in the gear the latter has made one revolution, no matter whether the pinion has revolved two, three or four times.

The problem now becomes more comprehensible. A street car motor is observed to be giving off a hum which the ear decides to be D, just above fundamental C (middle C on the piano). The ratio between the number of vibrations for an entire octave is represented by the following:

C,	D,	E,	F,	G,	A,	B,	C.
1,	$\frac{9}{8}$,	$\frac{5}{4}$,	$\frac{4}{3}$,	$\frac{3}{2}$,	$\frac{5}{3}$,	$\frac{15}{8}$,	2.

It has been stated that fundamental C required 264 vibrations, therefore D will have to have $\frac{9}{8} \times 264 = 297$ vibrations per second. The average motor car wheel is 30 ins. in diameter, therefore the car "running in D," will have a 30 in. wheel making $297 \div 64 \times 60 = 211.25$ revolutions per minute. This speed is equal to $211.25 \times 2.5 \times 3.14 \times 60 \div 5280 = 18.8$, nearly 19 miles per hour. "Thirty inch" car wheels vary in size from about 31 ins. when new to 29½ ins. when worn out. The maximum variations on error in the above calculations, will be about 0.9 and 0.3. Thus a new wheel would run 19.7 miles per hour, and a worn out wheel down to the 29½ in. limit could go but 18.5 miles, slip on curves being neglected in all these examples. This gives a possible error of but about one-half mile per hour for wheel variation with motor gears "running in D." Were the car running twice as fast, the error could be twice as much, bringing the speed approximation within one mile per hour for cars running at 12 miles per hour, and, as the variation could not be both ways (above and below a 30 in. wheel) on the same car, it may be safely stated that only one-half the error could be made by wheel size in any single car, bringing the error within 0.5 mile at a 12 mile per hour speed, or within 4 per cent.

A set of "constants" may be easily calculated from the foregoing. A motor car giving "D," has been found to run 18.8 miles per hour. The table given above says $D = \frac{9}{8}$ C. Then C must equal $\frac{8}{9}$ D, and a motor car giving C will be running 16.6 miles per hour = a difference of 2.2 miles per letter. Using all the fractions given in the little table, eight constants can be obtained as follows:

When motor "purr"	is	C	=	8.30	miles	per	hour.
" " "	"	D	=	9.40	"	"	"
" " "	"	E	=	9.82	"	"	"
" " "	"	F	=	11.08	"	"	"
" " "	"	G	=	12.46	"	"	"
" " "	"	A	=	13.84	"	"	"
" " "	"	B	=	15.57	"	"	"
" " "	"	C	=	16.61	"	"	"
" " "	"	D	=	18.80	"	"	"

For the octaves above and below, these speeds may be doubled and halved respectively, giving velocities from 4.15 to 37.6 miles per hour.

In ascertaining the pitch of the motor note, the observer must not make the mistake of listening to the commutator sound. That is separate and distinct from the motor gear note, and may be readily distinguished therefrom after a very little study of the two sounds. The speed may be calculated from the sound of the brushes upon the commutator, but it must be remembered that there are ninety-five segments in some commutators, while the gear has only sixty-four teeth, therefore different calculations will be necessary. The brushes would have to be given too great a pressure to make their sound readily distinguishable, and the number of teeth in the pinion would also enter into the calculations when the speed is estimated by the commutator "purr."

The sound made by the motor gearing can be distinguished whenever the car passes over a high place in the track; then the gears have more work to do than usual, and emit a loud note, similar to that given out when the car is getting up to speed or is climbing a grade. But very little practice is necessary to enable a man, with an ordinarily "good ear," to catch the sound of the gears. To determine the pitch of that sound is a matter that requires a better ear for music than is possessed by more than one man out of 1,000, but a little device can be purchased at any music store which will enable any man who can whistle a tune to do the "sound speed act" to perfection.

The little instrument referred to is known as an "adjustable pitch pipe." It consists of an ordinary organ reed upon which a pair of bearings, directly opposite each other, are made to slide by moving a gradient on an index plate, upon which the letters of the scale are stamped. The letters F to F are usually found there, and by adjusting the gradient so that the pitch pipe tone is in unison with the gear sound, its pitch may be taken directly from the reading on the gradient. A little calculation will enable a gradient to be made which is graduated to miles per hour, instead of letters, thus giving the speed direct.

A Well Drawn Insurance "Rider."

The following form of street railway insurance "rider" has been adapted by the Binghamton Railroad Company, of Binghamton, N. Y., from an earlier and somewhat similar form drawn up by the Buffalo Railway Company, and represents an excellent method of arranging for specific insurance. This rider has proved entirely satisfactory to some of the best insurance companies in the business.

BINGHAMTON RAILROAD COMPANY.
OF BINGHAMTON, N. Y.

This company covers such a proportion of each of the items named below as the amount hereby insured by this policy bears to the total sum of all the items.

On the following described property situate in the City of Binghamton, N. Y.

ITEM ONE—$..... On buildings—the term "buildings" to include all additions, permanent attachments and extensions thereto, and iron stack and transfer pits, and on platforms and car tracks, whether constructed in whole or in part of brick, stone, wood or iron, but is not to include stone or brick foundations underground.

ITEM TWO—$..... On engines and boilers, condensers, pumps, machinery, excepting dynamos, tools, implements, traveling crane and connections thereto, machines, shafting, belting, hangers, gearing, pulleys, heating apparatus, piping and electric apparatus and switchboard and connections, and blacksmiths' and machinists' stock, tools, materials and supplies, plumbing, and on timber, wire, lumber, oils, fuel, hose and reels, glass, stock and materials of every kind and description, and on office furniture and fixtures, patterns, designs and drawings (not more than 10 per cent. of this item to apply in any one location on patterns), printed books and models, iron safes, and on books of record and account, not exceeding their value blank, and on all other articles and supplies not otherwise insured pertaining to the business of operating street cars with electricity and horses.

ITEM THREE—$..... On dynamos and their connections, in event of loss, no one to be valued at to exceed $.....

ITEM FOUR—$..... On cars, sweepers, snow plows, sleds, sand cars, levelers, carts, sleighs, wagons, motor cars, transfer tables, motors and vehicles of every description, including all duplicate parts, attachments and appurtenances, and all other horse, car, motor and vehicle equipments and furnishings, and on horses. And on scales, hay cutters, tools, poles, harness, and parts of same, blankets, implements, apparatus, utensils, hay, grain, meal, feed, straw, bedding, sand and salt, including bags and packages, including also conductors' punches, fare

registers and cash boxes, and other fare recording apparatus, and stock and materials, and supplies of every kind and description, their own or held by them belonging to others. It is understood that this item covers property described while undergoing repairs on premises of assured.

Loss, if any, on cars not to exceed $..... for any one box horse car, $..... for any one open car, $..... for any electric street car, $.... for any one horse, $..... for any one electric snow plow.

Permission is hereby given to introduce and use trolley wires, electric light plant and electric light in the described premises.

It is understood that in event of loss, this policy shall not be liable for an amount to exceed its proportion based on the following schedule which is made a part of this policy.

Location.	Description of Property.	Item 1.	Item 2.	Item 3.	Item 4.	Total.
State Street, North West Side.	Car House, (frame).....	$...	...	$...	$...	$...
State Street, West Side.....	Power House, (brick).....	$...	$...	$...	...	$...
Robinson Street, North Side..	Storage Car House, (frame).	$...	....	....	$...	$...
Broad Avenue, West Side.....	Car and Horse Barn and Shed, (frame).....	$...	....	....	$ ..	$...
Glenwood Avenue, East Side..	Horse and Car Barn, (frame)	$...	....	....	....	$...
Cemetery Street, North Side..	Horse and Car Barn, (frame)	$...	....	....	....	$...
Conklin Avenue, South Side...	Dwelling, (frame).....	$...	....	....	...	$...
Cove Alley, North West Side..	Horse Barn, (frame).....	$...	....	....	$...	$...
		$...	$...	$...	$...	$...

New York Standard, Percentage Co-Insurance Clause. (For Application to Specific Items of Policy.)

If at the time of fire the whole amount of insurance on the property covered by each of the several items of this policy shall be less than 80 per cent. of the actual cash value thereof, this company shall in case of loss or damage be liable for only such portion of such loss or damage as the amount insured under each of said items shall bear to the said 80 per cent. of the actual cash value of the property covered by each of said items.

This insurance excludes all loss or damage to electrical appliances on motor cars, dynamos, exciters, lamps, switches and motors, that may be caused by electrical currents, artifical or natural, and will be liable for only such loss or damage to them as may occur in consequence of fire originating outside of the electrical appliances themselves.

New York Standard, Lightning Clause.

This policy shall cover any direct loss or damage caused by lightning (meaning thereby the commonly accepted use of the term lightning, and in no case to include loss or damage by a cyclone, tornado, wind storm, or to electrical appliances on motor cars and other property as stated above), not exceeding the sum insured, nor the interest of the insured in the property, and subject in all other respects to the terms and conditions of this policy. *Provided*, however, if there shall be any other insurance on said property this company shall be liable only pro rata with such other insurance for any direct loss by lightning, whether such other insurance be against direct loss by lightning or not.

Permission is granted for the use of the above described premises for any purposes incidental to the business of the assured; to let portions of them for purposes not more hazardous; for any building to be vacant or unoccupied; to keep and use such articles, materials and apparatus as may be deemed necessary, or may be incidental to their business or that of their tenants; to work at any and all hours; to repair buildings or personal property, and it is understood and agreed that in case additions or extensions are made to any of the buildings herein described, the respective items of this policy shall also attach and cover on and in any such additions or extensions as may be made, and on materials and supplies therefor. It is understood that the items on contents cover also in each case the insured property adjacent to the buildings described while in yards and on streets. Other insurance permitted without notice until required.

The validity of this policy shall not be questioned, because of any mortgage that may now be in force, or that shall hereafter be effected, upon property above described, that is not endorsed hereon.

It is understood that no oil except for illuminating purposes will be stored in car houses, and that metal cans for oily waste shall be provided, same to be emptied outside of the premises.

Errors or omissions in the description of the property shall not prejudice this policy.

Loss, if any, payable to the ..... Trust Company, of New York, trustees for the mortgage bondholders as their interest may appear.

It is understood and agreed that the title to property located on ..... is vested in ..... as owner, and that the insurance on said building is to protect and cover his interest, loss, if any, payable as interests may appear.

This policy covers to the extent of $....., being ..... part of each and every item specified above.

Attached to and forming part of policy No. ....., of the ..... Insurance Company of .....

.....*Agents.*

The Chicago & Suburban Electric Elevated Railroad Company, the incorporators of which are J. M. Hannahs, Albert Wahl, Fred W. Wolf, Canute R. Matson, Benezette Williams and Michael J. Ryan, will ask the City Council for the right to construct a downtown loop to connect the elevated railroad.

The Corrosion of Iron Pipes by the Action of Electric Railway Currents.

An interesting paper bearing the above title was read recently by Prof. D. C. Jackson before the Western Society of Engineers. The foundation of the paper was an investigation carried out under his direction by Paul Biefield and Fred. D. Silber at the University of Wisconsin. After mentioning some of the troubles caused by electrolysis in different cities, Professor Jackson continued as follows:

When electric railways were first constructed the rails in connection with the surrounding earth were relied upon to carry all the current back to the generator. It was soon discovered that the current would not confine itself to this path and that the resistance of the earth was far from being as low as was originally supposed. Bonding the rails, cross bonding, supplementary wires and ground plates were then tried. The last were found to be of little avail, while the copper bonds and supplementary wires were often themselves electrolyzed, and bond wires up to the present time have frequently been far too small in cross section for the large current to be carried. The tendency which now obtains is to make the return circuit of fully as great conductivity as that of the overhead supply circuit, without relying upon any conductivity from the ground. This is being accomplished by effecting the rail bonds and running heavy track feeders, or electrically welding the rails. There is little doubt that with a perfect return system, which is properly connected to systems of underground pipes, electrolytic disturbances will practically disappear in nearly all cities.

Though the corrosive action of the return current has been so frequently noticed and commented upon, no one has really determined what actually occurs in the ground under the conditions brought about by the operation of electric railway systems. Two theories have been put forward relative to the corrosion: First, that it is simply due to chemical action caused by ammonia, saltpeter, leakage from gas mains, etc., found in the earth; second, that it is the result of electrolytic action. While simple chemical action undoubtedly has much to do with shortening the life of a pipe, it cannot on the face of it produce effects of the magnitude of these noted above. The ordinary life of water and gas pipes where chemical action alone is met is said to be about twenty years, while the corrosive action with which we are dealing has destroyed new pipes in intervals having from a few weeks' to half a dozen years' duration. In every case of the corrosion to which we refer, an electric current has passed along the pipe, and the corrosive action has taken place at the point where the current left the pipe. This is conclusive proof of electrolytic action. Secondary chemical reactions play an important part in the final decomposition of the pipe, and these are dependent upon the character of the salts in the soil, but the current sets the ball rolling. The electrolytic action of the current may occur by means of two processes—(1) direct electrolysis of iron and (2) electrolysis of chemical compounds which are held in the water of the soil, setting up secondary chemical reactions at the electrodes. In order to have electrolysis at all, it is necessary to have the equivalent of an electrolytic cell. In the case of a current leaving a pipe at any point, the pipe is the anode or positive plate of such a cell, the waste of the soil containing the chemical compounds in solution is the electrolyte, and the rail is the cathode or negative pole of the cell. All corroded iron pipes taken from the earth present practically the same appearance. They are generally "pitted" in many places, and although the pipe is covered with a layer of reddish oxide, the bulk of the corroded metal has generally been entirely carried away in some form or other, presumably by a secondary chemical change.

In order to have the first electrolytic action go on (that is, direct electrolysis of iron), a soluble iron salt must be present in the soil, reaching from anode to cathode. The analysis of street soils shows no such salts, and hence we are safe in concluding that this factor does not enter into the corrosion to any practical extent. The point has been made by several writers on the subject that the phenomenon may be due to the electrolysis of water, the nascent oxygen set free at the anode attacking the iron directly, and forming iron oxide. An examination of the facts of electrolytic action shows that this is not an effect of practical magnitude. This leaves us but one hypothesis to work upon—that is, the electrolysis of substances held in solution in the water of the soils, with a resulting secondary chemical action on the pipes.

In order to determine as exactly as possible what occurs in the soil due to the return current, a series of laboratory experiments were performed in which the practical conditions were reproduced as fully as possible.

Almost every chemical analysis of street soils shows the presence of some soluble salts of ammonia, potash, soda, and because of their common occurrence an experiment was performed to determine the effect of these salts on the electrolytic corrosion of iron plates per ampere hour. Six small electrolytic cells were run in series under an electric pressure of about 100 volts, with a current varying from .2 to .04 ampere. The cells contained clean glass sand moistened with water containing the salts.

Cell	1	contained	$NH\ NO_4\ NO_3$ (Nitrate of ammonia).
"	2	"	NH_4 CL (Chloride of ammonia).
"	3	"	KNO_3 (Nitrate of potash).
"	4	"	KCl (Chloride of potash).
"	5	"	$NaNO_3$ (Nitrate of soda).
"	6	"	NaCl (Chloride of soda).

After a run of fourteen and a quarter hours the number of ampere hours was .7465.

Loss of anode of NH_4NO_3 cell per amp. hr. was .921 gramme.
" " NH_4Cl " " " " " 1.314 grammes.
" " KNO_3 " " " " " 1.887 "
" " KCl " " " " " 1.346 "
" " $NaNO_3$ " " " " " .729 gramme.
" " NaCl " " " " " 1.299 grammes.

It had been shown by previous experiments upon cells containing these salts that iron was carried off from the positive plates, but was not deposited on the negative plates. The deposit of iron was made in the form of a layer of hydrate or hydroxide of iron near the middle of the cell. The same was true of experiments made with cells containing street soil where only a comparatively small percentage of carbonates was present. This explains the remark often made in reports of the corrosion of pipes that the products of the corrosion had disappeared. It was noticed during the experiments that all the cells containing a nitrate gave off a gas at the anode, and this, on being collected, was found to be oxygen. The same cells showed an acid reaction at the anode when tested with methylorange, and the reaction grew less in intensity as the current decreased. In cell No. 1 of the series already referred to, this acidity failed to show itself when the current fell to .6 ampere; in cell No. 3 at .045 ampere, and in cell No. 5 it was very faint at .04 ampere when the current was shut off. The acid reaction and the escape of oxygen in these cells seemed to be associated, and here it becomes necessary to refer to the losses of the anodes in the different cells. It will be seen that the chloride cells exhibit the greater losses, while the nitrate cells show the smaller. Moreover, the cell containing a nitrate in which the formation of acid and oxygen ceased first shows the greatest anode loss, and the one in which it continued to a slight degree to the end of the experiment shows the least. These facts point very strongly to the soundness of the theory of the corrosion which has been finally worked out; namely, in an electrolytic cell with iron electrodes and a soluble salt or salts of the metals of the alkalies or alkaline earths in solution in the electrolyte the salt is electrolyzed by the current, the acid radical attacks the anode, forming an iron salt, while the akaline metal forms with water a hydroxide at the cathode liberating hydrogen there. Finally, the meeting by diffusion of these two products precipitates ferrous hydroxide (FeOH). As the amount of electrolysis varies with the strength of the current, a comparatively high current will liberate the acid radical more rapidly than it can combine with the iron, the critical point depending upon the affinity of the acid for iron. When this excess is present, the radical forms an acid by combining with water and at the same time liberates oxygen. Neither the acid nor the oxygen can combine with the anode because that is already engaged in the formation of an iron salt with the acid radical, and hence the gas escapes into the air. If the acid is formed in sufficient quantity, it diffuses through the electrolyte, meets the alkaline hydroxide and forms the original salt and water. In the case of chlorides the nascent chlorine liberated at the anode, forms with it a chloride of iron, and if the current is strong enough to form an excess of chlorine it will be dissolved in the water and may, under the influence of light and heat, form an acid and liberate oxygen; or, if enough heat is generated, free chlorine will be given off, as is shown by experiment. All conditions of these laboratory experiments are practically parallel in the earth, and hence it is safe to say that similar chemical reactions must go on there. Although the composition of street soils is more complex than the electrolytes in these experiments, they contain the same soluble salts, and as these are diffused through the moist earth they must lend themselves to exactly similar electrolytic influences and chemical changes. In fact where street soils were used in the experiments as the electrolytes of cells which were placed in series with cells containing known quantities of simple and mixed soluble salts, the losses of the anodes were entirely comparable. It is consequently seen that only such measures as will stop the electrolytic action on salts in solution in the soil can be relied upon to stop the corrosion of iron pipes.

The soil frequently contains carbonate of calcium and magnesium, which are dissolved by virtue of the carbonic acid in the water. When carbonates are present in the water to a considerable degree a reddish layer of iron carbonate is found on the pipe. This is generally mistaken by observers for oxide of iron, but we have never found the latter present as a result of electrolytic corrosion. To find the effects of carbonates upon the corrosive powers of soils we ran four electric cells in series. The first two had for electrolytes glass sand moistened with ⅓ per cent. solution of chloride of soda in distilled water, and the other two had the same electrolyte with the addition of a solution of carbonate of magnesia and carbonate of lime of uncertain strength. The latter solution was obtained by passing carbonic acid for one and a half hours through water containing equal parts of these carbonates in suspension. The test current was kept at .09 ampere for seven hours, making .65 ampere hours.

The average loss of the anodes of the cells containing chloride of soda alone was .6565 gramme, while that of the carbonate cells was .601 gramme. This makes it evident that the presence of the carbonates does not aid in the corrosion of the anode, and even the slight cathode loss, due probably to ordinary oxidation, is less in these cells than in those containing the chloride only. The difference in the losses of the anode is easily explained. In some previous experiments the loss of anode caused by the electrolysis of nitrate, a chloride, and a mixture of the two was compared. The chloride caused the greatest loss of anode, the nitrate the least, and the mixture caused a loss between the two. In the same way in the case of the carbonate and the chloride, the chloride caused a certain loss of anode, and when mixed with carbonate the loss is somewhat less than when the electrolyte is a chloride alone. The fundamental effect of the carbonates is shown by a further description of the experiment. Soon after the current was turned on the chloride cells began to show the formation of the ferrous hydroxide layer between the electrodes which has been previously spoken of, while the other two cells showed a reddish layer formed at the anode, spreading toward the cathode as the action progressed. The reddish layer consisted of carbonate of iron, which was formed by the action of the carbonates upon the products of the electrolysis.

The results of many experiments and the condition of corroded water pipes as observed leads to the conclusion that under the conditions existing in street soils the corrosion will primarily go on by virtue of the acid radicals of the hydrochloric, nitric, sulphuric and other acids, the carbonates held in solution by virtue of the carbonic acid acting merely to change the ferrous salts to the normal iron carbonates and the ferric salts to the ferric hydroxide. Should the carbonates in solution be electrolyzed in addition to the salts of the alkaline metals, the carbonic acid radical would not attack the iron, as the corrosive power of the other acids is so much greater, but would again form with the ferrous salts and iron carbonates.

Owing to the doubt which exists as to what minimum voltage is required to induce electrolysis of water pipes by the railway current, a series of determinations was made by means of the electrolytic cells. The iron electrodes were inserted in clean glass sand 1.5 centimeters apart, and had about 20 square centimeters exposed area. In the first cell a 1 per cent. solution of nitrate of soda was used with a voltage of .2. As before, the hydroxide layer was formed. The electrolytic action was plain without any other tests. In the following cells the existence of action was shown by chemical tests for the iron salt and the alkaline hydroxide. In the second experiment, a ⅓ per cent. solution of nitrate of soda was used with 5 volts; the action was at once apparent.

Cell 3.	Pressure .25 volt.		Action in 3 min.
" 4.	" .125 "		" " 5 "
" 5.	" .125 "	1-6 per ct. sol.	" " 5 "
" 6.	" .05 "	" " "	" " 40 "
" 7.	" .013 "	" " "	" " 50 "
" 8.	" .005 "	" " "	" " 1 hour.

In cell 8 the hydroxide layer began to be apparent after one hour.
Cell 9. Pressure .001 volt 1-6 per ct. sol. Action in 1 hour.
" 10. " .01 " Action in 4 hrs. 45 min.
Cell 10: The electrodes were 20 mm. apart and were 40 mm. by 68 mm. in exposed surface. The electrolyte was street soil.

A surprisingly low voltage produced an appreciable electrolysis in the sand cells. The pressure on cell No. 10 might undoubtedly have been reduced to a millivolt without stopping the corrosion, but the resistance of the soil was so high and the percentage of soluble salts so low that the time necessary to produce action would have been considerable. A milliammeter showed a barely perceptible reading in the case of the experiments in which very low pressure was used. The observations plainly show that a mere directive force is necessary to produce electrolysis, and the corrosion is simply a question of current.

It is impossible to give in a reasonable space even a summary of the great number of experiments which were made, but the following conclusions are directly drawn from them:

1. In no case is the action due to the electrolysis of water; where oxygen is liberated at the anode it does not attack the iron.

2. Only a mere directive force in the nature of a pressure will cause electrolysis.

3. The actual corrosion is therefore only dependent upon the actual current which flows, and is as much dependent upon the resistance of the soil as upon the pressure tending to cause the current.

4. Only a minute quantity of soluble salt is sufficient to start the action, and it will then continue as long as a current flows.

5. The gravity of a corrosion of a pipe depends on the amount of current flowing from a given area and the nature of the salts present in the soil the order of the activity of the salts being (1) chlorides, (2) nitrates, (3) sulphates.

The following table gives the average loss of iron from the anode per ampere hour, due to different salts and mixtures of salts. It must be remembered that the cathode or negative pole in no case showed a gain, but generally showed a slight effect due to simple oxidation.

Electrolyte.	Loss per ampere hour.
Street soil from a certain place	.8 gramme.
" " " Madison Electric Railway route	1.16 "
" " " " " " (clay).	1.14 "
" " " in front of Madison power station	.91 "

	1	gramme
Sand with Na_2SO_4	.66	"
" " KNO_3, ½ per cent. solution	1.03	"
" " NH_4Cl " " "	1.38	"
" " KNO_3 " " " mixed	1.084	"
" " KH_4Cl " " " mixed	1.084	"
" " NH_4NO_3	.921	"
" " NH_4Cl	1.314	"
" " KNO_3	.887	"
Sand with KCl	1.346	"
" " $NaNO_3$	.729	"
" " NaCl	1.299	"
Average loss of chloride cells	1.335	"
" " " nitrate cells	.892	"
" " " sulphate cells	.600	"

One ounce is equal to about 28⅓ grammes.

The averages emphasize the fact that the chlorides produce the greatest losses of metal, nitrates coming next, the sulphates last, the mixtures in an intermediate place. This seems to show that the power of the acid radical to corrode varies in general as the activity of the corresponding acids.

In I. H. Farnham's paper on "The Destructive Effects of Electrical Currents on Subterranean Metal Pipes," which appeared in the "Transactions of the American Institute of Electrical Engineers" in April, 1894, the statement was made that when the current was reversed every minute extending over a period of ten days, no material change took place in either during that time. Our experiments have shown that only the positive plate or anode is affected by the electrolytic action which occurs under practical conditions, and hence we should expect that when the current is frequently reversed both plates will be corroded, since they are alternately positive, unless the frequency of reversal is too rapid for chemical action to occur at all. In order to ascertain the effect of such reversals the following experiments were performed: An electrolytic cell was run containing a weak solution of nitrate of soda. The period of reversals ranged from fifteen seconds to five minutes, the current flowing being .04 ampere under a pressure of three volts. After a few of the quarter minute reversals, the presence of the iron salt was detected at both plates of potassium ferrocyanide tests. On prolonging the periods the iron reaction diminished at one plate and increased at the other during the same period, and *vice versa* in the following period. When the period of reversal reached two and a half minutes the electrolytic effect was very evident; the iron salt disappeared at one of the plates with each reversal, giving way to alkalinity. The experiments showed that the minimum period of reversal during which corrosion goes on must lie below fifteen seconds, which makes the prevention of corrosion by reversals entirely impracticable from this cause alone.

The problem of preventing the destructive electrolytic effects upon iron pipes of the railway return current is shown to consist simply of the prevention of electrolysis of the salts in the soil when the products of electrolysis are of such a nature as to attack iron. It is a problem that requires a careful study of the local conditions in each case before it can be satisfactorily solved. I am quite confident, however, after carefully studying many cases of corrosion and applying the conclusions of these experiments, that there are very few places where the difficulty cannot be avoided by proper construction and arrangement of return circuits. This can be ordinarily done at a comparatively small expense, and with a resulting advantage to the operation of the railway. Some of the conditions that exert the most marked influence upon the corrosion are the nature and amount of the soluble salts in the earth, the resistance of the earth itself in the locality, and the electrical pressure between rails and pipes. High pressure differences do not necessarily imply a high degree of action, as it is shown by the condition of the Madison water pipes. Here as much as seven volts is found between the rails and the pipes in front of the power station, and yet only a very small amount of corrosion is shown after one and a half years' time. Evidently the resistance of the path here must be very high or the quantity of soluble nitrates,chlorides or sulphates is extremely small. The fact that a special and ingenious instrument made to measure the amount of current showed but .0003 ampere flowing leads to the former conclusion. On the other hand, with the favorable conditions of a low resistance path between the pipes and rails, and a relatively large amount of soluble salts in the earth, there is no doubt that serious electrolytic effects may be produced where quite a small difference in pressure exists between the pipe and rails. The extent of the railway system does not always offer a guide to the destructive influences of the return current. Mr. Farnham, in his paper previously referred to, mentions a small road in Rockland, Me., where much damage was done to pipes in five months, while the system in Madison, which is probably fully as extended, shows up to date (a period of nearly two years) a barely appreciable action.

The use of alternating currents, which produce no appreciable electrolysis, would avoid all difficulty, but their use for driving street railway motors is not, up to the present time, an assured success.

The use of a double trolley system of conductors would also avoid the major portion of the difficulty, but I believe it can be equally well avoided by proper construction where the usual single trolley systems are used. This is not a question which has a real bearing upon the discussion of single *vs.* double trolley systems. If single trolley systems were really well built, less talk of double trolley systems would be heard. One great advantage of double trolley construction lies in the absolute certainty of its failure if the insulation of the lines is not excellent. Connecting the pipes and rails with heavy cables at points where the former are positive to the latter proves the most complete method of prevention. The conductivity of the track circuit must be properly reinforced by feeders so that an undue drop is not experienced in the return conductors. These track feeders should always be insulated and put on the lines exactly as are overhead feeders, in order to save them from corrosion. The connection of pipes and rails has been practically carried out in Milwaukee, Wis., at a cost of about $8,000, and has apparently done away with the trouble, and has at the same time decreased the resistance of the return circuit. In the Milwaukee system there is about 125 miles of track and over 200 cars in daily operation. The track circuit was originally put down in excellent shape. In the Madison system present indications show that one connection between rails and pipe systems opposite the power house, costing all told about $15, would prevent any serious action. Investigations have shown that when the negative pole of the generator is connected with the trolley, the pipes are positive to the rails over an extended outlying district, and corrosion goes on over a large area, while with the reversed arrangement the dangerous area is concentrated about the power station. The latter method of connection allows the difficulty to be most easily handled, and after the district within which the pipes are positive to the rails has been accurately determined by proper voltmeter tests, frequent connections of pipes and rails should be made within its limits. This can usually be done at a comparatively small cost, the interest on which may be annually saved by the decrease of lost power, if the connections are properly placed. The boundaries of this district should be rechecked from time to time, and the corresponding changes in connections should be made, if the tests show that they are necessary. The outlines of the "danger district" are likely to vary with the growth of the system, and even change slightly with the seasons, and the connecting wires may be eaten away; so that vigilance is here as everywhere the price of safety, but safety may be absolutely secured in most cases.

Proper tests with a satisfactoriiy arranged voltmeter, such as was used in testing the Madison road, seem to give sufficient indications of the density of the current which is leaving the pipes at any exposed point. Such tests, when reinforced by chemical examination of the soil, probably may be used with advantage in determining the extent of the corrosive action which is occurring at any point.

I have not touched upon any argument in regard to the really serious corrosion which has sometimes occurred from other causes than electric railway return circuits. This is a matter which is now generally understood, but is of less magnitude in most cases than the electric corrosion. The owners of pipes are often at fault from the fact that they have filled the soil with electrolyzable salts, but even in that case they may generally avoid danger by proper co-operation with the railway companies.

Location of Overhead Equipments, and Rights at Crossings.

By R. D. Fisher.

The new and various uses of electric wires have led to controversies concerning the rights of location of overhead equipments. The first to obtain possession of streets naturally resented the intrusion of newcomers, and for good reasons, because it has been proven that the more powerful currents used in electric railway service causes serious disturbances with the telephone currents. The highest authority at our command holds that the primary purpose of a street is for public travel; that all franchises to use the streets for any purpose are subject to the rights of the public to use the streets for the purpose of travel; and, in doing so it follows that they have the right to avail themselves of the newest and most improved modes of transportation, and if the operation of a street railway by electricity disturbs the workings of other plants, the latter are required to so readjust their methods to meet the new conditions and afford self protection. See, *Cincinnati Inclined Ry. Co.* v. *Telephone Co.*, Reported in 26 Weekly Bull. 8; 44 Alb. L. J. 86; Ry. Corp. Law Journal 82 and 27 N. E. Rep. 890.

On the theory that every company using electricity in and above the public streets must exercise inventive ingenuity to protect itself from the effects of the use of the same force by reason of close contact or crossing of the wires, no one company or mode of public service having a monopoly of the earth or the air in the streets, it can only be insisted that each use the best appliances practically available to avoid injury to each other or to the traveling public.

In the matter of adjustment of wires to fit the new order of things, we have been enabled to find only implied authority. A grant to set up poles and wires in a street is generally made expressly subject to the condition that they shall be so located as not to interfere with local travel, and shall not be dangerous by reason of sagging wires, or unguarded currents of electricity. *Hudson Telephone Co.* v. *Jersey City*, 49 N. J. L. J. 303. Hence, it would appear that if traveling by means of an electric system is a general and ordinary mode of travel or use of the streets, any interference with it by reason of improperly constructed telephone or other wires would be regarded as an unauthorized obstruction and treated as a nuisance, unless such construction and location have been specifically authorized; and in such case general authority to construct telephone or other lines, is not sufficient to legalize such construction or location, if proven to be dangerous and to interfere with the new and common mode of travel. (See Keasby on Electricity, Chap. 5.)

The permission to set up telegraph and electric light wires is generally made expressly subject to the condition that they shall not interfere with the free use of the highway for public transportation, and even without express words such a condition would be implied, as it is always understood that statutory powers of this kind are subject to the condition that they shall be adjusted to the requirements of the times. This requirement carries with it the expense of such readjustment. (See Mersey Docks Trustees v. Gibbs, L. R., 1 H. L. 93; Gaslight, etc. Co. v. Vestry, etc. 15 Q. B. D. 1 (1884) Biscoe v. Great Eastern Ry. Co. L. R., 16 Eq. 636 and Lawrence v. Ry. Co., 16 Q. B. 643.)

There is a long line of decisions holding that wires must be suspended sufficiently high to avoid interference with ordinary transportation. The rule, however, will not apply to a load thirty or forty feet high, neither would it require wires to be strung so high as not to interfere with house moving. *Penna. Tel. Co* v. *Varnan*, 15 Alt. Rep. 624; *Tel. Co.* v. *Wilt*, 11 Am. L. J. 374 and *Scott* v. *Jarnagan* on Tel. See 53 and Note.

Many states have statutes declaring that the use of public streets in cities and towns shall be subject to such regulations and restrictions as may be imposed by the corporate authorities of said municipalities. In such cases it is reasonable to suppose that electric companies are required to elevate their wires so as not to interfere with the construction or maintenance of a system of transportation operated by the trolley which has been chartered by such corporate authority.

Applying the general rule of law concerning railway crossings to that of electric railways, it would appear that the cost of construction and insulation and the maintenance thereof would fall equally upon the companies. The right to cross and maintain a crossing is undoubted, but no contest, as yet, to our knowledge, has been made to determine the relative cost in providing such preventive appliances as are necessary to avoid current interferences and the safe and speedy operation of the trolley at such crossings.

The Question of Fire Insurance Rates.

The New York *Journal of Commerce* recently published an article on the subject of insurance rates and automatic sprinklers, which, while not referring directly to electric railway and lighting stations, is so pertinent to the general subject of electric railway insurance, that we publish it entire.

"It is becoming more and more apparent that the stock fire insurance companies of the United States must greatly improve their method of fixing rates upon risks which are thoroughly equipped with approved systems of automatic sprinklers. While they are better able to decide as to the merits of a sprinkler equipment than are the majority of the mutual companies and Lloyds, it takes them so long to settle the rate question that their knowledge is of little value.

"There are dozens of insurance concerns, independent of any rate combinations or tariff associations, which are eager and even anxious to make great reductions in rates when risks are equipped with automatic sprinklers, and, furthermore, they are always on the alert to solicit the patronage of property owners as soon as a sprinkler contract is given out. Their rates are quickly named and are low, and while many of the cut-rate institutions are weak and unreliable, enough good loss-paying concerns of this kind may be found to cover any establishment of moderate size.

"While the regular stock companies make reductions for the sprinklers, they are frequently only about half as liberal as those obtainable in the open market, and it is often the case that the non-tariff policies have been bought and paid for weeks before the tariff organization's red tape routine has been completed. Undoubtedly many of the non-boarders are making unprofitably low rates on sprinkled hazards, but nevertheless, few underwriters will urge that the present tariff allowances for equipments are liberal enough. They are being made more liberal each year, but are always behind the market. This means that eventually about all of the sprinkler risks will be in the hands of the non-boarders, and it is likely that two-thirds of the sprinkled risks of the United States are already there.

"Possibly it will mean a repetition of the experience with the New England mills, which, through the short sighted policy of stock underwriters, were permitted to go to the mutuals, and in fact were practically driven to do so. The stock companies are now making an expensive effort to regain these New England hazards at about half the rates which would have retained them. In insurance as well as in many other lines of business it is easier to retain than to regain. Perhaps some force is affecting fire insurance akin to the law of gravitation. The present conditions must seem very absurd to large insurers with well equipped hazards, and it may safely be predicted that sooner or later the stock underwriters will awake to the necessity of a more business-like handling of the sprinkled risk problem."

A very good description of the workings of the system of mutual insurance, referred to above, was given in an address on the subject by Edward Atkinson, president of the Boston Manufacturers, Mutual Fire Insurance Company, delivered in Minneapolis several years ago. In this address Mr. Atkinson said:

"Applying the law of chances to our factory combination, we find that after establishing all the safeguards which can be reasonably adopted with a due regard to true economy in construction and use, the average chance of damage to each risk of 25 per cent. is once in about 100 to 125 years, or annually in one out of 100 or 125 factories. The average chance of a total loss once in about 400 to 500 years on one factory, or one in a year out of 400 to 500. This is the maximum chance, and since these figures were compiled we have greatly reduced the chances. These figures cover our whole experience from the beginning. Our conclusion is that when a sufficient number of risks are combined to make the sum of the premiums of one year equal to one maximum risk taken, it is safe to begin business; but most of us have an annual income equal to two or three maximum risks. It is possible to have two maximum losses, or several lesser but important losses in the same year, but they very seldom happen in this order.

"If you contribute your present high rates of premium, you would be very safe to begin in the same way, because twenty members at 5 per cent. or twenty five at 4 per cent. on even risks would suffice. I should, however, advise a greater number.

"If I am correct in my judgment that a flour mill can be made as safe as a cotton mill, then see where you are. We should not hesitate to begin on:

40	mills	$30,000	each	$1,200,000	1 per cent.	$12,000
40	"	40,000	"	1,600,000	1 "	16,000
60	"	60,000	"	3,600,000	1 "	36,000
40	"	80,000	"	3,200,000	1 "	32,000
20	"	100,000	"	2,000,000	1 "	20,000
200				$11,600,000		$116,000

"Here would be 200 chances of loss on a premium equal to one maximum risk, plus taxes, expenses and a margin over, while the average chance of a total loss is only one in four to five hundred at the maximum.

"Now suppose you put in

5	flour mills	$250,000	each	$1,250,000	at 5 per cent.	$62,500
20	"	100,000	"	2,000,000	5 "	100,000
30	"	50,000	"	1,500,000	5 "	75,000
100	"	10,000	"	1,000,000	5 "	100,000
45	elevators	20,000	"	900,000	2½ "	22,500
200				$6,650,000		$360,000

"If 5 per cent. is too much, lower to 4 per cent. and increase the number. But bear in mind the rate charged should be high to give the stability of a cash fund. It is the dividend or return of unconsumed premium which is the matter of greatest import. Don't haggle about rates in a mutual company provided they are equitably adjusted. Here you have also 200 chances of fire on $360,000 deposit, and only five maximums of $250,000 each. If I am correct in my judgment of the risks, *after* the construction is made good, *after* the pumps and pipes established, and *after* the automatics are everywhere, you would not average a loss and expense account exceeding $60,000 a year, and you would then save $300,000. On $6,650,000 insured on cotton and woolen mills our average chance of loss would be less than $20,000 a year. So much for the general principles and methods. You should have excellent and skillful officers who are familiar with the quality of your risks and the standing of your members. The latter is essential to success. The whole system depends upon mutual good faith and confidence in each other. The integrity of the member is as essential an element as the quality of the risk. We have had, in our company, but a single suspicion of a fire being set by the owner, and after ten years that suspicion was removed by the confession of the real incendiary."

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

St. JOSEPH, MICH., AUGUST 15, 1894.

EDITORS STREET RAILWAY JOURNAL:

Sunday, August 12, the Associated Press sent out a lot of dispatches in regard to a riot caused by an attempt to tear up the street railway tracks Sunday morning at about four o'clock, in Benton Harbor, Mich., and stated that I had shot an alderman while in discharge of his duty. The facts of the case are these:

The Street Railway Company constructed in November, 1892, two squares of tracks on Main and Sixth Streets running to Territorial Street, under the terms and provisions of an ordinance passed, accepted and approved August 17, 1892, the same continuing on Territorial Street and other streets to the east city limits. On June 7, 1893, the City Council agreed with the Railway Company to repeal that portion of the ordinance on Territorial Street, and change the same to Main Street, with the understanding that the property owners were to pay the railway company $1 per foot to develop their property on Main Street. Last June the financial depression caused them trouble and they could not raise the money. In May, 1894, the ordinance expired by limitation, this company claiming no further rights under it. On August 6, 1894, the property owners and this company came to an agreement. That night the Council passed a resolution repealing the ordinance of June 7, and requesting the company to remove the tracks at once.

I met the Council Committee on Thursday, August 9, and agreed to change the grade of 2,000 ft. of track, move all poles to the curb line, free of expense to the city. I also agreed to see that my track was planked with good three inch plank. The original grade was established by the city engineer, and tracks were laid according to his stakes. The two farmers on the committee said I should pave with cedar blocks. I declined to do it, as the planking was considerably better than the cedar blocks with sap, being the kind they are using for paving. Without authority of law or even a resolution from the City Council, two aldermen of the State Committee, with one of the paving contractors, three policemen, four wagons and a gang of thirty laborers, at the unseasonable hour of four o'clock, and on Sunday morning, proceeded to destroy my company's tracks. I appealed to the deputy sheriff after twelve o'clock Saturday night, and at his request and knowledge furnished him a posse of five men and myself, four guns. I ran a car to the scene of action and the rioters and track destroyers upon its approach began to throw blocks and planks on the track and proceed with picks to dig up the track. During the riotous proceedings and while the sheriff was trying to make them desist, my gun was accidentally discharged from the front platform of the car, the contents striking the gate of the car and going into the ground, with the exception of two No. 2 shot striking one of the aldermen, who was some distance away. One shot lodged in the thumb, just under the skin, and the other one lodged in the front part of the leg just above the knee. I assured them at the time that it was an accidental discharge of the gun. Not until the accidental discharge of the gun was heard did the sheriff have possession of the field. They gave me no time to appeal to the courts for relief, and I knew nothing of it until late Saturday night.

At the time of the trouble and arrest I was in full possession of the property, and after giving bonds and turning the property over to the sheriff for protection, I returned to my office in St. Joseph. After all of us had left the property, and the sheriff had taken charge of it for protection, he allowed the riotous work to begin again, and they succeeded in destroying the track, to the utter disgust of a large number of taxpayers and citizens who so badly needed the road to Morton's Hill. A petition had been circulated among the property owners and citizens of the East Side, known as Morton's Hill, and subscriptions had been taken for the further extension of this track. I declined to give my version of the affair to the Associated Press, through the advice of the railway company's attorney. Doubtless this was a mistake, which time will prove, but with the Street Railway Press and people I desire to keep the good name I have had among them for the past twelve or fifteen years.

W. WORTH BEAN.

Established 1884.

THE STREET RAILWAY JOURNAL

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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.

The New York State Street Railway Association, as announced elsewhere, will hold its twelfth annual meeting at Syracuse on the 18th of this month. The papers to be read are upon subjects very pertinent to the operation of street railway properties, and new methods having a practical bearing upon railway economy will undoubtedly be described. The New York State Association has had a most successful history, and has been of great benefit to the industry in this state. According to the present indications there will be a very large number of attendants at Syracuse, and a pleasant time may be expected by all.

Three Other State Associations, those of Ohio, Pennsylvania and Michigan, hold their annual conventions during September, and a number of similar meetings have been held in other states during the past summer. The number of state associations is constantly on the increase, and as the advantages secured by them become better appreciated, we believe that similar bodies will be organized in other states. The regular meetings are looked forward to with pleasure by the delegates and others who attend, as presenting opportunities for improvement as well as social enjoyment. In no better way can managers in different cities become acquainted with each other and compare details of practice as at these times. Even from a pecuniary standpoint, the information gained upon economic devices and practice at conventions will usually more than repay many times over the time and expense of attending. No one in any extensive business is so well posted in all its details, as to be unable to learn some points of others, and this is particularly so in a new industry like that of operating street railways. But state associations have other functions than those of a purely instructive or social nature. They can help to unite the street railway owners of a state against vicious legislative oppression or other blackmailing, can provide a body through which concerted action can be taken to procure cheaper insurance, more liberal treatment from municipal authorities, or in a thousand other ways be of benefit to its members. For these reasons a more general membership of street railway companies in their state associations is desirable. For these reasons, too, an effort should be made by each member company to be represented, because while all these results are not accomplished at any one meeting, the advice and suggestions of all are invited; besides, a member who misses any number of meetings of a body of this kind is apt to lose interest in its aims and results—something which would not occur were he to keep acquainted and in touch with the body by regular attendance.

The Use of Accumulators, in direct current incandescent lighting stations to average the load on the generators and engines, is quite common in Europe, and is growing in favor in this country. Under certain conditions, *i. e.*, where the maximun load is required for only a few hours out of the twenty-four and the average output is considerably below the capacity of the plant, the addition of batteries has been found economical, both from an operating standpoint and as a method of increasing the station's capacity. The subject of the use of storage batteries in stations was ably discussed at the Milwaukee Convention in its application to railway needs, but the system has not been put into practice in this country, nor had it been applied to electric railway service abroad, so far as we know, until its adoption recently by the Zurich electric railway. A description of this road, which is published on another page, gives full particulars of the details of arrangement. The accumulator system is especially desirable for small roads on account of the violent variations of current, and as the Zurich railway operates an average of only nine cars, the value of the system for a road of this size will be thoroughly tested, The method of regulation adopted, however, that of switching cells in and out, is not as simple as that involving the use of a "booster," in the manner explained by Mr. C. O. Mailloux at the last Convention. Not only is there less complicaton in the booster regulation, but the number of battery cells required is smaller and they are always charged and discharged equally—an important point.

The Destruction of Water Pipes by the return circuit through electrolytic action, is now, perhaps, the chief argument made against the introduction of electric railways in cities where trolley lines have not yet been admitted. General knowledge of the existence of this popularly supposed universal accompaniment of electric railway service is of comparatively recent date, and the average opponent of electric railways is not fully posted in regard to its exact methods of destruction or the causes for its existence. It is enough for him, however, that it is an ever present foe whose deleterious action is hidden from view, and hence of any imaginable magnitude. Electrolysis has, therefore, assumed in these later times the place formerly occupied in the minds of trolley road obstructionists by telephone interference, and the danger of the 500 volt circuit to habitants of the street. Unfortunately, this fear has been greatly strengthened in the minds of many citizens through exaggerated reports of city engineers on troubles experienced with the water pipe

systems in some places, and has finally grown into conviction, by undoubted evidences of corrosion in cities using old fashioned and badly constructed railway systems. But as the early faults of electric roads have been corrected, or so far minimized as to present no practical disadvantages, so it is certain that the danger of electrolysis can be entirely eliminated by the adoption of scientific precautions and care in the construction of the return circuit. According to the well known law of electric currents, electricity will flow between two points of different potential by as many paths as may be presented, the amount of current in each depending upon the conductivity of the circuit. The first and most important rule, therefore, for preventing any electricity returning by the water pipe system of a city, is to make the rail return of as good conductivity as possible. This can be done by bonding the rails so that the resistance at the joints shall be no greater than at any other points of the line. It is well, too, to waterproof all places where there is a contact between copper and iron to prevent local action, and to provide alternate paths by cross bonding with, perhaps, supplementaries in case there should be a breakage in the bonds at any joint. Overhead return feeders to supplement the rail return should also be used from points having a considerably higher potential than the bus bar at the station, as indicated by the voltmeter. It is, of course, not enough that the return circuit should have as high a conductivity as the outgoing circuit, as any action on the water pipes depends entirely upon the difference of potential between points of the return circuit. All pipes in the neighborhood of the station, which show a positive potential as compared with the generator ground plate, should also be electrically connected with it. To assist in making potential measurements between the track or pipes at any points on the system and the bus bar at the station to which all such measurements should be referred, we believe it would prove very convenient to run a system of small copper or galvanized iron testing wires reaching to every part of the line. They could be carried on the feeder poles, and should be provided at frequent intervals with junction boxes at which connections could be made. The cost of such an overhead system would be slight, and the wires could, if deemed desirable, be used also for a telephone dispatching service or emergency patrol system in connection with the operation of the road. Prof. Jackson points out in a paper printed in another column that danger can be avoided by the construction of a good ground return. And as the slight additional cost of a good return over a poor return circuit would undoubtedly be made up to the railway company many times over during a few years of operation, through the saving of power alone, independent of other considerations, the most evident economic rules would dictate such construction

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Do You Know that the Thirteenth Annual Convention of the Street Railway Association is to be held in Atlanta, Ga., on October 17, 18 and 19 proximo?

Do you know that your presence will add to the success of the Convention; that there is an enthusiasm born of numbers that can be created in no other way?

Do you know that you will be greatly benefited from participating in the proceedings, and from the opportunity that you will have to confer personally with others engaged in the same occupation as yourself?

Do you know that a little vacation will do you good, and that you will return to your duties better equipped mentally and physically for your work?

Do you know, if you are a Northern man, that you owe it to yourself to pay a visit to the South in order to correct your preconceived notions of the character of its people, its climate, and its natural resources?

Do you know, if you are a Southern man, that a duty devolves upon you to meet and welcome your Northern visitors and assist them in studying the resources and natural advantages of the South, and informing them of the grand possibilities that await investment in Southern enterprises; and do you know that you can learn from them many things that will help you to more successfully manage your street railway properties?

Do you know, if your home is on the Pacific Coast, that it is time you became identified with the affairs of the American Street Railway Association, and through it to let the fraternity know of the splendid service which is maintained in some of your cities, and what discoveries you have made in the way of improved appliances and methods of operation?

Do you know, if you are a manufacturer of street railway supplies, that the South is entering upon a period of the broadest and most rapid development of any in its history, with improved credit, and that its cities, especially the coast cities, are bound to grow, with a corresponding increase of street railway mileage, so that at present, here is the most promising field for street railway development in the near future of any section of the country, and that now is the time for you to bid for this anticipated trade?

Do you know that a trip through the South during the month of October will be a most delightful one, as the climate at this season of the year is superb? You will see the cotton pickers at work, and in the rice and sugar regions the process of harvesting these crops, and be interested in the great stretches of yellow pine forests, and in studying the turpentine industry, together with "the grasshopper and sweet potato vine." You will be surprised at the numerous lumber mills along the railway lines, the little hamlets with their weather beaten homes and the numerous negro cabins, and interspersed everywhere between the fertile regions, the characteristic red and crumbling banks of the ridges and gullies, the result of the heavy rainfali to which most of the Southern region is subject.

Do you know that your reception and entertainment will be more cordial and on a grander scale than at any previous meeting of the Association? You will have a chance to test the proverbial hospitality of the cheery Southern people and listen to the eloquence of their famous orators.

Do you know that this trip will afford a rare opportunity for the men who fought on either side during the the late unpleasantness to visit old battlefields and historical points which are more numerous in the vicinity of Atlanta, and more easily reached than those of almost any other section of the country?

Do you know that a special train will be run from New York and probably from other central cities to Atlanta, which will give an opportunity for friends to make the trip together, and an opportunity to make acquaintance that will add greatly to the pleasure of the trip?

A Street Railway Mutual Insurance Company—would such an organization be possible, profitable and a permanent benefit to the industry? Sixty years ago Zachariah Allen filled his cotton mill with the best fire extinguishing apparatus then known, and asked an abatement of the insurance rates charged. "No," was the reply, "a cotton mill is a cotton mill; the rate is 2½ per cent." "Then," said Mr. Allen, "cotton and woollen mills will insure themselves." He at once organized the Manufacturers' Mutual Fire Insurance Company, of Providence, on which nearly all the present "factory mutuals" are modeled. The rates of premium on the Allendale mills are to-day less than $0.40 per $100 *net*, and the stock insurance companies are doing their utmost by extreme concessions in rates to win back the enormous and highly "preferred" business which has been lost to them by the enlightened competition of these "mutual" companies.

* * * * *

The street railway managers of to-day are in a position to sympathize with the cotton mill owners of 1835. The stock insurance companies, frightened at the increasing number of destructive fires, attributed, though often quite unreasonably, to electricity, are refusing to sufficiently discriminate between the best and most highly protected street railway risks and the poorer ones, and many companies are, indeed, disposed to withdraw wholly or in part from this field. Now it is emphatically wrong to say in effect that "a street railway risk is a street railway risk." As Mr. Higgins has pointed out elsewhere in this issue, there have been grave engineering mistakes made in the highly stimulated street railway construction of the past few years, and these mistakes have not only cost money, but have unreasonably prejudiced the whole industry in the minds of the underwriters. We firmly maintain that most existing power station and car house risks may easily be placed in the "preferred" class by the adoption of methods and apparatus for the extinguishment of fires which have proven so successful in other industries. Street railway companies, in their own interest—since the destruction of a power station or an equipment of cars means a far greater loss of income and profits than can be measured by the insurance settlement—should be the first to seek the ways and means of reducing the real fire hazard to a minimum.

* * * * *

But suppose the stock insurance companies refuse to recognize the possibility of sufficiently protecting power stations and car houses, and insist upon high rates, merely because "electricity is dangerous" or "there have been *x* street railway fires during the past year?" Would it then be wise for the street railway companies which have thoroughly protected their plants, to organize themselves into a mutual company for self insurance? Five years ago, the answer would have been a negative. The investigations of Messrs. Wyman and Woodworth, in behalf of the American Street Railway Association, disclosed a decided indifference upon the subject among street railway managers. It was felt that the real danger of fire among the horse barns and car houses of that period was sufficient to justify the insurance rates then charged, and that there was doubt as to the ability of the industry to support a mutual company. The situation has changed, however, since that time. The general condition of our street railway plants has greatly improved with, and in spite of, the introduction of electricity, and gross insurable values have enormously increased; while both the actual and the proportionate cost of insurance has become so great as to call for serious discussion of remedies. It seems probable that the field is now sufficiently large to support a conservatively managed mutual company, underwriting only such selected risks as can be brought up at once to a high standard of excellence in the matter of fire protection. Such a company, with a substantial guarantee fund and with rigid rules governing the admission of new members, would inspire confidence and would rapidly gain ground. It would probably largely reduce the present average cost of insurance in competition with the stock companies, burdened as they are with heavy expenses, the amount of the reduction depending, of course, on the volume of business to be secured. The fear of assessments urged against mutual companies has little force. The gross rates charged ought to be high enough to mark the practical limit of responsibility assumed by each member—the dividends returned being greater or less according to losses and to business management. The liability to assessment, therefore, would become in effect a dead letter, although it should always, of course, be an integral part of such an insurance organization, because of its moral effect in giving stability to the company's promises. On this matter of assessments, Edward Atkinson says of his own company, "One or two assessments were made in the early history of the business over forty years ago—none since. We have twice returned the whole premium; the interest and profits on a change of investments in certain years covering small losses and all expenses."

* * * * *

Finally, the whole problem—if it is found on further examination that the field is now sufficiently large to support a mutual company—is one of management. Commencing with the association for self insurance of a few strong and well protected companies who would select officers widely and favorably known in the street railway and insurance field, we believe that other companies would cheerfully adopt such apparatus and comply with such regulations as would make them "preferred risks," and would seek admission as members. It is true that there are unsuccessful and discredited mutual companies in the field. In most cases, however, it is found that in the necessity which is upon them of meeting expenses and losses within too narrow a field they have invaded other industries and have accepted poor risks—some even which may have previously been utterly rejected by the stock companies at any rates. The whole question of meeting this insurance problem in the best possible manner should be freely discussed at Atlanta, both in convention and in those exceedingly valuable and private "experience meetings" which form so important a feature of our annual gatherings.

The Terre Haute Street Railway Company netted large receipts during the great harness race meeting held in that city last month. A total of $91,000 was offered by the Terre Haute Fair Association for a single week of trotting and pacing, and as the weather was excellent the electric railway company was largely benefited by the meeting. Each evening when the races were finished both President Harrison and Superintendent Burke were at the entrance gate to facilitate matters, and notwithstanding the large number of cars put on the race track line, the same schedule was maintained on all branches. One night one car on this line drew five trailers all of which were loaded, the estimated number on the train being 700.

The Street Railway System of Montreal, Can.

Montreal, the largest city of our extensive Northern neighbor, Canada, is an ideal city from a street railway standpoint. It is at the head of navigation on the St. Lawrence River, and with its substantial stone quays and warehouses extends along the river front for six or seven miles. A mile and a half from the river rises Mount Royal which has been transformed by the inhabitants of the city into a magnificent park. This acclivity helps to confine the business and manufacturing districts of the city to the side of the river, making the local transportation system an important factor in the city's activity.

The Montreal Street Railway Company, which operates all of the lines of the city, with the exception of a short eight mile line belonging to the Montreal Park & Island Railroad Company, was chartered in 1861, and up to a recent date operated all of its cars by horse power. The road has now, however, an excellently well arranged electric system, and the cars are carrying large numbers of passengers.

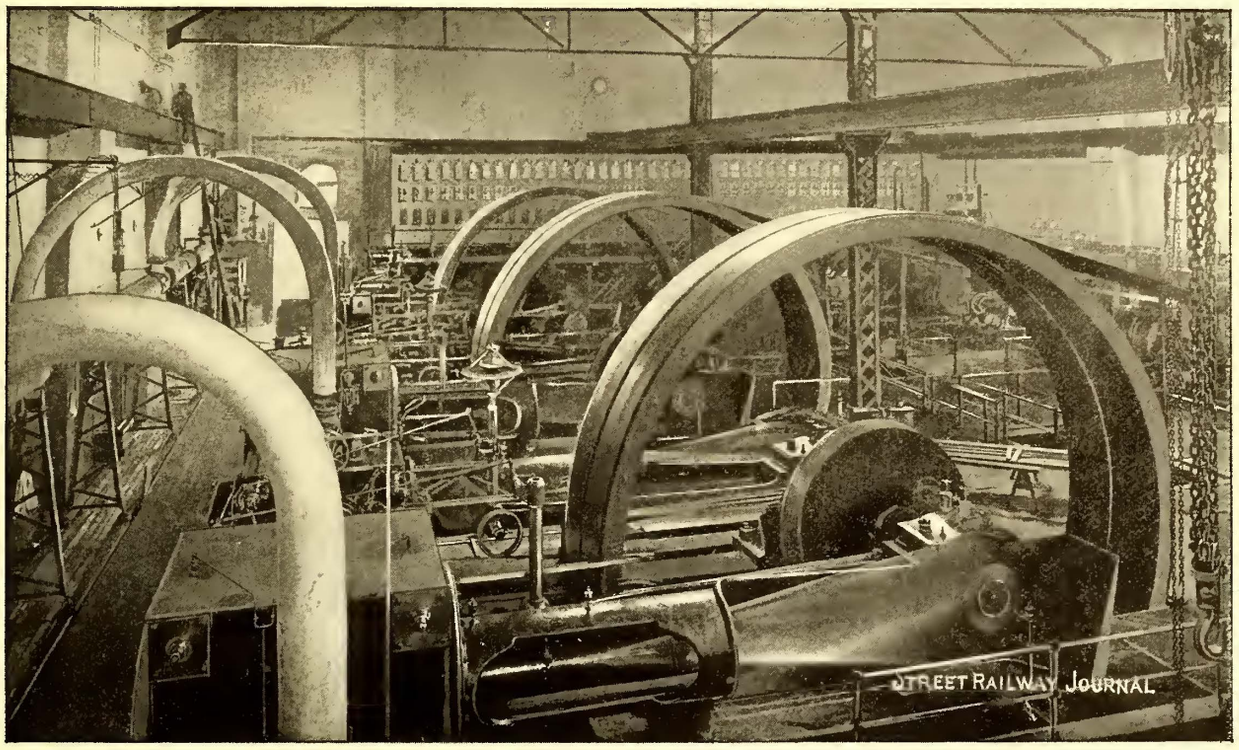


FIG. 1.—INTERIOR OF WILLIAM STREET POWER STATION—MONTREAL STREET RAILWAY CO.

The power station of the company is shown in Fig. 2. It is of brick and Montreal bluestone, and is located at the corner of McCord and William Streets, with a frontage on William Street of about 350 ft. The engine room, which is 200 × 80 ft., contains cross compound Corliss engines of 600 rated H. P. each, built by John Laurie & Brother, engineers, of Montreal. The cylinders are twenty-four and forty-eight inches in diameter and four feet stroke, and the rated speed about sixty-eight revolutions per minute, which gives a periphery speed on the twenty-two foot flywheel of nearly 5,000 ft. per minute To each of the first three engines are attached four General Electric 200 K. W., bipolar generators, built at the Canadian works of that company at Peterborough. Each of the remaining three engines will drive two General Electric multipolar generators of 300 K. W. each, by one pulley and friction clutches. The belts used are three ply, twelve being twenty-four inches wide and three fifty-four inches wide. Two cranes of ten tons capacity each operate in the engine room. Peerless engine oil, manufactured by Samuel Roger & Company, is used for lubrication.

The switchboard extends entirely across one end of the room, as shown in Fig. 1. It is built of hollow bricks made of terra cotta lumber and cemented over with adamantine plaster, which insures thorough insulation. The switchboard appliances are of the Westinghouse type.

The exhaust steam from each engine is taken care of by an independent condenser of the Worthington type, 12 ins. and 15 ins. × 10 ins. The circulating water is taken from the canal through a main twenty inches in diameter, running through the boiler and engine room, having connection for each pump. The hot water is returned to the outgoing main and from there to the canal; part of this water is taken off for boiler feed.

The boiler room, which is 100 × 125 ft., contains twelve boilers of the double flued Lancashire type, built by Daniel Adamson, of Manchester, England. The flues are solid welded and jointed together with Adamson's patent flanged joint. The boilers are rated at 250 H. P. each, on the thirty pounds of water per hour basis. They are fitted with a dead load safety valve, which is the one nearest the front. Then comes the steam nozzle, which is six inches diameter. Next in turn is the low water and safety valve combined, and then the manhole with the government pop valve on the cover. The boilers are built of nine sixteenths inch steel plate, with eleven sixteenths end plates, double riveted on the transverse seams and butt joints and straps, and quadruple riveted on the longitudinal seams, and capable of carrying a working pressure of 125 lbs. per square inch.

The gases from the furnaces pass along the flues and return under the boilers and go back by the sides into the main flue at the back. The temperature of the gases leaving the boilers is 450 degs. From there they pass into a fuel economizer of the Green type, made by the Fuel Economizer Company, of Matteawan, N. Y., and also of Wakefield, England, which reduces it considerably, at the same time raising the temperature of the feedwater from 80 degs. to 260 degs. A by pass is arranged for passing the gases direct to the chimney, to allow of inspection and repairs to the economizer. Stratton separators, Chapman valves and Schaffer & Budenberg gauges are used. Water is fed to the boilers by four Northey pumps, manufactured by the Northey Manufacturing Company, of Toronto.

The chimney, the highest in the city, is 190 ft. above the fire grate and gives a draft equivalent to a column of water of one and one-eighth inches. The core of the chimney is circular in section, and nine feet inside diam-

eter, built with an air space all the way up; the external wall is eighteen feet on a side at the bottom.

The steam piping is made of solid welded tube covered with Asbestos block covering. The main header where it enters the engine room is eighteen inches diameter, diminishing as it extends on either side. The flanges are made from three-quarters of an inch steel plate and pressed from the solid plate. The pipes are made doubly secure by means of wrought iron bands being shrunk on the body of the pipe. The hoop pipes from the header to the engine are seven inches diameter, and bent by John McDougall, engineer, of Montreal, as were also the six inch pipes connecting from the boilers.

Coal to the boiler is brought in on a side tipping carriage which holds 1,400 lbs. and runs on a specially prepared track from the coal yard. The yard when fitted up will be capable of storing 2,000 tons of coal. The ashes are got rid of in a very simple and efficient manner by means of doors in front of the boiler, through which they are passed into the ash pit below.

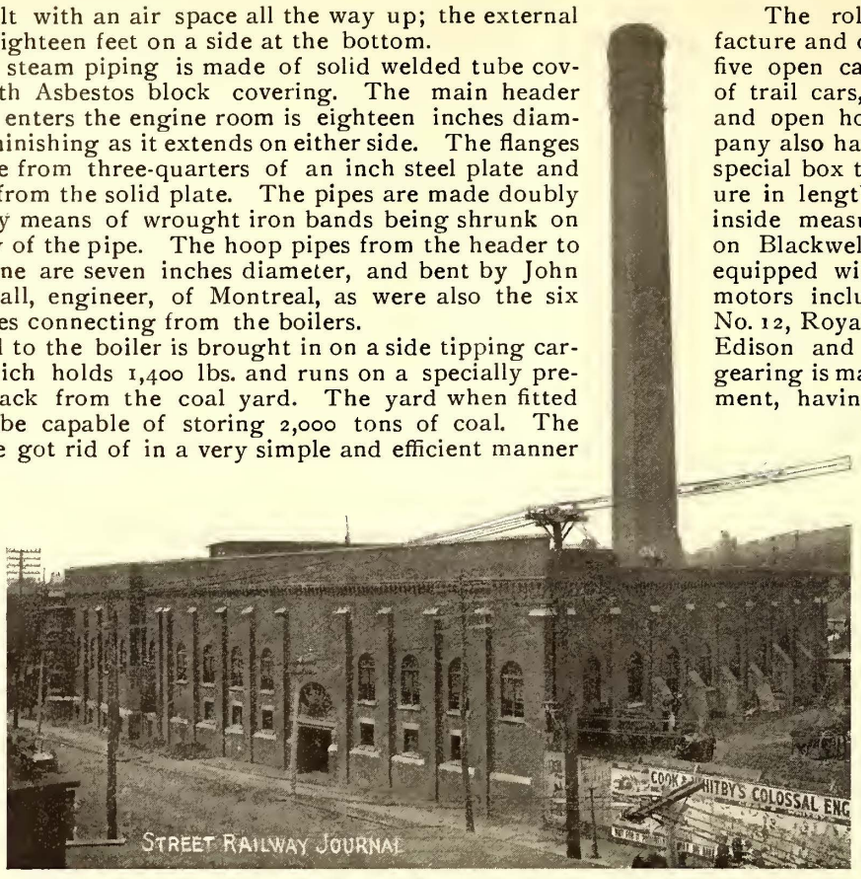


FIG. 2.—EXTERIOR WILLIAM STREET POWER STATION—MONTREAL STREET RAILWAY CO.

The line of the company has a length of sixty-four miles with a maximum grade of 10 per cent. for a distance of 200 ft. The sharpest curves are of forty-five and fifty feet radius. Both wood and iron poles are used. The trolley wire is of No. 00 hard drawn copper and the feed wire of No. 0000 with solid weatherproof covering. The return circuit employs sixteen No. 0000 copper feeders. The rails are bonded with No. 4 wire which is soldered into rivets driven in the rail.

The rolling stock is of Canadian manufacture and consists of 150 box cars and twenty-five open cars, together with a large number of trail cars, consisting principally of the box and open horse cars formerly used. The company also has five special open trailers and ten special box trailers. The box car bodies measure in length from twenty-six to sixteen feet inside measurements. The cars are mounted on Blackwell, Brill and Bemis trucks, and are equipped with a number of different types of motors including the Westinghouse, No. 3 and No. 12, Royal and General Electric, of which the Edison and W. P. 50 types are used. Steel gearing is mainly employed for the motor equipment, having been found preferable to any other. The cars are equipped with foot gongs, sand boxes, Clendinning stoves, etc. New Haven registers are used on a number of the cars, but fare boxes carried by the conductor, and in which the passenger deposits his own fare, are also employed. St. Thomas wheels and wheels from the foundry of John McDougall are used. Some of the cars are equipped with the Ives fender manufactured in Montreal, and some have a special fender manufactured by the street railway company itself. The orlling stock of the company also includes four snow sweepers manufactured by Ahearn & Soper, one snow plow and two extension tower wagons. A number of other snow sweepers are under construction for the company.

The car house of the company is 250 × 103 ft., and contains nine tracks in groups of three, located eleven feet from center to center. It is a substantial building of brick and stone.

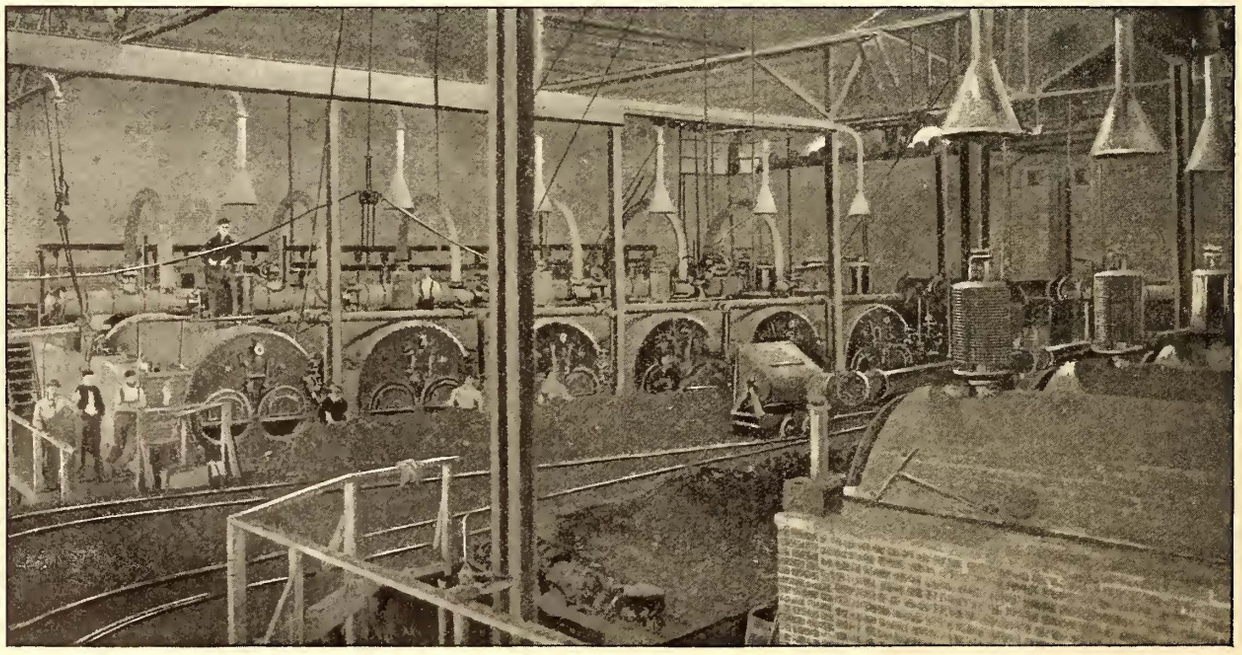


FIG. 3.—BOILER ROOM—MONTREAL STREET RAILWAY CO.

The company is also well equipped in the line of repair and machine shops, and does a considerable amount of its own machine work. An idea of the completeness of this portion of the company's equipment is shown by the fact that in the repair shops of the company are the following tools: One planer, two engine lathes, one speed

lathe, one three-spindle drill, one emery grinder, one grindstone made by Gardner & Son, of Montreal, one Brainard milling machine, one shaper, one drill made by A. R. Williams, of Montreal, one tool grinder made by Robert Mitchell, of Montreal, and one Prentice drill

The track construction is of a most interesting type, being the first trial in this country, so far as we are aware, of the English method of laying girder rails directly on concrete. The type of rail used is grooved girder weighing seventy-two pounds per yard, and supplied by Dick, Kerr & Company, of England. The joints are connected by six bolt fishplates.

Fig. 6 shows a section of the construction used. Wooden ties are not employed on streets where there is a concrete foundation under the pavement. Where the girder rail, which is six and a half inches deep, is laid on wood, paved or stone blocked streets upon concrete foundation, the concrete was cut to the width of the flange of the rail about an inch deep. The rails were then placed on oak shims in this excavation and flooded with a cement grout, consisting of one part of cement and one of sand, under the flange of the rail. The rails were tied together with iron rods, and each side of the web of the rail was filled with cement grout mortar of one to one to the width of the rail. The wood or stone blocks were then replaced, and all the intersections were filled up with cement grout of the proportions mentioned. The track has stood thoroughly well under the heavy traction, in spite of the fact that during the winter the temperature fell as low as 20 degs. below zero.

A considerable amount of interesting special work was also laid in the construction of the road. One of the most complicated pieces of special work is at the corner of St. Lawrence, Main and St. Catharine Streets, and was installed by the Canada Switch Manufacturing Company, of Montreal. It is at a point where two lines of double tracks cross each other with double track right angle curves, connecting each set of main tracks with the other.

The width of St. Catharine Street between curb lines is thirty-eight feet, and that of St. Lawrence forty-three feet, and the special work is built up of girder rails and connected with wrought iron fishplates. The joints were all accurately produced by machinery, and the tongues are made of hammered steel.

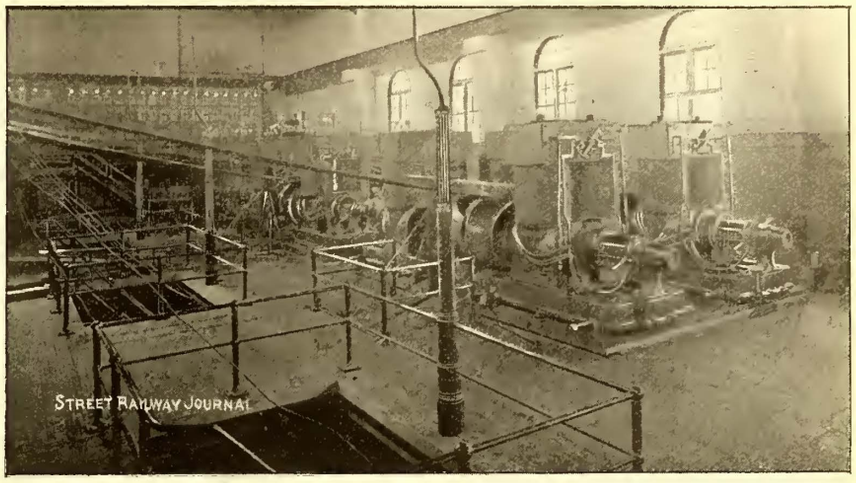


FIG. 4.—GENERATORS—MONTREAL STREET RAILWAY CO.

The number of feet of rail used is 2,148 ft.; total weight of iron in intersection, twenty-six tons; radius of curve

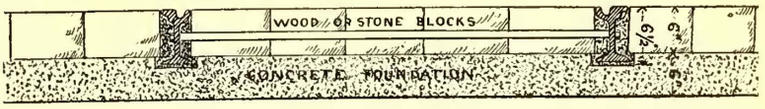


FIG. 6.—SECTION OF TRACK LAID ON CONCRETE—MONTREAL STREET RAILWAY CO.

corner, ten feet; weight of girder rail per yard, seventy-nine pounds; depth of rail used, six and a half inches; radius of curve of inside rail, forty-five feet; maximum width of devil strip, eight feet six inches; minimum width of devil strip, four feet; angle of intersection, 87 degs., 45 mins.

The rails of the crossing are spiked to cedar ties which are bedded in concrete.

FIG. 5.—SWITCHBOARD—MONTREAL STREET RAILWAY CO.

The company carried last year 17,177,952 passengers, or an average of five per car mile run. The total operating expenses per car mile were 17.04 cents, and with the present equipment it is believed that this can be materially reduced during the next year. The average number of car miles run per car per day during the last fiscal year was eighty and a half. The officers of the company are: President, L. J. Forget; manager and chief engineer, Granville C. Cuningham; secretary and treasurer, Edward Lusher; comptroller, J. T. Hill; electrical engineer, Robert C. Brown; superintendent, Duncan McDonald; directors, the president and manager, with James Ross and K. W. Blackwell.

A NEW branch of the Montreal Park & Island Railway was put in operation August 1. It extends from the Island of Montreal, giving direct communication with the city to the outlying districts of Outremont and other suburbs. A large number of prominent guests were present. This company is rapidly putting into operation new lines and extending its system.

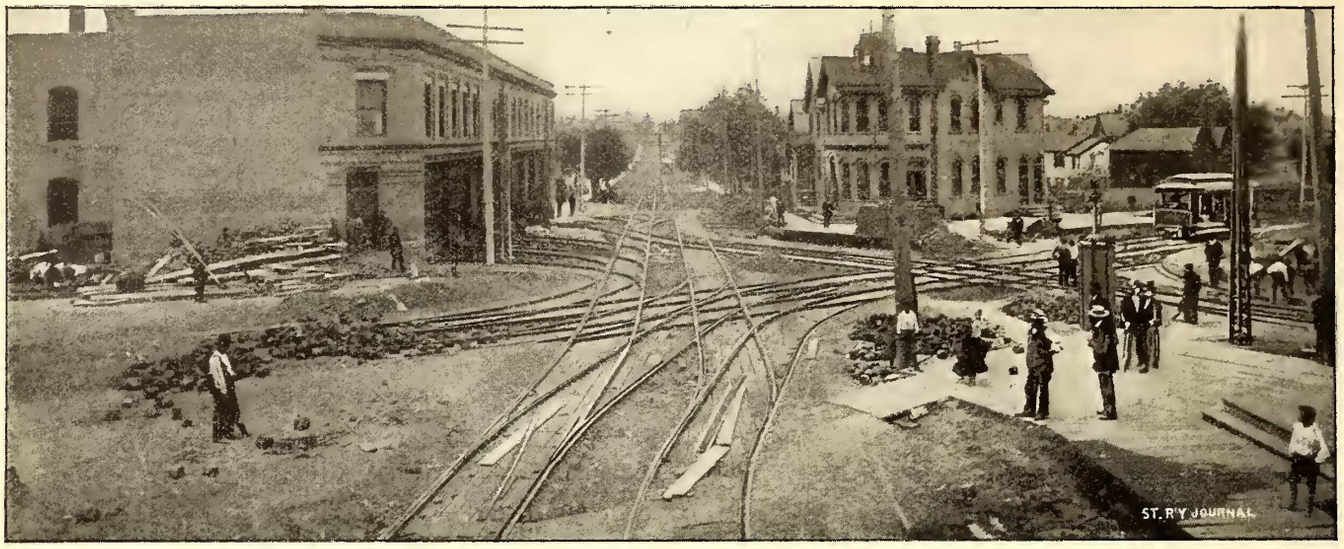
An Elaborate Crossing.

The system of curves, switches and crossings illustrated on this page of the Journal, has just been completed by the Milwaukee Street Railway Company, and perhaps contains some features of interest to other companies. It is located at the intersection of Farwell, North and Murrays Avenue, and embraces the crossings and connecting curves of the lines on these streets, and the entrance curves to Farwell Avenue car house. The curves are so arranged that cars from any of these three streets can be switched to any other, or into the car house without delay or difficulty. These tracks are used by five lines, the Farwell Avenue, Lake Park, North Avenue, Forest Home and the Whitefish Bay steam dummy line. The cars from the first three lines are operated from the Farwell Avenue car house, which has a capacity of 125 cars.

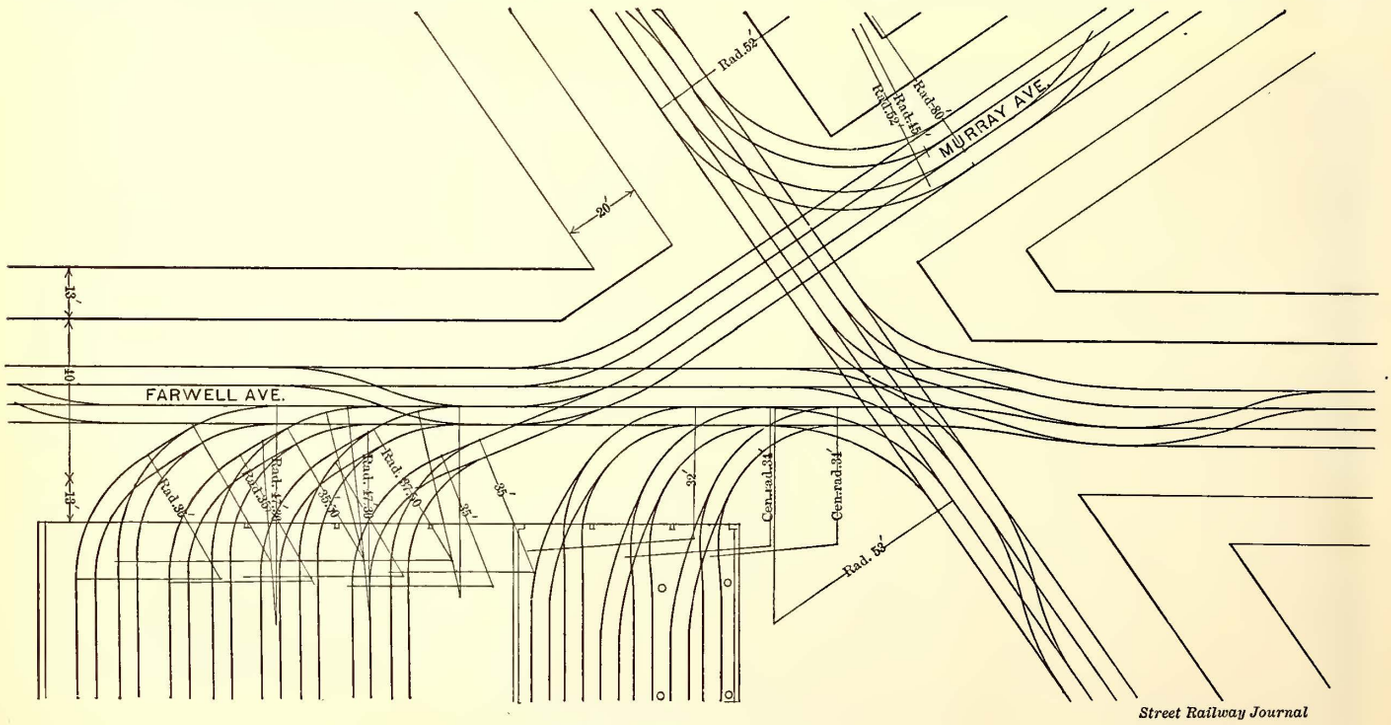
The present curve construction includes twenty-four distinct curves (fourteen of which are entrance curves to the car house), requiring thirty pairs of tongue switches and mates, with forty-nine frogs and two double track crossings, besides five crossover switches. The whole work is built of fifty-eight pound girder rail five inches high, with a base of four inches, which is the standard rail of the company.

In designing this work the first requirements were to obtain the best possible construction, to insure the smooth riding of the cars, and, subject to this to keep the expense as low as possible. The difficulties in the way were chiefly due to the narrowness of Farwell Avenue, the roadway of which is but thirty-eight feet, in width, the tracks being laid ten feet center to center. The distance to the front of the car house is but twenty-five feet from the gauge line of the inner track.

The car house was rebuilt from a horse car barn, and consequently the tracks and the posts are closer together than they would be for a new structure planned for electric cars. This made it a matter of some difficulty to get curves into the house that would permit the cars to enter without striking the posts. It was also necessary to keep the switch point of the first of these curves out of the crossing of Farwell and North Avenues, to avoid having the cars run over the tongues. This required a small reverse curve at the barn entrance, to get back on the track in the barn. The wide angle between Farwell and North Avenues threw the curves connecting these two lines into



VIEW DURING CONSTRUCTION OF FARWELL AVENUE CROSSING, MILWAUKEE.



PLAN OF FARWELL AVENUE CROSSING, MILWAUKEE.

the crossing, so that there are thirty-four frogs within a radius of twelve feet. None of these frogs are three-way, and none closer together than two feet, a result which was obtained by running a piece of straight track through the crossing, connecting the curves on the northwest corner.

Besides making a smoother construction, this also made a great saving in cost, and the frog will last longer, and be more easily repaired, than would be possible if any were three-way.

Owing to trouble with property owners, and legal proceedings in connection with earlier work, it was necessary to keep the curves as far as possible from the corners, this distance being fixed in one case by an order of the court.

All of these curves are guarded on the inner rail with a guard made by bolting an old tram rail five inches wide to the girder rail, using cast iron fillers. The switch-tongues are made of machine steel, first bent to the proper curve, and then planed straight on one side. The shortest radius used is thirty-two feet, which is for a curve entering the car house. The wheel base of the cars is six feet six inches, and not the least trouble is found in running over these short curves.

The first cars out of the barn were taken out before the curves were wired, and consequently had to leave the barn at a good speed, in order to reach the main track, which was easily done. The entire work was built in the shops of the company under the personal supervision of A. W. Lynn, superintendent of construction and repairs, and cannot be excelled by the best work of any of the regular switch and frog companies.

Mr. Lynn was formerly manager of the Old Cream City Railway, of which the Farwell Avenue line was a part, and at the beginning of electrical reconstruction by the consolidated companies he realized the value of a system of lines radiating from the intersection of Farwell and North Avenues, making the Farwell Avenue car house the distributing center for all of the East Side cars.

Owing to the large expense of changing from horse to electric power, Mr. Lynn was for several years unable to persuade the company to go to the additional expense necessary to carry out his plans embracing the extensions of the lines and the construction of the curves and crossings just described.

The first cars ran over the new work on August 5, opening a line to the beautiful Lake Shore Park and the rapidly growing residence region adjoining. This route became at once so popular, that two lines of cars are run over it, with the results of bringing the North Avenue line from the condition of being operated at a loss to that of the best paying line in the city, and materially increasing the business of the other intersecting lines. It now seems probable that this increased business will pay for the work the first year, thus fully demonstrating the value and accuracy of Superintendent Lynn's foresight.

All the plans and detail drawings for this crossing were drawn up by Clement C. Smith, at that time engineer of the Milwaukee Street Railway Company, and at present connected with the Chicago City Railway Company as engineer of track construction. Mr. Smith is a well known authority on track work, and has had long experience in this branch of street railway construction.

New Switching Facilities—Chicago City Railway Company.

The Chicago City Railway Company has just put into practice a new system of switching at the 63d Street terminus of its State Street line, which has points of interest, not only in itself, but as indicating the great change of sentiment from old ideas, and as marking the great contrast to the old ways, when tow horses were deemed an indespensable adjunct to cable roads on level streets—a characteristic quite pronounced in Chicago topography. It is not many years ago that horses towed trains from

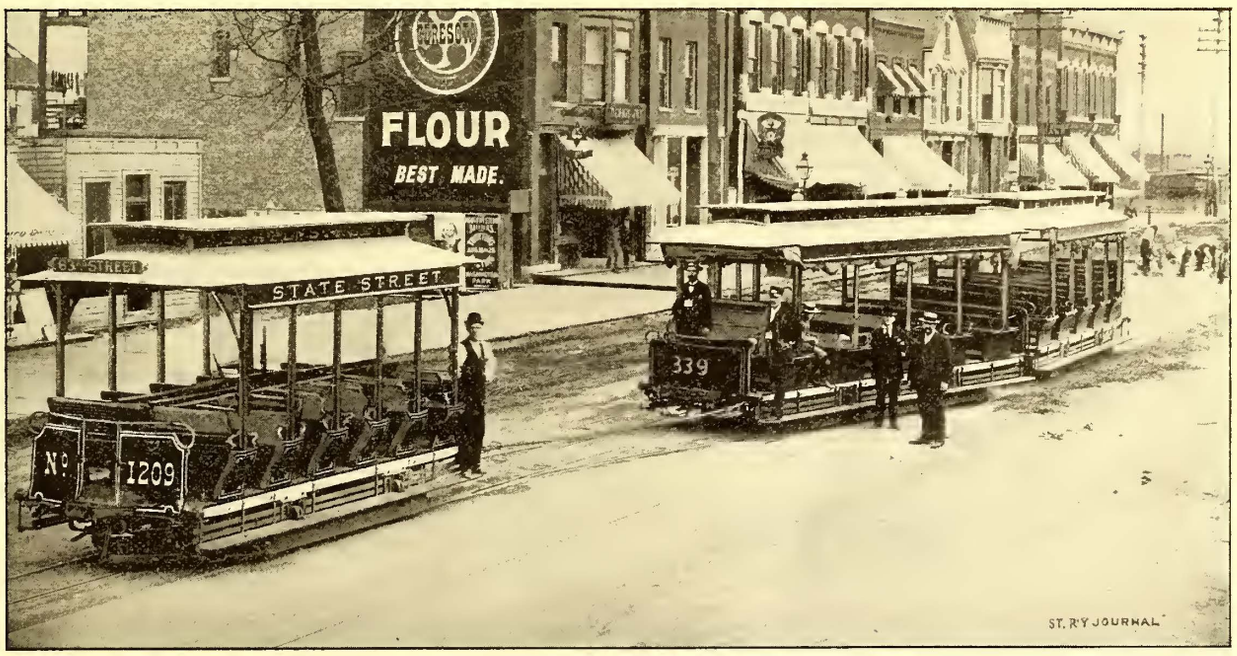


FIG. 1.—METHOD OF SWITCHING CABLE CARS AT 63D AND STATE STREETS—CHICAGO CITY RAILWAY..

the throw-off point of one cable to the pick-up point of another; whereas now, the unnecessary crook in the tracks at pick-up points having been abandoned, nine passengers in ten do not know when one cable is dropped and another taken.

Fig. 2 shows a plan view of the new switching arrangement, and the manner of operation is as follows: The train, which we will suppose comes along the lower track, passing from left to right, acquires a headway from the cable which is then thrown from the grip. The coaches are uncoupled from the grip car, while in motion, the grip car passes over on the grip crossover, which is the one farthest to the right in Fig. 2, and which is always open, to the return track. The coaches are stopped by the conductor, between the grip and coach switches. As the grip car passes on to the return track, the grip jaws are open and receive the cable which is elevated to meet the grip jaws by an elevating sheave.

Should too great a speed be attained and the car go beyond the pick-up, the cable is prevented from being thrown off the sheave by a guard which leads the grip around the sheave, guiding it away from the cable. The coaches are now pulled over to the return track by means of a rope manipulated by the conductor of the trail car, as shown in Fig. 2. The rope is of hemp, one and a

quarter inches in diameter and wrapped with wire to prolong its life. One of these ropes lasts about two weeks.

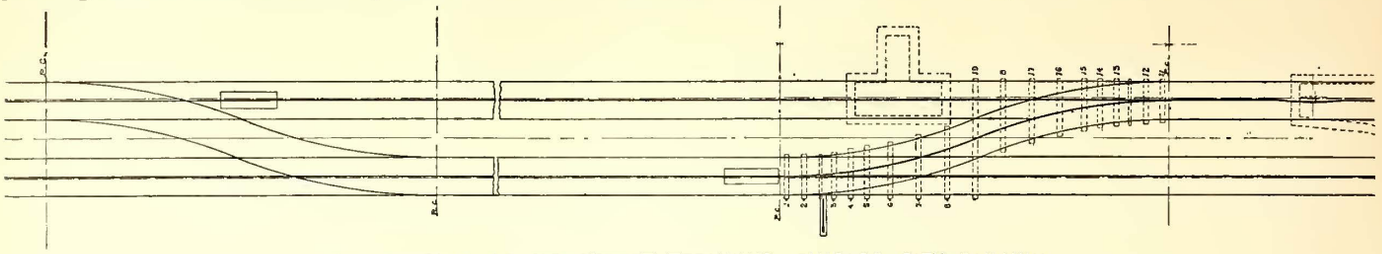


FIG. 2.—PLAN OF 63D STREET TERMINUS—CHICAGO CITY RAILWAY.

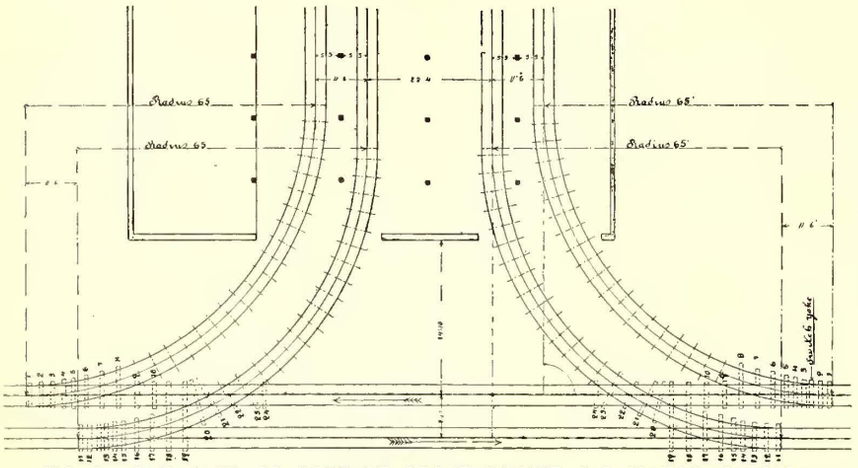


FIG. 3.—OLD PLAN OF COTTAGE GROVE AVENUE CAR HOUSE—CHICAGO CITY RAILWAY.

The very small speed required to carry the grip car from one track to the other is one of the striking features of the system, the car entering the switch at a speed not exceeding five or six miles per hour.

The grip switch is the standard in use by the Chicago City Railway, and was constructed by the Paige Iron Works, of Chicago.

The rapidity and ease with which trains are handled and switched back gives rise immediately to the query: "Why has not this system been adopted long ago?" This is especially so when the cost of the change and saving in operation are considered. Originally, or under the old way, there were required to do this switching two horses and two men with an extra horse and man during the rush hours, making in all shifts seven horses and five men. More recently, however, this had been cut down until one horse and two men did the work, making in all three horses and four men, there being three shifts for the horses and two for the men. Under the present system all of these are dispensed with. Allowing as the cost of keeping one horse fifty-five cents per day, and the wages of the men $1.50 per day, there will appear a saving of $230 per month or $2,760 per year, while the cost of the new switching arrangement has been less than $2,500. The saving compared to the time when seven horses and five men were required is annually $4,086. Practically the company has made an investment which nets it annually over 100 per cent. over the very best previous methods.

This is only one of the many improvements made in its switching facilities by the Chicago City Railway Company in the last three years. The principle of using the momentum derived from the cable to do the work formerly done by horses has been successfully applied at all the cable car houses with the result that labor of men and horses has been done away with by investments ridiculously low compared with the resultant saving.

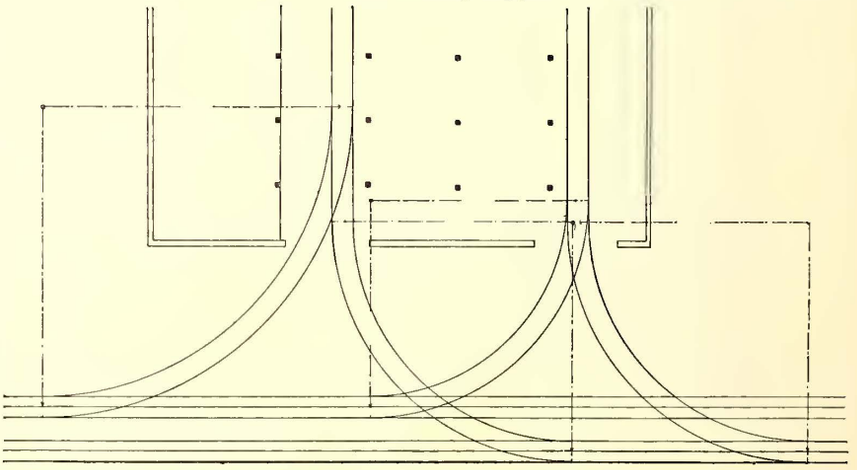


FIG. 4.—NEW PLAN OF COTTAGE GROVE AVENUE CAR HOUSE—CHICAGO CITY RAILWAY.

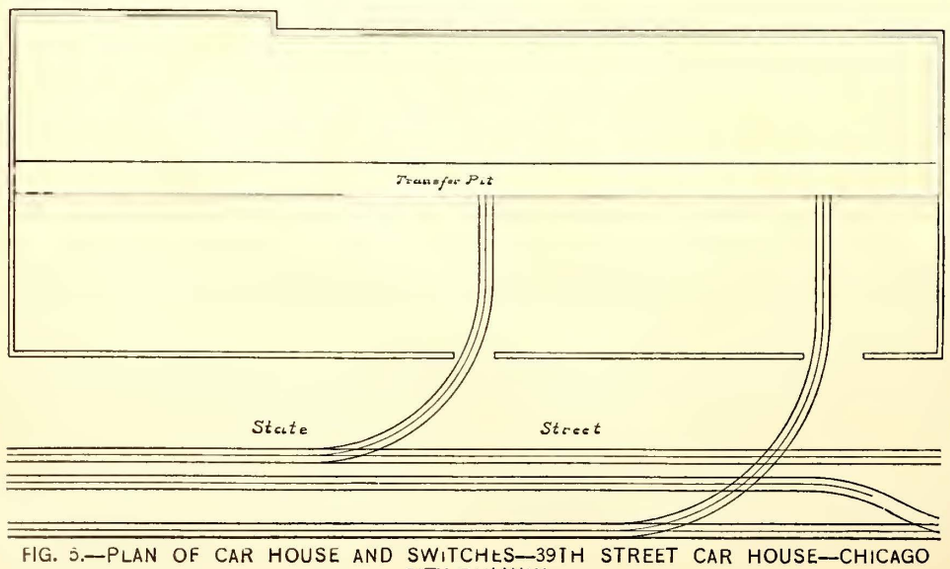


FIG. 5.—PLAN OF CAR HOUSE AND SWITCHES—39TH STREET CAR HOUSE—CHICAGO CITY RAILWAY.

Figs. 3 and 4 represent respectively the old and present arrangement of switches at the Cottage Grove Avenue car house. Under the old system nine horses and nine men were required, nearly all of these being dispensed with under the present system, resulting in an annual saving of $7,774.

Fig. 5 represents the arrangement of the switches at the 39th Street car house of the State Street line. Here, as in the Cottage Grove Avenue car house, the trains run in by momentum and out by gravity. A saving in horses and men of $4,608 per year has been effected here.

Figs. 6 and 7 represent respect-

ively the old and new arrangement of the 61st Street car house of the State Street line, and in the new system here there is annually saved $3,474.

It is learned from the management that by studying out and by putting into practical operation labor saving devices, of which the foregoing are merely a few examples along one particular line, that $8,183 monthly is being saved in the labor of men and horses alone over the operation of 1891, equal to $98,196 annually.

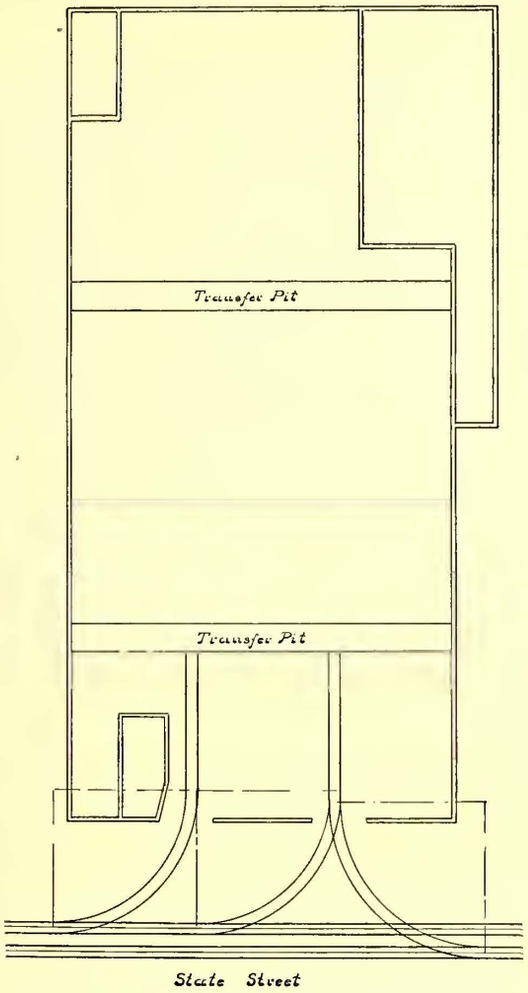


FIG. 6.—OLD PLAN OF 61ST STREET CAR HOUSE—CHICAGO CITY RAILWAY.

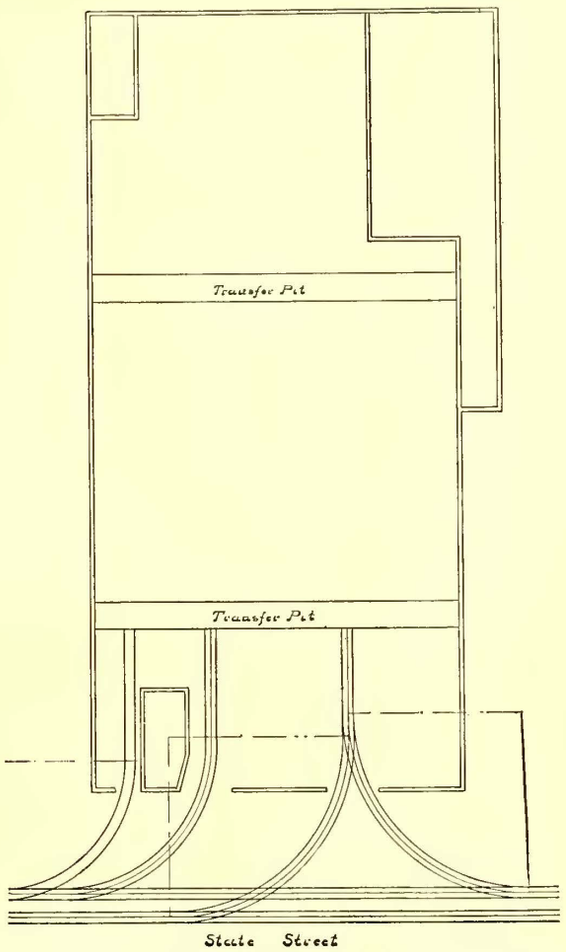


FIG. 7.—NEW PLAN OF 61ST STREET CAR HOUSE—CHICAGO CITY RAILWAY.

The Clipping of Horses in Germany and Austria-Hungary.

The *Strassenbahn* has recently analyzed several works which treat of the clipping of horses in Germany and Austria-Hungary. The excellent work of the German major, Richard Schoenbeck, entitled "Guide pour les Officiers Montés de l'Infanterie," published by R. Bredow, Leipzig, gives the following information:

The clipping of horses has more defenders than opponents. Major Schoenbeck is of the opinion that for horses which have much work to do it is very desirable. With horses which are not clipped perspiration dries with difficulty; it remains in the hair and chills the skin. A clipped horse perspires less, and the perspiration dries more quickly. He commends also the regular clipping of horses which have to stand still very much of the time. The process of clipping is good for the skin, and exercises an influence on the appetite of such an animal, which makes up for the want of exercise. The clipping ought to be done during the months of October and November.

According to Mr. Eberhardt, author of the book entitled "Le Cheval et l'Art de Conduire," also published in Leipzig, the clipping of horses is also considered of value from a hygienic standpoint. This author recommends, however, the making of an exception of those horses which have long and difficult work to do in winter.

After being clipped, the horses ought to rest for at least three days without work, so that they may not catch cold. According to Mr. Eberhardt, the month of October is the best month for clipping. At this time the hair of the animal is not yet entirely grown, and crops out rapidly. By means of recent improvements the clipping of horses has become an easy matter. A good groom ought to clip a horse in from four to five hours. As a groom ought to take care at the minimum of eight horses, it is not possible for him to look after this number well if the hair is kept too long. No disease of the skin is caused by clipping.

At the stables of the tramway company of Lintz-Urfahr all the horses are clipped near the end of October or during the first part of November. The company employs a clipping machine.

THE New York, New Haven & Hartford Railroad Company has recently constructed a solid steel, four track swing bridge over the Bronx River at West Farms. The bridge is one of the first four track bridges of the kind to be constructed in the state. It will be operated by electricity which will be furnished from the power station of the Union Railway Company. It is said to be the largest bridge in the country to be moved by electric power. Its cost when completed will be $50,000.

THE Chestnut Hill & Spring House Passenger Railway Company, of Philadelphia, Pa., was incorporated August 18, with a capital of $48,000. Henry C. Moore, 624 North 22d Street, Philadelphia, is the president of the company, and other stockholders are Hyland C. Murphy, D. C. Golden and Thomas B. Foot, all of Philadelphia.

Intramural Motors in Brooklyn.

The Atlantic Avenue Railway Company, of Brooklyn, has recently added to its motor equipment three of the motor cars which were employed in the operation of the Intramural Railway at the World's Fair. These motors are in operation on the company's West End division, which extends from 39th Street Ferry to Coney Island. This line was formerly operated with steam locomotives, but is now entirely equipped with electric motors.

As already stated in these columns, the motor cars are equipped with four General Electric motors of the single reduction, four pole type, one on each axle. These are probably the most powerful railway motors ever constructed, being rated 150 H. P. each, and especially designed for heavy passenger traffic. They are geared for a speed of thirty-five miles per hour, and weigh, exclusive of the gear, only a little in excess of 3,000 lbs. The armature is of the slotted, iron clad type, the winding being embedded in the laminated iron body. The motor was illustrated in the June, 1893, issue of the STREET RAILWAY JOURNAL.

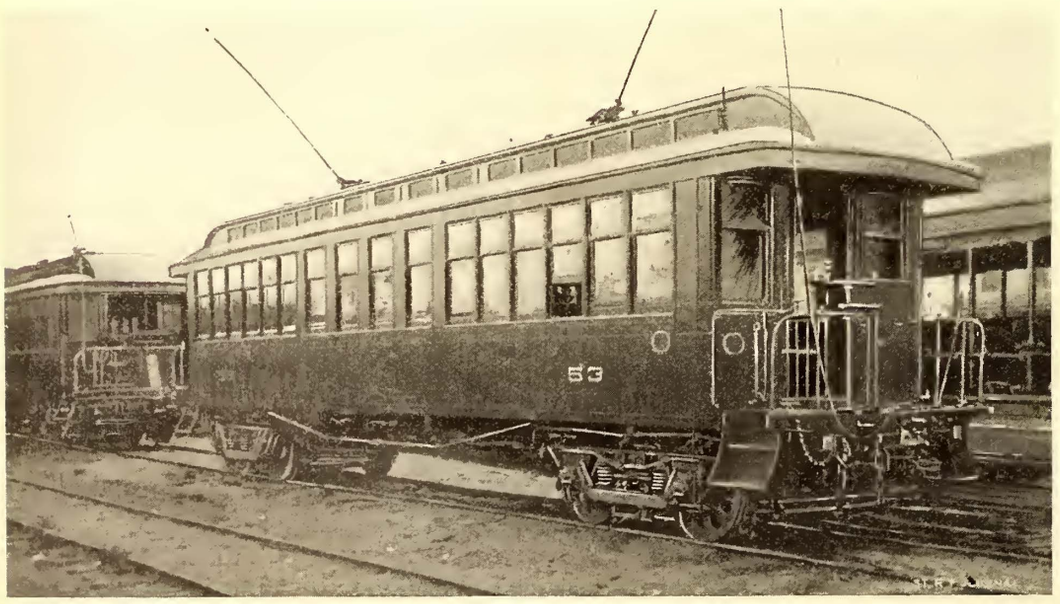
The trucks were built by the Jackson & Sharp Company, of Wilmington, Del. The original car bodies have been removed and replaced by forty-five foot closed car bodies built by the Wason Manufacturing Company, of Brightwood, Mass. The cars are similar in appearance to those in use on the elevated railways, and have seating capacity of forty-five persons. The interior finish is rich and tasteful. The seats and backs are of rattan, and they are lighted by six oil lamps held in handsome brass chandeliers.

In the operation of the motors on the Intramural Railway current was taken from the conductor rails by means of a sliding contact shoe. These latter have been removed and the cars are now equipped with the ordinary overhead trolley.

When the change was made from the sliding contact shoe to the overhead trolley some trouble was experienced on account of the trolley coming off. The difficulty has been overcome by the use of a Carpenter enamel rheostat of special design. The rheostat works automatically, and protects the motor in case the circuit is broken by the trolley coming off and suddenly closed by replacing it. The cars are provided with two trolleys, one of which is used for the regular run and the other for switching purposes at the Brooklyn end of the line. Whistles operated by air from the brake reservoir are employed instead of gongs.

FIG. 2.—INTERIOR OF CAR ON BROOKLYN, BATH & WEST END RAILWAY.

Trains are operated, consisting of a motor car and three open trail cars. The trail cars were built by the Wason Manufacturing Company, of Brightwood, Mass. They are forty-five feet in length, and have a seating capacity of eighty passengers.



45 FT. CAR ON BROOKLYN, BATH & WEST END RAILWAY—BROOKLYN, N. Y.

The cars are provided with the New York air brake system, the air being stored in the reservoirs by means of an automatic air pump, with cylinder dimensions 5×9 ins., and operated by a stationary motor. The motor and air pump are controlled by a pneumatic rheostat, which automatically cuts out the motor when the air pressure reaches sixty pounds and starts the motor again, when the pressure falls below that point.

First Trip of Brooklyn's Postal Car.

The first trip of the electric postal car of the Atlantic Avenue Railway Company, described in our last issue, was made August 12. The car carried the postmaster of Brooklyn and other postal officials of that city, Superintendent Newkirk, Treasurer Frick and Engineer Silliman of the Atlantic Avenue Railway Company, and other invited guests. C. C. Overton, who was one of the party, on entering the car, mailed a letter to himself for Bath Beach. It was the first carried on the new line. A number of mail pouches were also taken aboard. The trip was then begun, and several mail bags were received and contents distributed along the route.

There will be three deliveries each day. The postal car will leave the Post Office at 6 A. M., 12 M., and 4.15 P. M., arriving at Coney Island, one hour and nine minutes after the start in each case.

Electric Brakes in Philadelphia.

Passengers on the People's Traction electric railway in Philadelphia for the past two or three weeks have been treated to quite an unusual and pleasing experience of riding on cars equipped with the electric brake. The action of the brake in stopping is described by a reporter in one of the dailies as "though the car were running into a feather tick or air cushion." Each car is equipped with one Sperry forty horse power motor, swung on springs between the two axles. The armature of the motor revolves at right angles with the direction in which the car moves and is connected with the two axles by flexible joints and bevel gears. The Sperry controller is operated by a lever moving crossways of the car, and the controller box is placed, as usual, close to the dasher, and occupies very little space. The current is thrown on and the car started by moving the lever to the left. There is an attachment for reversing the motor.

The electric brake is operated by the controller lever, and is entirely distinct from the hand brake, which need not be used except in emergencies. It consists essentially of a friction clutch composed of a disk carried on the wheel, against which a C-shaped magnet surrounding the axle is made to bear, as shown in Fig. 1. The coils are placed inside of this magnet, and it is held from revolving by being attached to the truck. The electric power to operate the brake is generated by the motor, which becomes a dynamo and produces a current from the power supplied by the momentum of the car.

In operating the brake the lever is thrown back sharply. This shuts off the trolley current from the motor and at the same time connects the motor, brake magnets and about eighteen ohms of resistance in series with each other. The motor immediately generates a current which actuates the brake. The amount of current and consequently the braking power varies with the amount of resistance in the circuit, so that this can be regulated by the controller handle. This enables the motorman to make the hardest application at high speed and have it automatically reduced as the speed falls off, the true principle of braking, as explained by Mr. Sperry at the Milwaukee convention.

Trolley parties seem to be all the go in Philadelphia at the present time, as many as three or four each pleasant evening going over the line and enjoying the delightful air, the historical Germantown battlefield being the Mecca of most of the excursionists. The electric brake cars are universally preferred for these parties; the smoothness of the action and remarkable ease of operation and control on the part of the motorman on the heavy grades making them the favorite cars.

The new extension of the line from the old car stables on Dauphin Street to Germantown is not only over a road of considerable historic interest, but quite remarkable for its grades and curves. The rise is almost continuous to the end of the track in Germantown, the ascent being fully 200 ft. in the distance.

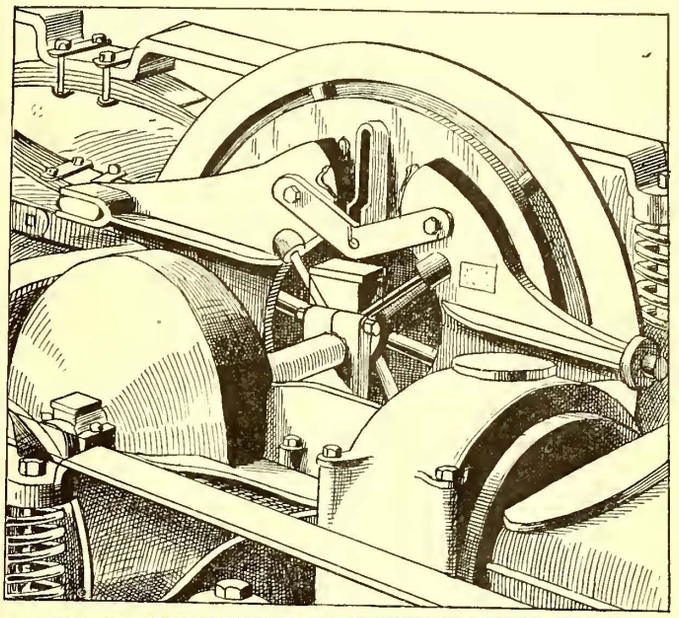


FIG. 1.—ARRANGEMENT OF SPERRY ELECTRIC BRAKE.

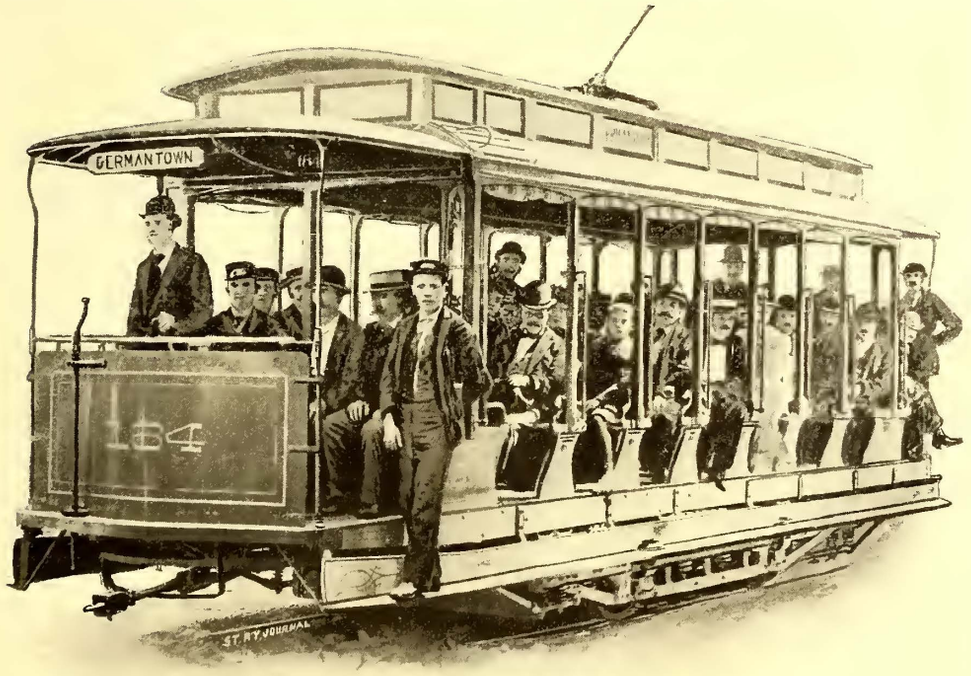


FIG. 2.—CAR—PEOPLE'S TRACTION CO., PHILADELPHIA.

The action of the brakes on these grades has been watched with much interest. The car seems to be under perfect control, and when the register shows eighty fares with people standing in the aisles, the brake stops the car very smoothly on the most abrupt descent. The fact that the company is daily adding to its equipment of the cars on this line seems to indicate that the brakes are successful in handling the cars upon these grades.

A more delightful ride could not be had than by taking one of the electric brake cars of the People's Traction line and riding to Germantown and return.

THE Delaware County & Philadelphia Railway Company of Philadelphia, Pa., recently purchased a 2,500 gal. tank sprinkling car of the Jackson & Sharp Company of Wilmington, Del. On account of the excellent satisfaction given by the sprinkling car, the company has recently placed an order for vestibule cars with the same manufacturers.

THE Willow Grove (Pa.) & Hathore Street Railway Company, was organized August 25, with a capital of $18,000. John H. Fow, of Philadelphia, is president. Others interested are A. D. Markley, S. J. Garner and J. F. Cottman, all of Jenkintown, Pa.

A NEW electric road will be built by the Braintree (Mass) & Weymouth Street Railway Company.

The Next Annual Meeting of the American Street Railway Association.

As the time approaches for the annual meeting of the American Street Railway Association, at Atlanta, indications point to the largest and most successful convention ever held by the Association. The selection of a Southern city for the meeting seems to have been a most popular choice. The Southern members of the Association will certainly be present in force, and those who live north of the Mason and Dixon line seem to be also preparing to attend in large numbers.

The number of those who will avail themselves of the special train to Atlanta, mentioned in our last issue, seems to be growing, and as the train will run via Chattanooga, delegates will have the opportunity of visiting Lookout Mountain at perhaps the most beautiful time of the year as regards scenery.

The local committee in Atlanta has been most assiduous in its labors for the proper entertainment of all, and those who attend may be sure of enjoying to its fullest extent the large hearted hospitality for which the Southerners are famous. The arrangements for the entertainment of attendants have been perfected, and a varied and attractive programme has been decided upon. Some of the special features are as follows:

On the evening of Wednesday, the first day of the convention, a reception will be extended, from 4 to 9 P. M., at the Capital City Club, of Atlanta, to which all attendants and visiting ladies will be invited, and at which a number of Atlanta ladies will receive. On Thursday afternoon carriages will be provided for all the ladies in attendance, and a drive will be taken to visit the most beautiful parts of the city. The annual banquet will be given Thursday night at 9 P. M.

On Friday the attendants will have an opportunity of enjoying a genuine, royal, big Georgia barbecue at Stone Mountain 20 miles east from the city.

A number of changes have been made in the local committees, of which Joel Hurt is general chairman, and these are now composed as follows:

Hotel.—Wm. W. Kingston, chairman, W. M. Kelley, S. W. Trawick, E. P. Thomas. Exhibits.—N. W. L. Brown, chairman, Dana Bullen, W. M. Kelley, Wm. W. Kingston. Transportation.—W. M. Kelley, chairman, J. H. Allen. Entertainments.—R. J. Lowry, chairman, J. C. Payne, J. W. English, Jr., Wm. W. Kingston, T. K. Glenn, Henry Inman, Livingston Mims. Banquet.—H. E. W. Palmer, chairman, J. C. Payne, R. J. Lowry, E. Woodruff, Henry Jackson, T. B. Felder, Jr. Excursion.—W. M. Kelley, chairman, E. Woodruff, H. N. Hurt. Finance.—E. Woodruff, chairman, R. J. Lowry, T. B. Felder, Jr., J. J. W. English, Jr. W. C. Sanders.

The Opening of the Bridgeport Traction Company's Electric Road.

On Friday, August 24, occurred the official opening of the new electric system of the Bridgeport Traction Company of Bridgeport, Conn. A large number of gentlemen interested in the company were present, including the president, Col. N. H. Heft; general manager, Andrew Radel; vice-president, Elias Ward; secretary, Gen. Thomas L. Watson; cashier, W. J. DeShays; electrician, Thomas Moncks; contractor, Thomas Murray, the contracting engineer, C. J. Field, as well as a number of invited guests, including a representative of the Street Railway Journal.

Special cars were provided to carry the party over the lines of the road to the power station. A sumptuous and hospitable repast was provided for the visitors, and altogether a most pleasant time was enjoyed by all.

The power station of the company contains one Providence-Greene tandem compound engine, 12 and 20 × 42 ins., and two Watts-Campbell Corliss engines are also being installed. The latter two engines will be run direct connected to two 300 K. W. General Electric generators, while the former now drives by belting one 200 K. W. General Electric generator. Return tubular boilers, manufactured by the Pacific Iron Works of Bridgeport, Conn., are used.

The rolling stock of the company consists of fifty handsome cars of the J. G. Brill type, mounted on Brill trucks and equipped with Lewis & Fowler registers.

The track is laid with nine inch and six inch T rail, and a remarkable record was made in its construction by Contractor Murray and his engineers, E. G. Wright and R. N. Billings, twenty-three miles of roadbed having been constructed in sixty-five days in order to meet the conditions of the franchise.

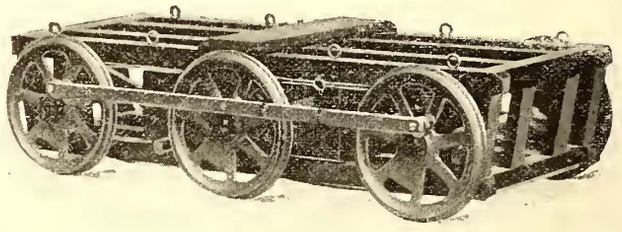
An Electrical Clambake.

The annual clambake tendered the electrical fraternity by the American Electrical Works of Providence, R. I., and which to this class of the community has come to be recognized as one of the most delightful events of the year, occurred on Saturday, August 25. The day was an ideal one, and there were a large number of guests to enjoy the hospitality of this well known company. All sections of the country were represented, and there were in all over two hundred guests who sat down to a most generous repast.

The event was held at the Union Club's country house, which was reached from Providence by electric cars chartered for the purpose. Upon their arrival the guests found a huge tent spread on the grassy lawn adjoining the club house. The usual baseball game, hammer throwing and other pastimes were indulged in to the accompaniment of an excellent band of music and before the discussion of the menu. President Eugene F. Philips, of the American Electrical Works, was an ideal host and extended a cordial welcome to all the attendants. The printed menus were artistic and a thorough good time was enjoyed by all.

A Reciprocating Electric Motor Truck.

Reciprocating electric motors have not up to this time been used extensively in street railway operation, but a truck employing them has been devised by J. T. Wilson, of Tyrone, Pa. Early forms of Mr. Wilson's truck have been illustrated in previous issues, and we present herewith an engraving of a model showing Mr. Wilson's latest improvement. The principle of the truck is as follows: The motors, of which there are four for each truck, are each mounted in a frame



A RECIPROCATING ELECTRIC MOTOR TRUCK.

adapted to slide longitudinally on balls running on girders supported from the end bars of the truck. A disk is carried on each armature shaft, and a point on its circumference is connected rigidly by a rod with the truck. Another rod connects the field magnet frame with an internal crank on the car axle. As will be seen, the effect of operating each of the motors is to give a reciprocating movement to the motor frame, which is communicated to the axle with which it is connected. The four motors are similarly connected, but are arranged to operate quarterly so that there will be no dead points.

No lurching effect is imparted to the motion of the truck, since half of the motor equipment is moving in one direction, while the other half is moving in the opposite direction, thus balancing each other. To the connecting rods of the truck are attached slotted blocks in which the disk pins of the armature move to insure proper action of each motor at points that otherwise at times might prove to be dead points.

The middle wheels of the six wheeled truck shown may be with or without flanges, and are mounted on spindles with ball bearings, as their use is to support the middle of the truck. These cars will start on and run up grade. They run smoothly and with but very little noise. When the electric current is cut off, the mechanical action reverses from axles to motors, making it an easy matter to start the car quickly.

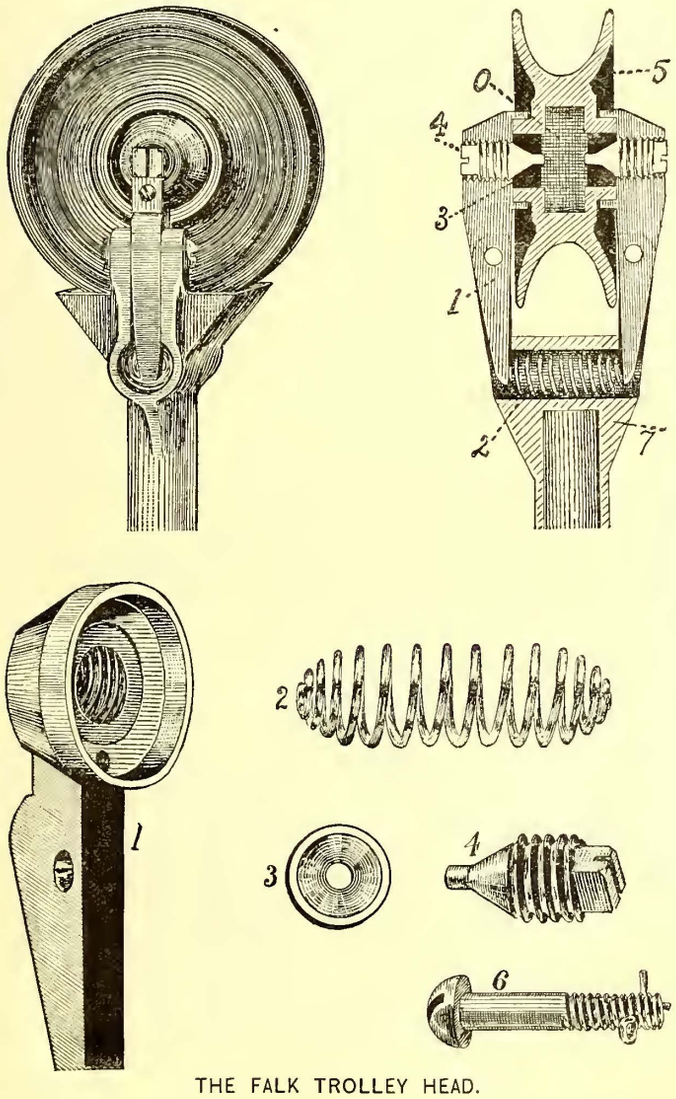
Application is to be made at the next General Assembly of Connecticut for leave to build an electric road between New Haven and Bridgeport, with connection at the West Shore terminus at Woodmont, the line continuing by Merwin's Point, through Milford, to Stratford and Bridgeport, and sending off spur tracks to various points in Milford.

A New Type of Trolley Head.

We illustrate herewith a trolley head manufactured by the Falk Manufacturing Company of Milwaukee, which has been adopted by the Milwaukee Street Railway Company for all of its cars, and which is giving excellent satisfaction. The conditions in Milwaukee include the use of center pole construction for a considerable portion of the equipment, and a working conductor of small diameter, conditions which are particularly arduous, and which consequently reflect greater credit for satisfactory operation by an appliance of this character.

The Falk trolley head avoids the use of graphite bushings or roller bearings, and employs instead cone bearings which automatically adjust themselves to compensate for any small wear. Every part of the trolley head is made of steel. If a railroad company insists upon the use of brass wheels they will be furnished by the Falk Manufacturing Company, but steel is recommended in every case. The cut, which presents a view of the trolley head in cross section, shows very clearly the arrangement of the cone bearings. As will be seen, they are kept tight automatically by the spiral spring, 2, which presses outwards on the arms which holds the cone points. Both cones and bushings against which they bear are of hardened steel.

When the wear becomes greater than can be cared for by the spring shown the cone points can be screwed in or out by a screw driver and adjusted by means of the split pin shown in the engraving. In case the cones break, the wheel will not fall out of the harp, as there is still a shoulder to act as a bearing until the trolley head can be conveniently fixed.



THE FALK TROLLEY HEAD.

A hollow space is left on the inside of the wheel for dope. This is applied every three or four days by removing one of the cones and inserting the nozzle of a specially constructed dope can which fits the hole in the bushing. When the cone is replaced the inspector, of course, adjusts the bearing so that the spring holds the cone at the proper tension. The wheel requires absolutely no other attention until worn out, and at Milwaukee one man will dope thirty cars in an hour and a half.

The bushings have been found to last about four months, which is an excellent record when the wear is as severe as in a case of this kind. The cost of maintenance is very low, and all rattle and play is avoided.

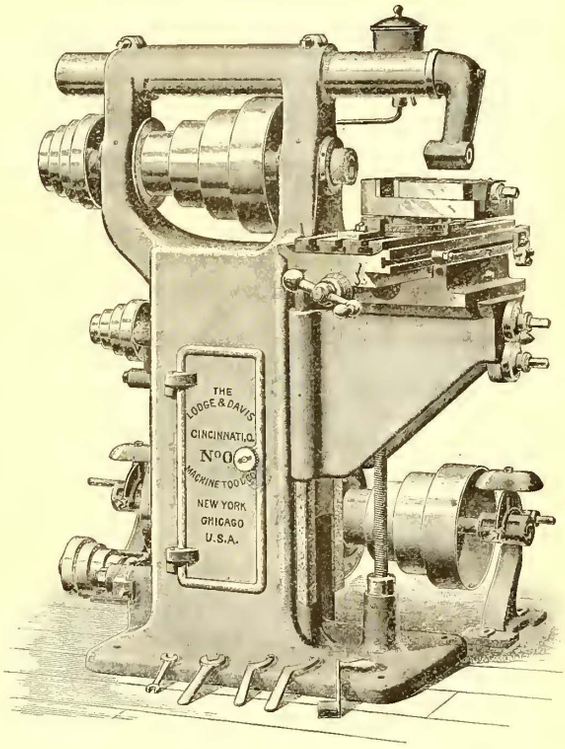
The harp is so shaped that it will not engage on the span wires.

Plain Milling Machine.

Milling machines form a necessary part of street railway repair shops, and a conveniently arranged machine of this character, made by the Lodge & Davis Machine Tool Company, of Cincinnati, O., is shown herewith. As will be seen, the machine conforms in its features to the standard knee form of machine, has its uprights tied together above the cone pulley, and has an overhanging arm for supporting the outer end of the mill arbor.

The table is provided with an oil channel running around it, and drainage tubes are provided at each end for running the oil into vessels which can be hung upon hooks provided for the purpose. All the traversing screws are provided with micrometer graduations, and the rings are secured in place by knurled nuts, so they are very readily adjusted without the use of tools. There is a quick return motion for the table, this being at the right of the machine, and operated by a crank. The automatic stop for the feed operates in either direction, and is placed on a T slot, which also receives the auxiliary dog for hand feeding. A new device is provided which is adjusted by a slotted screw, and takes up all lost motion in the traversing screws.

The feed is reversible by tumbler gearing, and has a range of .008 in. to .1 in. per revolution of spindle. The lower feed cone is mounted

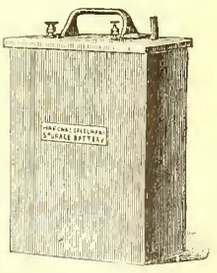


PLAIN MILLING MACHINE.

upon a swiveling yoke by means of which it can be adjusted to keep both feed belts at proper tension. A double friction countershaft accompanies the machine. The feed of the table is twenty-four inches; movement of table in line with spindle, seven inches; vertical movement of knee, nineteen inches.

A New Storage Battery.

A new storage battery, for which excellent claims are made, has just been placed on the market by Haschke & Creelman, 18 to 30 West Randolph Street, Chicago. The battery is very light in weight, small in size, and capable of withstanding rough handling.



ACCUMULATOR CELL.

The elements in the 300 ampere-hour cell, especially constructed for street car propulsion, weigh only thirty-four pounds. It is five inches wide, seven inches long and ten inches high. One of the main features of the battery is the secret process of insulation used in separating the elements. This insulation is electro-chemically treated, and when placed between the elements, causes them to solidify and withstand punctures or rough handling, and renders buckling impossible. The batteries have a very low internal resistance. The chemical action is very quickly revived after an excessive discharge, thereby maintaining a constant voltage.

Compressed Air for Car Cleaning.

Railroad car cleaning by compressed air is one of the latest developments of compressed air application, of which, in late years, there has been almost endless multiplication. Attention was drawn to it recently in a report of a committee of the Master Car Builders' Association detailing the growing use of compressed air in car shops and yards, and illustrating various forms of pneumatic hoists, pumps and other labor saving apparatus for railroad service. Not the least interesting among these were the dusting nozzles, which in three instances at least—on the West Shore, the Erie and the Chicago, Rock Island & Pacific lines— have been put to use with such good results that they would seem to promise the early relegation to the railroad curio scrap heap of the conventional rattan beater and brush. These compressed air dusters, as shown by tests made by the committee, effect a decided saving in time in cleaning car cushions, the average time consumed by two men, one operating one of the nozzles and the other handling the seats, in removing the dust from plush and springs of 200 seats, cleaning them perfectly, being from twenty-seven to thirty-three seconds for each seat. The air used in these tests was supplied from a reservoir at a pressure of from sixty to ninety pounds per square inch. Another test at cleaning by hand in the usual way, with beaters and brushes, showed the time necessary for each seat to vary from three to four minutes, the air dusters thus effecting a time saving of about 85 per cent.—*Cassier's Magazine.*

Handsome Cars for the Dartmouth & Westport Street Railway.

The Dartmouth & Westport Street Railway Company, of New Bedford, Mass., has recently put on its line some very handsome cars, which we illustrate on this page. The cars are from the works of the Jackson & Sharp Company, of Wilmington, Del., and have given such good satisfaction that orders for additional rolling stock of the same make and finish have been given.

FIG. 1.—COMBINATION BAGGAGE AND PASSENGER CAR—DARTMOUTH & WESTPORT STREET RAILWAY.

They are 22 ft. long inside and 30 ft. over vestibules; the width over panels is 6 ft. 6 ins., and the height of the car from the under side of the sill to top of trolley board is 9 ft. 1 in. The height from the top of track to the top of the trolley board is 11 ft. 7 ins. All the sills are of Georgia long leaf, yellow pine, and cross framing is of oak; the floor is also of yellow pine. Posts, top rails, ventilator rails and all material used in framing is of white ash.

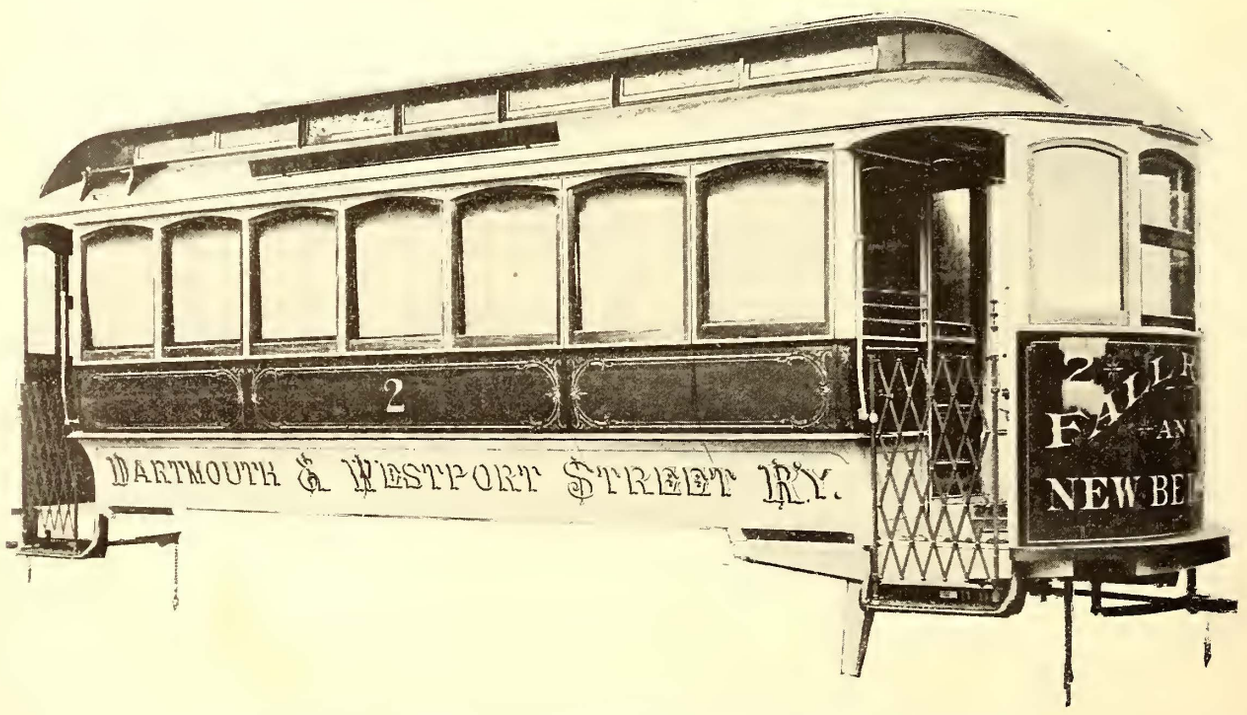


FIG. 2.—CLOSED PASSENGER CAR—DARTMOUTH & WESTPORT STREET RAILWAY.

The roof is of the dome pattern, extending the whole length of the car and out over the platforms the same as steam cars with vestibuled platforms. The roof is covered with the best quality of duck. The ceiling is of three-ply veneer of birch, neatly and tastefully decorated with one large bronze candle and electric lamp in the center and two small lamps at each end with one light in each vestibule. The deck sash is of mahogany and glazed with Muranese glass, and is hung on ratchets with bronze deck sash openers to operate it. Two beveled mirrors are located in each end in neat mahogany frames. The hand

rails are of mahogany with bronze bratckets, and there are seven padded hand straps to each. There are seven windows on each side and two in each end, glazed with the best double thick glass, and imbedded in rubber on all edges.

The inside finish of the cars is of the best Mexican mahogany, handsomely figured. The curtains to each window are fitted with the McKay patent fixtures. The seats are reversible, with Hale & Kilburn

FIG. 3.—INTERIOR OF CAR—DARTMOUTH & WESTPORT RAILWAY

patent fixtures, and are upholstered in old gold plush. There are seven single seats on one side and seven double on the other with nickel plated arm rests. The aisle is covered with carpet, which gives the car the effect of a regular railway coach.

Large, roomy vestibules are provided with gates on each side. Bronze brake wheels and Stanwood steps are used, and all trimmings, both inside and out, are of bronze of the newest design.

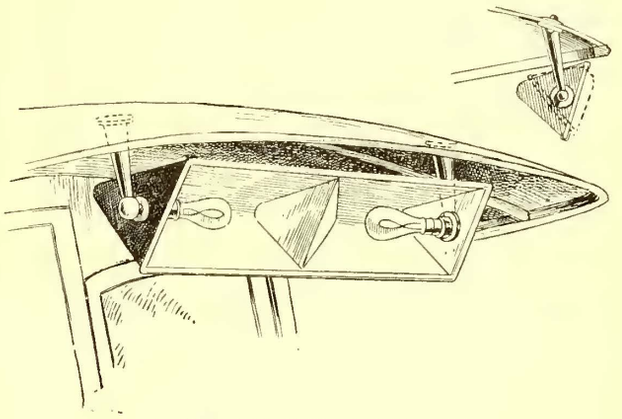
In regard to the outside finish, the cars are painted chrome yellow with white concave panels handsomely decorated with the name "Dartmouth & Westport Street Railway" in silver. On the outside of the vestibules the name "Fall River and New Bedford" is painted in large, gold letters. Each car is also provided with side signs. Fig. 3 gives an interior view of the car. The combination car (Fig. 1) is the same size as the passenger cars, except that it has a bulkhead dividing eight feet off for a baggage room. The baggage room is finished in ash, while the balance of the car is finished in quartered oak, with cross seats upholstered in leather. This car is to be used as a smoker. It is also provided with two card tables to be used by card players. The baggage room has two large doors, one on either side, the same as used in baggage cars on steam roads.

A New Electric Headlight.

The Lindell Railway Company, of St. Louis, has recently equipped its cars with an electric headlight of a new type, an illustration of which is presented herewith. It is the invention of George W. Baumhoff, superintendent of the company, and has given excellent satisfaction. It consists of a triangular shaped casing of metal about twenty-four inches in length and nine inches in width, with its inner surface lined with reflecting material. The casing is attached to the under side of the car bonnet by hollow tubular castings through which the wires connecting with the lamps are carried and arranged in such a manner as to protect them from the weather and prevent them coming in contact with passengers. Two lamps are provided, the sockets for which are attached to the horizontal parts of the supporting casting which also provides bearings on which the lamp casing turns.

The interior of the casing is divided by a V-shaped central partition forming a powerful reflector for each lamp.

The reflector is arranged to turn on its bearings, the front headlight being used to light the track in front which it does for a distance



A NEW ELECTRIC HEADLIGHT.

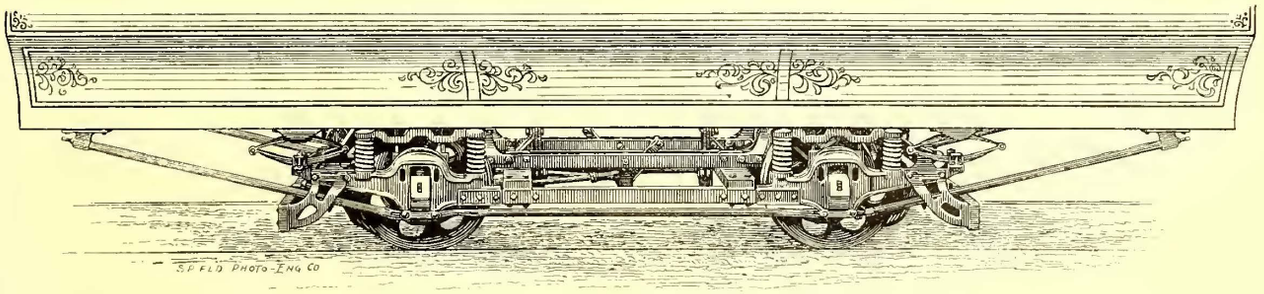
of about 150 ft., and the rear one for lighting the rear platform and the interior of the car.

Previous to the adoption of the electric headlights the cars were provided with oil headlights which required the services of two men to keep in order.

With the new headlight the company estimates a saving of the salary of two men, the cost of lamps and current required to operate the new system being equivalent to the cost of coal oil and the breakage of lamp chimneys and headlights.

Bemis Standard Cable Truck.

The engraving of the Bemis Car Box Company's truck, on this page, shows that company's standard motor truck, as adapted for cable



BEMIS TRUCK FOR CABLE CARS.

Recent Work of a Large Car Company.

The American Car Company, of St. Louis, Mo., as mentioned in our last issue, is receiving orders for a large number of cars in its own city, as well as elsewhere. The order from the Union Depot system covers thirty twenty-five foot closed cars, fitted with plush covered, cane, cross seats. The interior finish of these cars will be elegant and elaborate, and they will be mounted on Sutton's maximum traction, double motor trucks. Captain McCulloch, general manager of the Citizens' Street Railway Company, of St. Louis, has also placed a recent order with the American Car Company. This calls for sixty twenty six foot closed cars, to be mounted on Sutton's maximum traction, double motor trucks. These cars are to be very handsome, both in design and finish. The attractive cars recently built by this company for the Missouri Railroad Company assisted very materially in deciding where the order should be placed.

THE Quincy & Boston (Mass.), Street Railway is to be extended from West Quincy to East Milton.

work. 180 of these trucks have been adopted by the Third Avenue Railroad Company, of New York, for use under its twenty-two foot box cars.

The truck is equipped with the Bemis cushioned wheel brake, and the drum brake as used by the Third Avenue Railroad Company. It carries the grip independent of the spring motion of the car, is easy riding, and in all respects a very satisfactory truck.

Recent orders for this truck, adapted for electric service, are from the Baltimore Traction Company, the Electric Traction Company, of Philadelphia; Hestonville, Mantua & Fairmount Passenger Railroad Company, of Philadelphia; Fair Haven & Westville Railroad Company; New Haven Street Railway Company; Norfolk Suburban Street Railway Company; Calais & St. Stevens Street Railway Company; Skowhegan & Norridgewock Street Railway Company; Marlboro Street Railway Company; Gardner Street Railway Company; Lowell & Suburban Street Railway Company; Union Street Railway Company, New Bedford, and at other points. The Bemis Company has also just completed an order for 450 for the Philadelphia Traction Company, and owing to other large orders has now about three months' work ahead.

Flexible Pole Brackets.

We illustrated in a recent issue the Creaghead single, flexible bracket for wooden poles. The results secured by this bracket in practice,

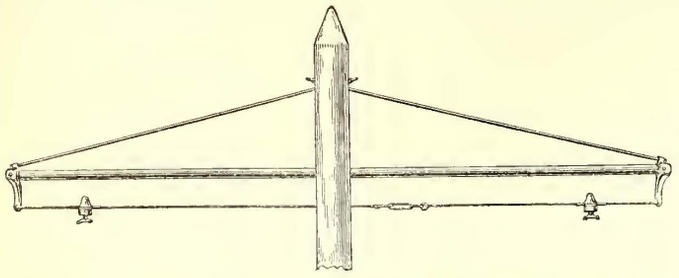


FIG. 1.—DOUBLE FLEXIBLE BRACKET FOR WOODEN POLES.

especially on high speed suburban and interurban lines, have been so satisfactory that we present views of other standard types brought out by this company. Fig. 1 illustrates the double bracket for wooden poles; Fig. 2 the single insulated, flexible bracket for iron poles, and Fig. 3 the double insulated, flexible bracket for iron poles.

The Creaghead Engineering Company has designed a number of special forms in which its patented flexible device is used, but the three forms herewith illustrated are designed for the standard single and double track work for use with wood or iron poles. The single and double flexible brackets for iron poles are insulated from the iron poles, thereby giving double insulation between trolley wire and pole. Figs. 2 and 3 show clearly the insulated turnbuckle in the top guy rod, the hard wood, corrugated plug in the horizontal arm and the insulated bushing in the

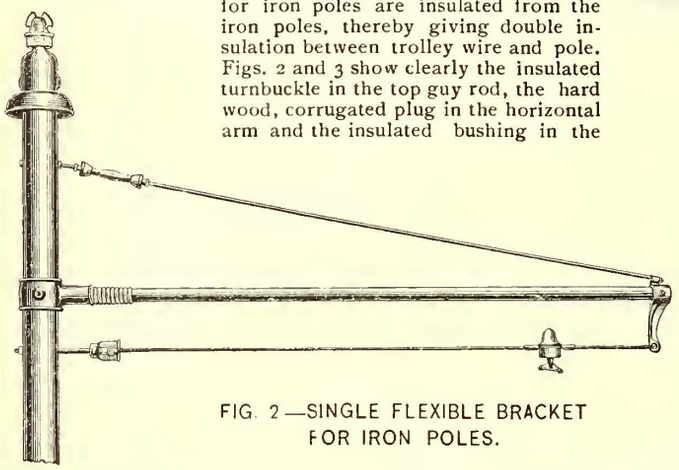


FIG. 2—SINGLE FLEXIBLE BRACKET FOR IRON POLES.

pole through which the flexible span wire passes. The Creaghead Engineering Company has recently equipped throughout, the Cincinnati & South Covington Street Railway Company's Evergreen line, with a large number of double brackets for wood poles with special ornamental curve brace on each side of the pole under the arm. The Rutland Street Railway Company, of Rutland, Vt., has also recently placed an order for several hundred of Creaghead brackets for its new lines, and a large number of orders for standard brackets have been received and filled by the Creaghead Engineering Company, besides the above mentioned orders for special brackets.

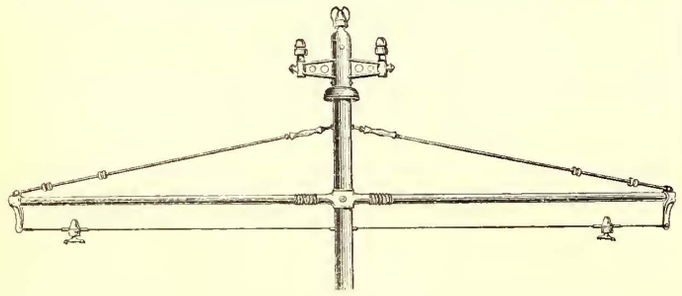


FIG. 3.—DOUBLE FLEXIBLE BRACKET FOR IRON POLES.

By use of this flexible bracket the "hammering" and sudden jars peculiar to stiff forms of brackets are avoided, the first cost of construction is greatly reduced and cost of maintenance brought down to correspond with ordinary span wire construction.

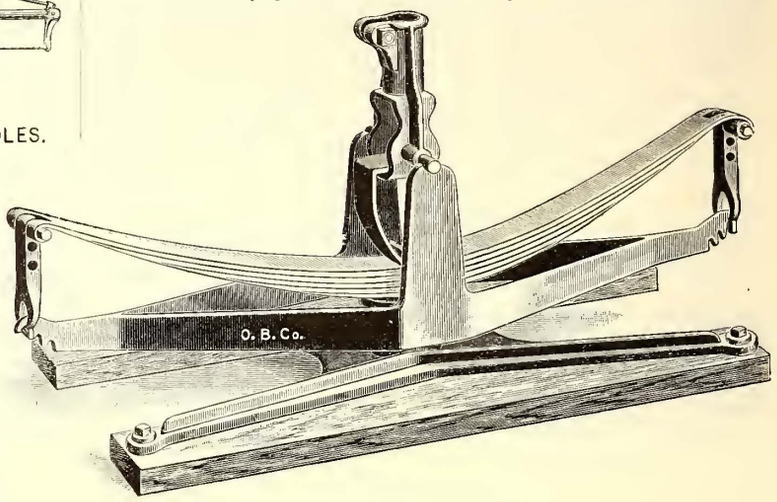
Handsome Vestibuled Cars.

An excellent opportunity is offered by one of our advertisers for a street railway company to secure a small equipment of substantially built and well finished cars. These cars were built by the J. W. Fowler Car Company, and owing to the financial embarrassment on the part of the road for which they were built, the cars were never delivered. They are described in detail elsewhere in our columns this month, together with an illustration of one of the four cars, all of which are handsomely finished and beautifully decorated.

The Ohio Trolley.

The Ohio trolley, manufactured by the Ohio Brass Company, of Mansfield, O., is shown herewith, and is claimed to be very simple and most effective. It is made up of less than a dozen pieces, any of which can be easily duplicated. The spring is the regular flat leaf style, such as any manufacturer of carriage springs keeps in stock. The working parts of the trolley are made of steel and malleable and wrought iron, and in consequence are not easily broken, and do not get out of repair.

The base and stand are three feet long and eight inches wide, and when the trolley pole is in a horizontal position but thirteen inches



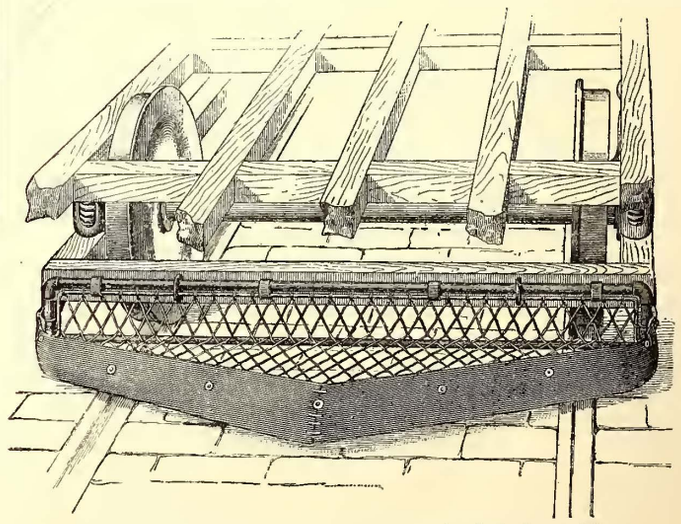
THE OHIO TROLLEY BASE.

high. The trolley pole can be swung either forward or backward or in a complete circle, and the pressure against the trolley diminishes as the pole assumes more nearly a horizontal position. The trolley can be assembled or dismantled in a few minutes' time, without the aid of tools. It is very easy and flexible in action, and will follow the variations of the trolley wire quickly and surely.

In fitting these trolleys out complete the Ohio Brass Company uses its special carbonized steel trolley pole. This pole is drawn cold through a die and is made of the best Norway iron. It is then carbonized to a proper degree to give it sufficient elasticity. It is seamless and endless, and formed to a perfect taper. The claim made on this pole is that it is lighter, more flexible and stronger than the regular style trolley pole. It will not break, and if bent out of shape can be straightened cold without injury. This pole is one of the specialties of the Ohio Brass Company.

Recent Orders of the Sterling Supply & Manufacturing Company.

The Sterling Supply & Manufacturing Company, of New York, reports an excellent business. During the first three weeks in August the company booked orders for several hundred registers. Among these



FENDER USED ON THE BROADWAY CABLE ROAD.

may be mentioned thirty registers for the Columbus Avenue division of the Broadway cable system, a large order from the New Orleans Traction Company, which will amount to about 150 machines; the Consolidated Traction Company, of New Jersey, 100 machines additional; the Yonkers Railroad Company equipment; the Lake Cities Railroad Company, of Michigan City, Ind.; the Geneva & Waterloo Railroad

Company, of Geneva, N. Y.; the Nassau Electric Railway Company, of Brooklyn, for its entire equipment; the Terre Haute Railway system and the Middletown-Goshen Railway Company.

This company has also just been awarded the contract for sixty sand box equipments by the Nassau Electric Railway Company of Brooklyn, and report a large business in this department.

The car fender of the company has been adopted by the Metropolitan Street Railway Company, of New York, and the Third Avenue Railway Company, of the same city, is also using the device. It is designed to be carried as close to the track as possible, and its shape is such as to practically preclude the possibility of any person getting under the wheels. It is made of wrought iron pipe, malleable iron fittings, woven wire and rubber belting. We present a view of the fender on page 586.

The managers of the company seem to find business in a very satisfactory condition, and believe that the best evidence of the merit of their goods is the additional orders which they are receiving for them.

Report of the North Metropolitan Tramways Company.

The annual report of the North Metropolitan Tramways Company of London, England, for the year ending June 30, 1894, was submitted to the stockholders at a meeting held August 10. It shows gross receipts of £227,709 12*s* 8*d*; expenditures, £182,166 5*s* 2*d*. A dividend of 8 per cent. was declared.

Owing to the leading position taken by the company among tramway companies in London some of the facts given in the report will be of especial interest to American readers as giving an idea of the average receipts: Average number of cars running, 324.88; mileage, 49; miles run, 4,177,696; passengers carried, 41,608,498; average receipts per passenger, 2.56 cents; average receipts per mile run, 25.42 cents; percentage of total working and general expenses as compared with total receipts, 79.90.

To better compare the cost of operation, we give below a statement of the provender required for the half year ending June 30, with the prices paid: Maize, 9,857¾ qrs. @ $4.57; oats, 7,296¾ qrs. @ $4.00; beans, 44¼ qrs. @ $8.16; bran, 1,492 cwts. @ $1.19; peas, 5,285 qrs. @ $6.17; barley, 6,580½ qrs. @ $3.24: hay, 2,988½ loads @ $24.54; straw, 1,134 loads @ $12.32.

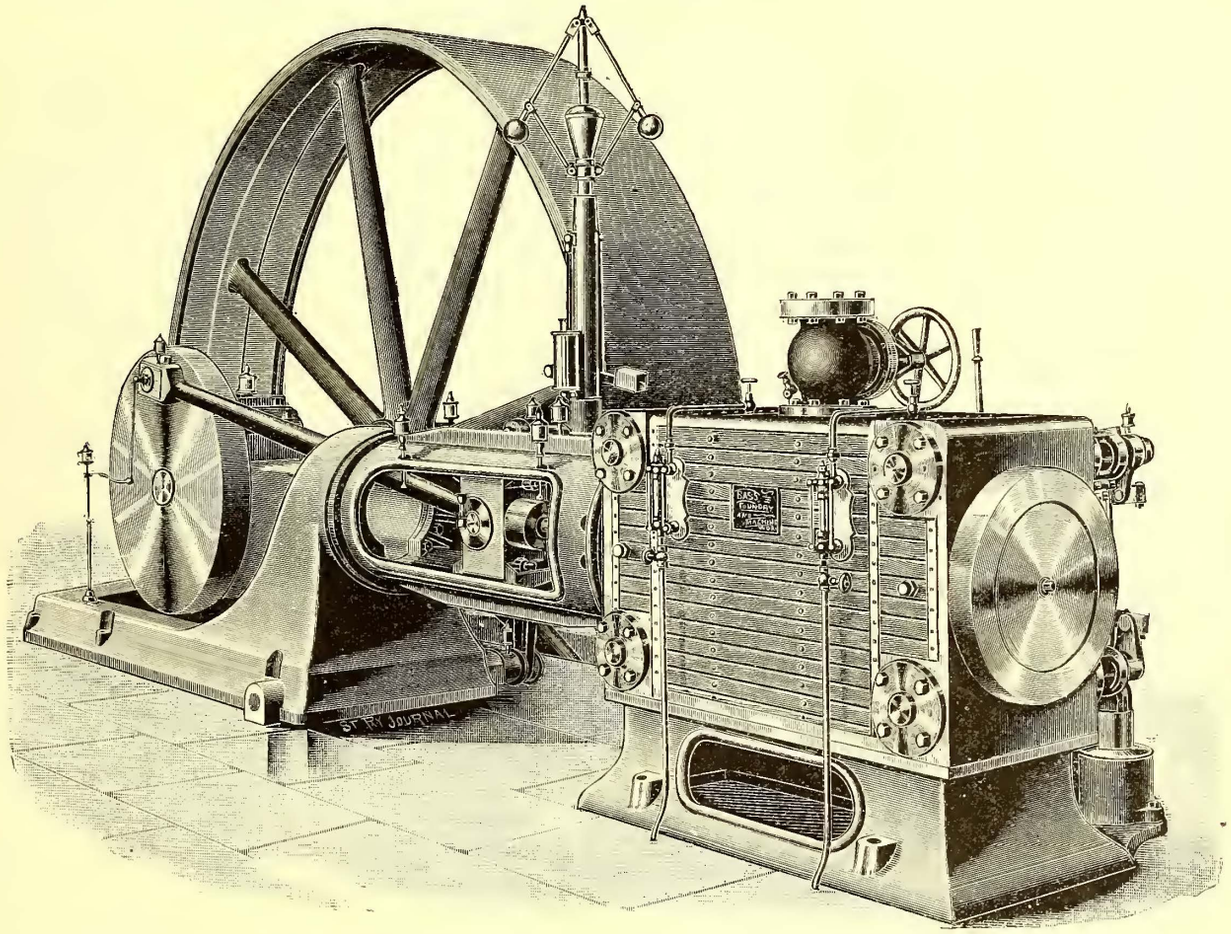
THE Gloucester & Rockport Street Railway Company, Gloucester, Mass., with a capital of $40,000, has been formed to construct a street railway from this city across Good Harbor Beach to Brier Neck, to the line dividing Gloucester from Rockport. The board of directors are D. S. Presson, A. B. Hallowell, F. W. Homans and D. A. White, of Gloucester; W. B. Fergusen, of Malden; A. D. Bosson and J. A. Cunningham, of Chelsea.

A Corliss Engine for Street Railway Work.

The accompanying engraving illustrates a new Corliss engine recently placed on the market by the Bass Foundry & Machine Works of Fort Wayne, Ind. This engine was designed especially for street railway and electrical work and is built to withstand sudden and severe strains.

The general appearance of the engine is shown in the engraving. The cylinders are eighteen inches in diameter with forty-two inches stroke. One of the new and important features is the large ports, they being twenty and three-quarters inches long. The improved valve gear for quickly opening the valve together with the large ports afford perfect steam distribution, there is very little loss in the initial pressure of the steam on entering the cylinder. The steam and exhaust valves are accurately ground on dead centers and the valve gear has a minimum number of parts and is easy of accesss. The governor is of the well known Porter type and is accurately made and highly finished throughout and thoroughly tested.

The construction of the cylinder base and that of the main bearings are such as to give an extra large bearing surface on the foundation. The girder is that portion of the engine bed between crosshead guides, and the pillow block is of very heavy design giving great strength and preventing any torsional strains. The bearings are exceptionally large, the main journal being of a length equal to twice its diameter.



CORLISS ENGINE—BASS FOUNDRY & MACHINE WORKS.

The boxes are adjusted for taking up wear, by means of set screws, and a steel plate is placed between the set screws and the box to receive the thrust of the screws.

The company has recently commenced the manufacture of a special type of engines which embraces all the essential features of the Corliss engine with improved valve gears which admits of a much higher rotative speed than is possible with the ordinary valve gear.

This engine was designed to meet the requirements where space is limited and a high degree of ecomony is necessary. Among the recent orders received by this company are two 30 × 60 in. rolling mill engines for the Newcastle Steel & Fire Plate Company of Newcastle and 36 × 70 × 60 in. tandem engine, with flywheel thirty feet in diameter and seventy eight face turned for rope drive. In addition to these an order has just been received through the New York office for two cross compound engines for the Williams & Clark Fertilizer Company, of Carteret, N. J.

The Bass Foundry & Machine Works has acquired high reputations for condensers, feedwater heaters, engines and boilers.

The Eastern interests of the company are ably represented by H. Ruel Baldwin who has an office in Cortland Street, New York.

WORK on the new electric railway connecting Phillipsburg, (Pa.) Osceola, Houtzdale, Morrisdale, Munson and other neighboring towns and villages has been begun.

New Trolley Head.

We illustrate herewith a trolley harp and wheel which has been recently put on the market. It has been designed after a most careful study of the conditions which this important element of the car equipment has to meet, and, it is claimed, has special advantages.

It is made of the best malleable iron, and also of the highest grade bronze, with steel flange. The crescent section of the side bars adds strength to lightness, and affords a rounded surface which will not catch or dent the trolley wire. They are shaped to give ample room for the edges of the wheel and perfect protection to the contact springs. The pin is fastened by an improved method, giving a large bearing and avoiding sharp corners. The metal is so distributed in the body that the wheel may be entirely worn out; and the wire can never be worn by coming in contact with the harp—an important point.

The wheel is designed to give a greater amount of service than any yet produced. The desired result is obtained by using the highest grade of bearing bronze, and in the proper distribution of the metal. Many of these wheels are still in service after making the excellent record of 10,000 miles, and their merit has been established on some of the leading electric railways in the country. The wheel is one of the the specialties of the Hubley Manufacturing Company, of Lancaster, Pa., which manufactures complete equipments for electric railway and lighting plants. This company is at present doubling the capacity of its works to accommodate the enormous increase in the demand for its apparatus.

NEW TROLLEY HEAD.

Direct Connected Engine and Generator.

The new Mather generator was illustrated and its important features described in our last issue. We present herewith a view of an improved Mather 100 K. W., direct connected generator and 150 H. P. Ideal engine. The construction of the generator is claimed to be such as to make it particularly adapted to direct connection. The electrical design lends itself very readily to the best mechanical construction, and full advantage of this fact has been taken, the result being a machine perfect in its mechanical details.

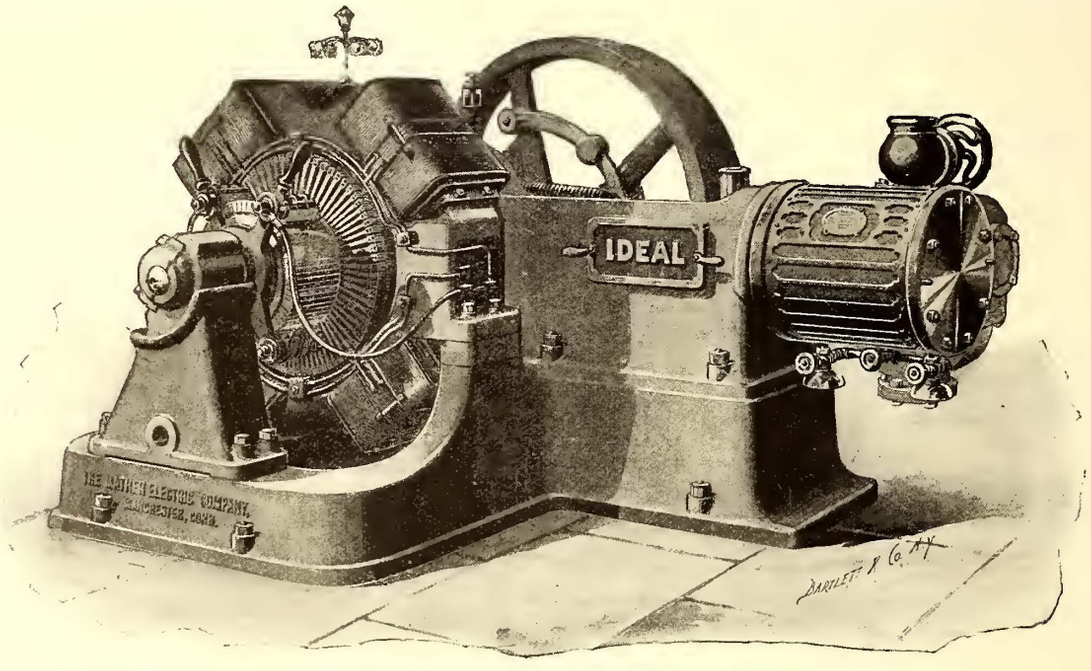
One peculiar advantage of this type of generator over others is that on account of the fields being cast in four pieces, and entirely separate from the frame, all being bolted together, the assembling or taking apart of the generator, or the removal of the armature, is accomplished in an exceedingly short time and with the greatest ease.

They are designed to be directly connected to any first class type of engine adapted for this work, and are exceedingly compact. They are self oiling, self exciting, perfectly self regulating, and after being started, completely self attendant. They are compound wound and manufactured to be equally well adapted for electric lighting, electric railway, or power purposes.

A common difficulty with a generator is sparking at the brushes, which is usually caused by the points of commutation shifting with the variations in the load. It has been the aim of the Mather Company to overcome this difficulty, and that it has been done is proved by the fact that after the brushes have once been adjusted, further change in their position is not necessary, no matter how sudden or how great may be the variations in the amount of current supplied by the generator. One of the tests to which the generators are subjected at the factory is to throw on and off heavy loads, always leaving the brushes in the same position. No sparking, it is said, is caused even by a current in excess of the rated capacity of the machine, and it is impossible to distinguish by watching the brushes whether the generator is loaded or not. All these generators can be operated for an indefinite period at their full rated capacity without any undue or dangerous heating of any of the parts.

One great advantage of these generators is that on account of the field and armature being practically identical with those of the company's standard multipolar generators, it has been able to design testing frames, upon which before shipping, every generator can be set up and run under conditions similar to those it is intended to meet in actual practice, and no machine is allowed to leave the factory unless meeting all requirements as to its mechanical and electrical perfection.

Four or more sets of brushes, as may be required, according to the conditions, are used. Each is held in an independent holder; hence any single brush can be raised from the commutator without disturbing the others, and each, having its own spring, may be perfectly adjusted. The diametrically opposite brushes are of the same polarity and are connected. The rocker arm of the brush holder is of rigid construction, and the different parts are perfectly insulated; it is designed so that it will adjust all the brushes simultaneously.



DIRECTED CONNECTED ENGINE AND GENERATOR.

The Siemens & Halske Company Ready for Work.

On August 1, there occurred in Chicago a disastrous fire which destroyed the plants of the Siemens & Halske Company, the Wells-French Car Company and other important plants. Fortunately the most important plans and patterns of the Siemens & Halske Company were saved, and immediately after the fire the directors voted to resume manufacturing as soon as possible. The results of the fire will be quite important. The Siemens & Halske Company and the Wells-French Company have made an arrangement together with the revived Grant Locomotive Works of Cicero, near Chicago, to be combined in a new corporation to be known as the Siemens Company, with a capital of $2,000,000. Operations will be begun at once at the old Grant Locomotive Works. Motors, railway cars and all kinds of electrical devices will be manufactured. Every separate product of each of the three old companies will be turned out by the new company, and it is predicted that the new concern will develop into one of the largest manufacturing corporations in the world. It is probable that the new company will engage between 1,000 and 2,000 men, and over 600 will be put to work immediately, while an investment of several thousand dollars will be made in enlarging the Grant Works. The company promises to deliver electrical apparatus within sixty days.

Among the first orders which the company will complete will be the dynamos for the West Chicago Street Railway Company and the Garden City Street Railway Company, which will supply power for the electric cars of the West and North Side Yerkes' system in Chicago.

The West Side station is to be located at the corner of Washington Boulevard and Western Avenue, where the repair shops and stables are located. The Siemens & Halske Company will build three 2,000 H. P. and one 1,000 H. P. generators for immediate use, but the ultimate capacity of this central plant will require five dynamos of 2,000 H. P. each and one of 1,000 H. P.

A CORPORATION to be known as the Milton & Boston Street Railway is being formed in Milton, Mass., with a capital stock of $50,000. The company will build an electric street railway from East Milton to Mattapan, a distance of about four miles, and connect with the Dedham Street Railway at Mattapan. A preliminary organization has been made with A. A. Brackett, J. R. Lawrence, D. J. Brown, W. H. Rice, of Milton; J. A. Duggan, T. H. McDonnell and W. P. Pinel, of Quincy, as directors.

A New System of Transportation.

We show on this page a new type of electric car, the invention of Charles H. Barrows, of Willimantic. Conn., who is also the inventor of the Barrows' elevated and surface railway system now being constructed in Baltimore County, Md., by the Randallstown, Granite & Harrisonville Rapid Transit Company. The car embodies some new and valuable features which will be of interest.

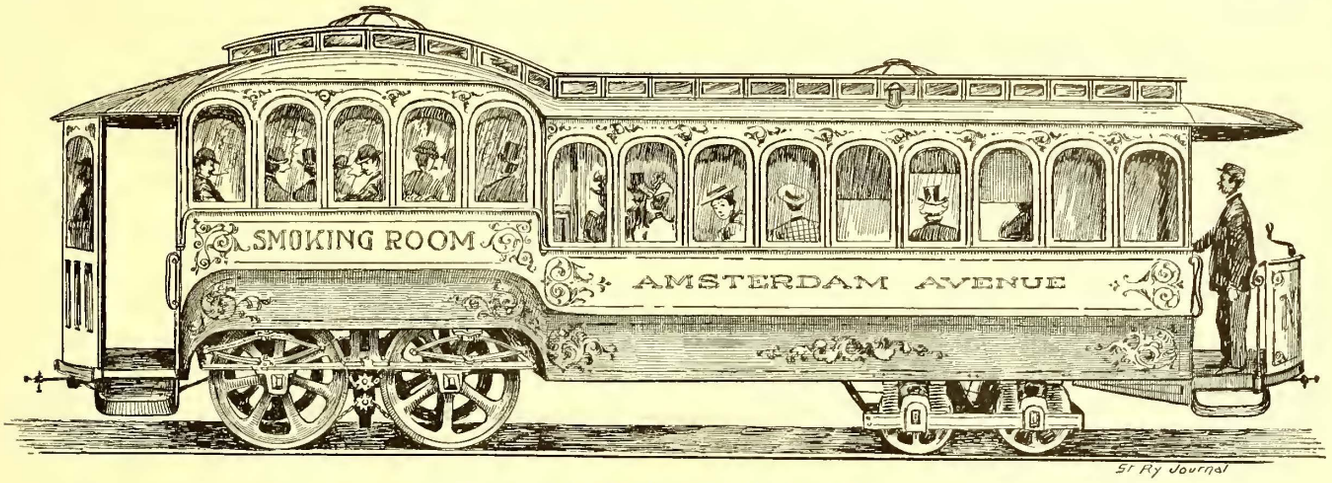


FIG. 1.—THE BARROWS ELECTRIC CAR.

Fig. 1, gives a perspective view of a double truck car, thirty-two feet over all. These cars can be built, of course, in any length with either double trucks or single trucks, and can be run as motor cars or in trains. The motor is directly connected with all four driving wheels, and as 75 per cent. of the total weight is on these wheels there is ample tractive force to haul a heavy load.

The truck, as will be seen from Figs, 2 and 3, is of novel and ingenious design. The single motor is fixed in the center of the truck, and elastically supported by hangers and bars from the sides and ends of the truck frame, having no contact or connection with the axles which are entirely free from any friction, except at the boxes, where they are journaled in anti-friction bearings. The motors for these cars are built for high speed, and the higher the better, for the greater the number of revolutions the greater will be the leverage for a given speed of the car, and with this sprocket chain driving mechanism, with a sufficient speed of the motor the diameter of the driving pinions might be reduced to simply a couple of spurs on the armature shaft.

Each end of the armature shaft of the motor is provided with one or more small spur driving pinions which engage with the one or more sprocket driving chains which encircle the driving drums of the driving wheels. Each driving drum is provided with a groove in which is seated a yielding or elastic filling, which furnishes a soft bearing for the chains and increases the frictional contact between the chains and the drums. The sprocket chains are endless and completely encircle the driving drums of the driving wheels, and are in like engagement with the driving pinions on the armature shaft of the one motor. The proper tension of the chains is created and maintained by means of adjustable idle pulleys under the chains and over which the chains run, as may be seen in the cut.

The application of the power of the motor to the propulsion of the car is by a direct pull on a line from near the periphery of the driving wheels to very near the center of the armature shaft, and may be likened to the act of pulling on a rope hand over hand with the rope

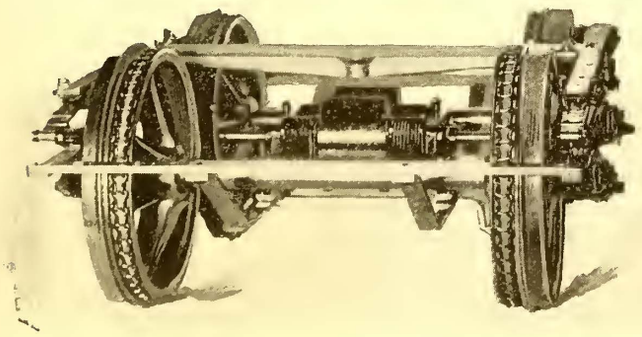


FIG. 2.—END VIEW—BARROWS ELECTRIC TRUCK.

around the circumference of the wheel to be turned. In this manner the power of a fast speed motor is utilized, a point of considerable advantage, as the weight of the motor can be greatly reduced.

The car is supported at points very near the truck axles, the wheel base being so short, four feet or less. The absence of gearing and all the heavy parts of the usual equipments obviates the necessity of heavy truck work, and reduces the dead weight of iron to a minimum.

The car body is of the lightest possible structure consistent with the necessary strength to sustain the load. The short wheel base creates very little friction on curves. The central situation of the motor admits of its being enclosed in a light dustproof and watertight case. The compartment for smokers is a feature that will be very popular with the public. The general contour of the car is pleasing to the eye. Its outlines are graceful and its furnishings of the latest improved styles. It is claimed that there will be no end teetering or jolting when starting, an account of the long leverage available, and it may be put into full speed from a dead stop almost immediately. The body is low and of easy access, and the entire car has an attractive and business like appearance.

The Chicago General Street Railway Company's Car House Competition.

The Chicago General Street Railway Company, whose offer inviting drawings and specifications of a model plant for the use of forty cars, was published in the STREET RAILWAY JOURNAL, has awarded the prizes in its competition. The first prize of $100 was awarded to J. R. Cravath, electrical editor of the *Street Railway Review*; the second prize of $75 to Caywood & Ritter, contracting engineers, Chicago; third prize of $50 to A. S. Krotz, an engineer of Springfield, O.; fourth prize of $25 to E. W. Goss, superintendent of the Amesbury Electric Light, Heat & Power Company, Amesbury, Mass.

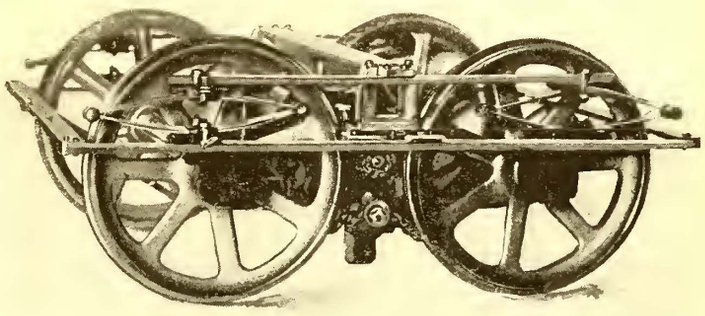


FIG. 3.—SIDE VIEW—BARROWS ELECTRIC TRUCK.

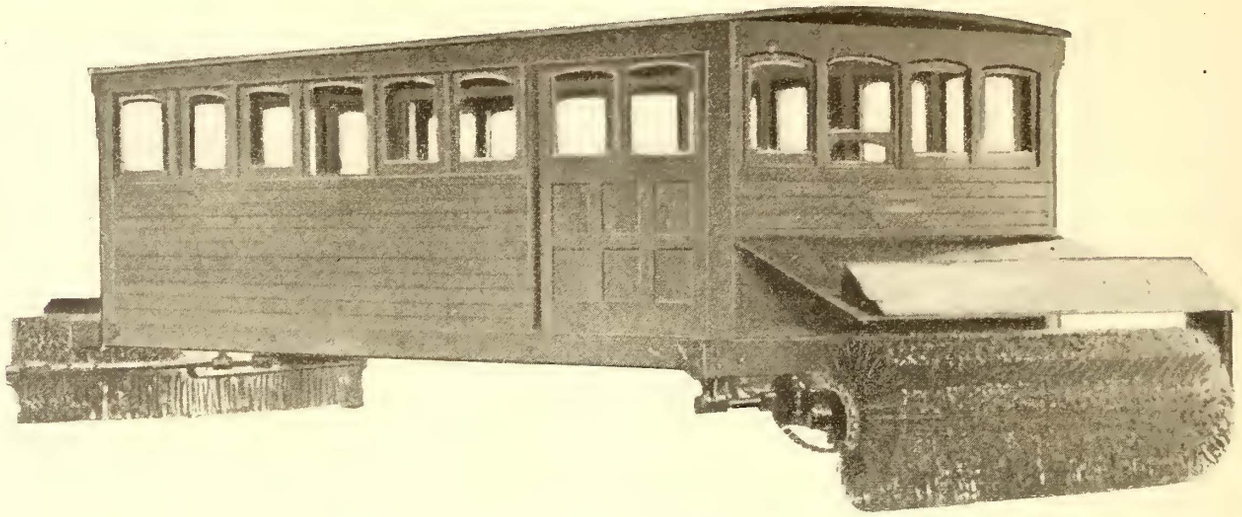
None of the plans selected will be used in full, but ideas will be adopted from each. The site selected for the new power plant is a four acre lot corner of Kedzie Avenue and 31st Street. It is expected that a car shed 125 × 300 ft., engine room 100 × 100 ft. and boiler room 100 × 60 ft. will be constructed this fall, the other buildings to follow as rapidly as the work will permit. The operation of the present lines will be under the management of the president, Congressman McCann, and the superintendent, W. F. Brennan, while C. L. Bonney, vice-president, will have charge of the construction of the new lines and power plant.

Extensive Contract at Lancaster, Pa.

The Lancaster Railway Construction Company, has been awarded a contract by the Pennsylvania Traction Company, for building forty-three miles of electric railway in Lancaster County. The lines will run from Lancaster to Manheim, Lancaster to Mechanicsburg, New Holland, Blue Ball and Terre Hill, with an eight mile branch from Mechanicsburg to Ephrata. The specifications call for Pennsylvania Railroad standard construction, including switch and signal system. The overhead construction, and all equipment will be of the highest grade, and must be completed, ready for service, within ninety days. The Lancaster Railway Construction Company is a chartered corporation with the following officers: Henry Baumgardner, president; Michael Reilly, vice-president; F. H, Steacy, secretary; J. E. Hubley, treasurer; H. E. Crilly, superintendent of construction.

A New Type of Electric Railway Sweeper.

We present herewith an engraving of a new electric sweeper for street railways built by the Brooklyn Railway Supply Company, of Stamford, Conn. The sweeper possesses a number of very novel features, which, it is claimed, will add greatly to its practical usefulness, and we have no doubt that the sweeper will make an excellent record during this winter.



ELECTRIC RAILWAY SWEEPER—WITH ADJUSTABLE BROOMS.

One striking feature of the sweeper is that the forward end of the cab, instead of being at right angles with the sides, as in an ordinary car, is inclined to the sides at the same angle as the revolving broom, *i. e.*, about 45 degs. There are a number of advantages gained by this construction. The brooms are brought entirely out from under the car, and they can be raised and lowered as desired. They can also be very easily inspected by the operator from the car window. Another advantage gained by this arrangement is ease in attaching and detaching the broom, the brackets holding the main shaft to the sweeper being bolted directly to the frame.

Another advantage of the sweeper is that, owing to the removal of the revolving brush from under the car body, the cab can be placed as low or as high above the track as desired. In other words, the cab does not require a special truck, but can be mounted on any truck owned by the railway company, saving in this way an entire electric equipment. The connection between the revolving brush and main shafts is made by an intermediate sprocket, which affords perfect freedom to the brooms while being raised or lowered. The main shaft is driven by a sprocket chain from a motor carried in the cab. Access is provided by a door at the side, as shown in the engraving.

The Falkeneau Engineering Company has just been organized in Philadelphia, as consulting and constructing mechanical and electrical engineers. The company is composed of Messrs. Keller, Willyoung and Pike, all formerly connected with Queen & Company, and Mr. Falkeneau, a well known Philadelphia engineer.

A New Car Fender.

The fender shown in the accompanying engravings on this page was invented by Oswald W. Routh, of Greenville, N. J. The engravings show the fender attached to a car of the Newark (N. J.) & South Orange Electric Railway.

Fig. 1 shows the fender ready for operation. As will be seen, there is a curved pick-up in front of the car, provided at its outer end with a roller, so that it will not dig into the ground even when the car enters upon a steep grade. Fig. 2 shows the fender just after a person has been picked up.

The most important claim made for the invention is in the use of the auxiliary screen carried just behind the main pick-up, making it practically impossible for a person who is struck to be crushed by the wheels. If by any accident, the person struck should fall forward on the track, so that the front screen would pass over him, the auxiliary screen or fender, which is three feet in the rear and which works automatically, would drop down and push him off the track. This is an important point in favor of the device.

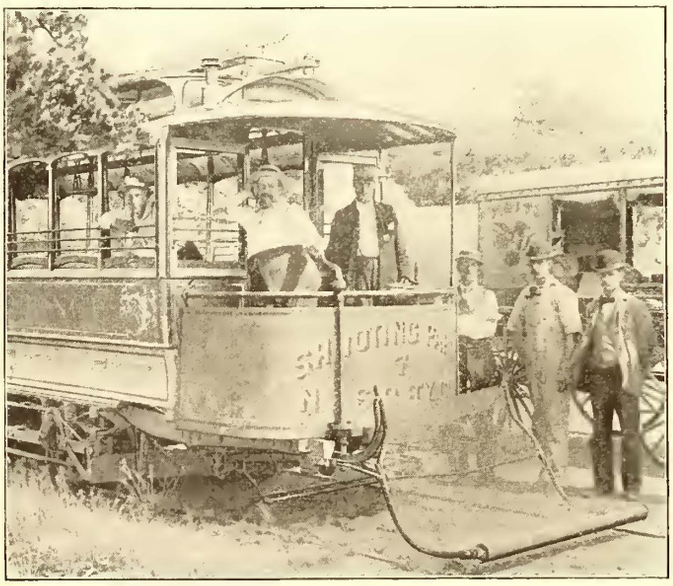


FIG 1.—FENDER READY FOR USE.

FIG. 2.—FENDER IN OPERATION.

The International Register Company of Chicago, seems to have no difficulty in securing a constant supply of orders for registers. The machine of this company has achieved such a wide reputation that it is regarded as indispensable by many leading street railway managers. One of the notable contracts received by this company recently was from the Kansas City Cable Railway, of Kansas City, Mo., for 100 portable machines for equipping the Grand Avenue division of the Consolidated system. The lines of some of the divisions of the Kansas City Railway have been long users of registers, and have given them a thorough test, so that the adoption of the International type after such a trial means a strong endorsement for the machine. The International register is becoming recognized more and more every day as a standard, high grade register, and the record made by it is one which reflects great credit on the manufacturers.

The New York Wood Vulcanizing Company and Its Process for Preserving Ties, Poles, Cross-arms, etc.

The extensive works where this company carries on its process of vulcanizing wood for the purpose of preserving and strengthening it, are located at 155th Street, and the Harlem River, New York City, where they occupy a plot of ground 600 × 250 ft. with a water frontage of 250 ft. There are excellent dock facilites with sufficient depth of water for large lumber schooners. An exterior view of the works is shown in one of the accompanying illustrations.

The main building is of brick 125 × 152 ft. The boiler room is 30 × 125 ft., and contains two Campbell & Zell water tube boilers of 150 H. P. each. In this room are also the heating and cooling tanks, circulating engines and air compressors. There are two "straight line" compressors built by the Ingersoll Sergent Company. The steam cylinders are thirty inches in diameter and the air cylinders twenty inches with a thirty inch stroke. The heating and cooling tanks are each twelve feet long by forty inches in diameter. Steam from the boiler is superheated and passes through tubes in the air heating tank from which the air is forced to the vulcanizing tanks and is kept in motion by the circulating engine.

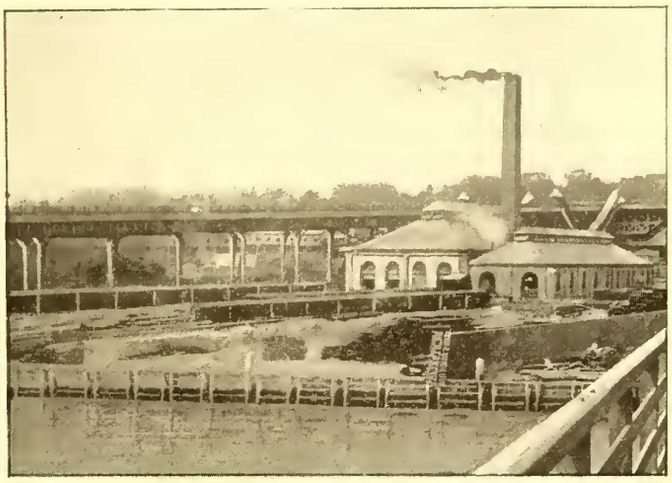
Adjoining the engine room is the vulcanizing room where there are four vulcanizing tanks of three-quarter inch steel each 103 ft. long and six feet six inches in diameter with a capacity of 18,000 ft. of lumber each. Inside of these huge tanks, the end doors of which are shown in one of our illustrations, are placed suitable tracks on which the cars, loaded with lumber are run. These cars are of iron 8 × 3 ft. and trains are operated by a hoisting engine and steel cables. There is a transfer table which will shift cars to sixteen different tracks running to the wharves, so that excellent facilities are afforded for handling large orders.

In the process of vulcanizing the wood is heated in these closed cylinders from eight to twelve hours at a temperature ranging from 280 degs. to 400 degs. Fahrenheit and under a pressure of from 80 to 150 lbs. to the square inch. A circulation of superheated and dried compressed air removes the surface moisture and any water that does not take part in the reaction and combine with the woody constituents. Hence, wood or timber, in any condition, may be immediately treated. As the treatment penetrates to the heart of the timber, considerable time is required for cooling, which is, of course, done in the cylinder and under pressure. Timber is introduced and treated while upon the cars which run into the cylinder upon small tracks.

As vulcanizing changes the sap from the liquid to the solid or semi-solid state, does not char or make the wood brittle, saturates and seals up the pores of timber with solid matter instead of liquid soluble matter which nature provides, considerable strength and durability are added by vulcanizing, the wood being rendered more cohesive, harder and denser. The spike-holding quality is naturally much increased, and even after ten years' service railroad spikes seem to be as firmly imbedded as when just driven.

The life of vulcanized timber is not known; none of the timber or ties used in railway construction during the past ten years have been known to decay. Timber placed on the Manhattan elevated roads of New York City, as far back as 1883, shows no signs of decay, and is as sound and sweet as if fresh from the tree, while untreated timber laid at the same time has rotted away and has been replaced.

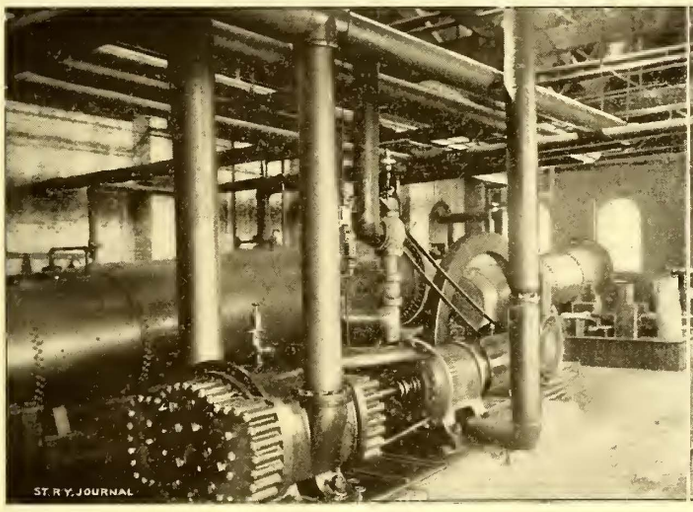
In 1883 about 1,000,000 ft. of lumber was treated for the Manhattan Elevated Railroad Company, with no charge for treatment, as a the test of the preservation from decay of vulcanized wood. This the company had in use six years before a comparative and critical examination was given it. The result of this investigation proved that while the average life of untreated wood was between five and six years, this treated wood, at the expiration of six years, showed no evidence of decay. From that time up to the present the Manhattan Company has used nothing but vulcanized lumber for ties, guard rails and slatting, and has had vulcanized since that date, nearly 20,000,000 ft. of lumber. From March, 1891, to March, 1893, the Manhattan Company had vulcanized 5,500,000 ft., and since March, 1893, about 4,500,000 ft. The timber that was first put in in June, 1883, is still in use and in perfect condition, and this fact is well attested by authoritative statements made by Colonel Hain, general manager of the Manhattan Company, and R. Black, superintendent of tracks.



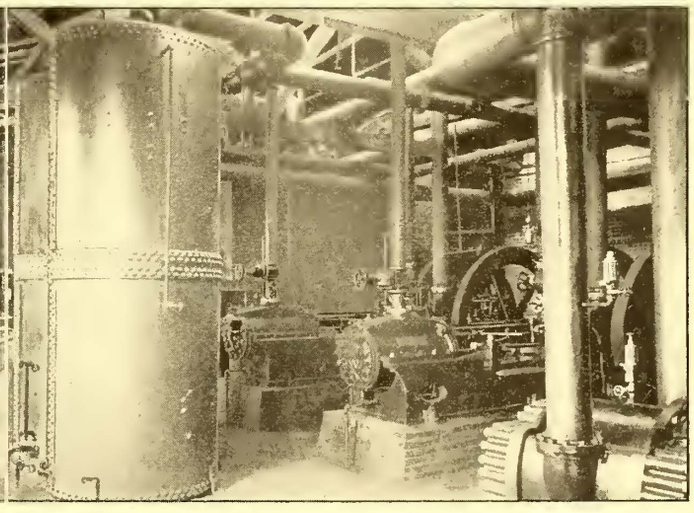
WORKS AND CARS LOADED FOR VULCANIZING.

In the fall of 1883 six yellow pine ties were laid in the switch-yard of the New York Central & Hudson River Railroad. In 1891 two of these ties were taken up for examination and found to be perfectly solid, the spikes having held as firmly as they were when first driven. In 1893 three of these ties were taken up and found to be in perfect condition. There was unusually severe wear on the ties in the switch-yard, and their life is ordinarily but three to four years.

In June, 1883, eighteen yellow pine ties were laid on the Newark branch of the New York, Lake Erie & Western Railroad near Bergen tunnel. At the same time, white oak, untreated ties were laid adjoining them. The latter have all been replaced once, and some of them twice. Twelve of these yellow pine ties are still in use in their original position and are as good and sound to-day as when first laid. One of the ties has been taken up by the railroad comoany for examination and found to be in good condition.



CIRCULATING ENGINE, HEATING AND COOLING TANKS



AIR COMPRESSORS

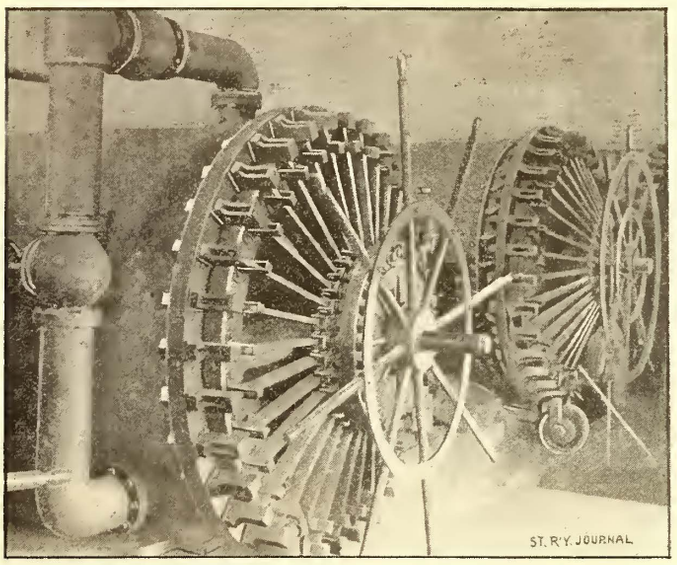
To the increased weight on single locomotive driving wheels within the past eight years—from 16,000 to 24,000 lbs. upon one road—is due 50 per cent. of the renewals. The other 50 per cent. is due to decay. Up to the time railroads commenced using this heavy equipment, the renewals were almost entirely due to decay. After the weight of locomotives was increased 50 per cent., an increased weight of rail was demanded, and this increased the rail base from four inches to five inches, overcoming the resistance about 25 per cent.

From tests made by Prof. Alfred Trautwein, the process of vulcanizing increases the compression strength of yellow pine 25 per cent. Therefore, it will be seen that by the increase of one inch of rail base and of 25 per cent. in strength by the process of vulcanizing, it brings the tie back to its original condition, when renewals were mainly due to decay.

This company has also sold quite a quantity of vulcanized yellow pine to the Edison Electric Illuminating Companies of New York and

Brooklyn for subway purposes, and to the Cleveland, O., and New England Telephone and Telegraph companies. About 500,000 ft. of cross-arms have also been vulcanized, among the purchasers of which are the Southern New England Telephone Company and the New York & New Jersey Telephone Company.

Besides these strong recommendations as to the value of vulcanizing, excellent results were obtained from tests made by Dr. R H. Thurston, Director of Sibley College, and by Prof. C. F. Chandler, of Columbia College, indicating its value when applied to the treating of cross-arms, poles and ties.



DOORS OF VULCANIZING TANKS.

The Demand for Emergency Wagons.

Owing to a constantly increasing business, the Gleason & Bailey Manufacturing Company, of New York, has found it necessary to greatly enlarge its already extensive works.

One of the specialties manufactured is a wrecking wagon for cable and electric street railways. These wagons are especially designed to meet the requirements of street railways, and are constructed through out with the same high class of workmanship and material that is required in the manufacture of fire department apparatus. The wagons are provided with end and side entrances. A central tool box with removable cover extending the full length furnishes seats for the crew. Arranged along the sides of the tool box are spring sockets for holding axes, picks and small crowbars. There are also lockers under the driver's seat and underneath the wagon body, filled with pulley blocks and tackle and all apparatus necessary to meet any emergency. The wheels are of the Sarven type with overlapping steel tires and open hubs. Bronze nuts are used and are fastened with steel cotter pins. The springs are of the best quality of steel and oil tempered.

Powerful self releasing brakes are provided, which can be operated from either side of the driver's seat. An alarm bell of the locomotive type is attached to the front of the wagon body and is operated by the driver's foot. In addition to the wrecking tools the wagons are provided with "needles" for building temporary bridges to support the hose over the car tracks.

In electric railway service strong and light extension ladders for repairing overhead wires are included in the equipment.

Important Purchase by the Fort Wayne Company.

The Fort Wayne Electric Corporation has purchased the factory, patterns, patents, etc., of the Wenstrom Electric Company of Baltimore, Md. The Wenstrom patents, it is claimed, cover some important points in dynamo and motor construction. It is said that the Fort Wayne Corporation will extend its business so as to include street railway work, and that the purchase of the Wenstrom plant is the first move in that direction.

Large Truck Order Awarded.

As our last form is on the press the announcement is made of the award of a large order of 120 trucks by the Chicago City Railway Company.

The type of truck selected is the Columbian, manufactured by the McGuire Manufacturing Company, of Chicago. This is the third order received by this company for trucks from the Chicago City Railway Company, a fact which speaks volumes for McGuire trucks.

Street Railway News.

New Roads.

Anderson, Ind.—The company proposing to connect several gas belt cities by electric railway has petitioned the Madison County Commissioners for right of way on thirty miles of pike road.

Annapolis, Md.—An electric railway is proposed to connect Annapolis with Bay Ridge. The incorporators so far agreed upon are Thomas C, Musgrove, Luther H. Gadd, George T. Melvin, James H. Vansant, Daniel J. Saunders and L. H. Rehn. The capital stock is placed at $20,000. The road will be entitled the Annapolis, Brighton Beach & Bay Ridge Electric Railway of Anne Arundel County.

Arundel, Md.—It is reported that certain citizens of Annapolis, in connection with Philadelphia capitalists, will build and equip an electric railway from Annapolis to Bay Ridge and Arundel-on-the-Bay. Thomas C. Musgrove, of Philadelphia, is said to be interested in the enterprise.

Braddock, Pa.—The Braddock Electric Street Railway Company has been granted the right of way over Talbot Avenue and Eighth Street. The company had the right of way over these streets three years ago, but allowed it to lapse.

Braintree, Mass.—The Board of Selectmen has granted a location for a street railway to the Braintree Street Railway Company.

Brooklyn, N. Y.—The Rockaway line of the Nassau Electric Company, to operate between Broadway and Jamaica Bay, is being rapidly pushed to completion.

Charleston, S. C.—Julian Fishburne and associates have petitioned for permission to build a trolley line through the main streets, the same to be completed in eighteen months.

Chicago, Ill.—The Northern Electric Railway Company has been granted a franchise by the city of Chicago, giving it the right to lay tracks from West 47th Street and Lake Street, north to Cragin Street, and west to Hansen Park. Paul Dickinson will be president, and will have charge of the purchase of all supplies for the new company. His address will be 68 Churchill Street, Chicago. The company is in the market for eight miles of track and all equipments, such as engines, generators, cars, trucks and line material.

An ordinance has been introduced in the County Board, providing for the granting of a franchise to the Morgan Park Electric Street Railway Company, for an electric line between West Pullman and Morgan Park.

C. E. Loss, 621 Pullman Building, Chicago, has secured a contract to build two miles of road and will buy all equipment outside of the power plant, which is already built. Mr. Loss is in the market for cars, trucks and overhead material for this line.

Cohoes, N. Y.—The Cohoes City Railway Company was incorporated lately with a capital of $50,000. The directors are Urban Weldon, Murry Hubbard, G. W. Lansing, George E. Simmons and others.

Columbus, O.—It is stated that a movement has been started here to build an electric railroad to Cincinnati. The County Commissioners have granted the right of way on certain conditions, one of which is that work is to begin on the road by December 1 next, and that it must be in operation by December, 1896. The following parties are interested: L. D. Hagerty, Columbus; Henry B. Moorehead and Dennis Dwyer, Cincinnati and O. B. Brown, Dayton.

The question of granting the Columbus & Buckeye Street Railway Company the right of way along the old National road between this city and Hebron, with a three mile branch along the shore of Buckeye Lake, came recently before the County Commissioners. The company has a capital stock of $100,000. The incorporators are James H. Anderson, C. B. Cowan. DeWittC. Jones T. J. Keating, George J. Converse, R. R. Dubois and William F. Simonton.

Doylestown, Pa.—The Bucks County Railway Company was incorporated August 3, with a capital stock of $100,000, to construct and operate an electric railway at Doylestown, Bucks County, Pa. Francis Fenimore, of St. Davids, Delaware County, Pa., is the president of the company. Other stockholders are Wm. Jenks Fell, 131 South 5th Street, Philadelphia, and Marshall S. Lynch, of Philadelphia.

Gaithersburg, Md.—The Chevy Chase & Kensington Rail way Company has been organized to construct an electric railway from the present terminus of the Rock Creek Railway to Kensington. The following are the officers: President, Oliver R. Harr; vice-president, Alfred Ray; secretary and treasurer, W. H. Walker.

Hammond, Ind.—A movement is on foot for the building of another electric line between this city and Chicago. The line will run through West Hammond, Burnham, and will connect with the Calumet electric line and 108th Street. Talford Burnham is one of the projectors.

Hanover, Mass.—The Selectmen have granted the petition of the directors of the Hanover Street Railway Company for a franchise to lay tracks from a point near the boundary line between Rockland and Hanover through Webster Street to the Norwell line, a distance of three miles.

Hartford, Conn.—The directors of the Hartford, Manchester & Rockville Tramway Company have authorized M. S. Chapman, the president of the company, to let the contract for building the line to Manchester.

Lockport, N. Y.—The Lockport City & Olcott Electric Railroad Company was incorporated August 18, to construct an electric railway about twenty miles in length from Lockport to the village of Olcott, on the south shore of Lake Ontario. The capital is $200,000, and among the directors are, William T. Holt, Noel Gale, George E. Dunscombe and F. Eugene Crasson, of New York City.

Marlboro, Mass.—At a special meeting of the Aldermen recently, the location of the proposed electric railroad between this city and Hudson was defined and the franchise for the road granted.

Milford, N. Y.—The Milford Town Council has granted the Delaware Valley Electric Railway the right of way through the borough.

New Bedford, Mass.—The question is being discussed among residents of Mattapoisett and Marion, of an electric railway to connect these towns with Fairhaven and thence to this city.

Pawtucket, R. I.—The petition of the Moshassuck Valley Railroad Company, for permission from the Town Council of Lincoln, to operate an electric railway line from Saylesville through Branch Avenue and the Smithfield Pike to the Pawtucket line, was lately presented to the Board of Aldermen. The Board also received a petition from the Pawtucket Street Railway Company covering the same district.

Philadelphia, Pa.—The Philadelphia, Cheltenham & Willow Grove Electric Railway Company has awarded the contract to build the line from Rising Sun to Jenkintown, over the York turnpike, to William Wharton, Jr., & Company. Work is to be completed through the borough of Jenkintown by November 1.

THE Aramingo Avenue Passenger Railway Company was incorporated August 6, with a capital stock of $12,000. Henry C. Moore, of 624 N. 22d Street, is the president of the company. Others interested are Henry M. DuBois and David C. Golden, of Philadelphia.

ON August 20 there was chartered the Chestnut Hill & Spring House Passenger Railway Company, of Philadelphia; capital $48,000. The incorporators are Henry C. Moore, David C. Golden, Joseph C. Lugar, Hyland C. Murphy, Robert C. Shelmerdine and Nelson Sailer.

Port Carbon, Pa.—The Tamaqua & Pottsville Electric Railway Company has filed a declaration of its intention to extend its main line from Port Carbon to St. Clair, and thence to New Castle and Frackville and down to Maizeville in the Mahanoy Valley.

Pottsville, Pa.—The Pottsville Traction Company was incorporated July 30, with a capital stock of $200,000, to construct and operate an electric railway at Pottsville. Wilbur F. Sadler, of Carlisle, is the president of the company; other stockholders are W. F. Sadler, Jr., and L. S. Sadler, of Carlisle.

S. B. EDWARDS, solicitor for the Pottsville, St. Clair & Minersville Railway Company, is reported to have declared that the company will be ready to commence the road immediately after the right of way has been granted. The road is to be ten miles in length, and has a capital of over $150,000.

Poughkeepsie, N. Y.—It is stated that the electric road between Poughkeepsie and Wappinger's Falls, which is approaching completion, is only one of a chain of electric railways connecting all the inland towns between New York and Albany, and that a road connecting Wappinger's Falls with Fishkill will next be constructed.

St. Paul, Minn.—The Assembly has extended for one year the franchise of the Fifth Ward Transfer Railway Company. The original franchise was given two years ago, and the company was to have completed fifty miles of road into St. Paul by August 1 of this year. The promoters are Mayor Smith, C. H. Petsch, M. D. Munn and others.

Sandusky, O.—The Sandusky Valley Electric Railroad Company, of Upper Sandusky, was incorporated July 31 by John O. Wirick, Frank Dunn R. R. Dunn, G. H. Reynolds and Thos. Carroll. The company will build an electric road from Marion through Upper Sandusky, Tiffin and Fremont to Fort Clinton. The capital stock is $10,000.

Taneytown, Md.—At a meeting held in this place recently a permanent organization was effected in the interests of the electric road which is projected from Baltimore to Gettysburg. A. H. Zollickoffer was elected president, and Martin Hess secretary.

Taylor, Pa.—The Scranton & Pittston Traction Company has been granted the right of way through the borough of Taylor.

West Chester, Pa.—The West Chester & Philadelphia Turnpike Company has procured a charter for an electric railway, and contemplates the construction of a trolley system from Philadelphia to West Chester via Newtown Square, with a branch line from the latter point to Paoli and various other points.

Westerly, R. I.—A meeting of citizens was recently held here to further the project of the Westerly & Jewett City Railroad, and the extension of the electric railway system through White Rock to Ashaway.

Westminster, Md.—At a meeting of the citizens of Westminster interested in the building of an electric railway between Union Mills and Reisterstown, Herbert T. Shriver, Chas. E. Stewart, John L. Reifsnider, Charles Gorsuch, George Albaugh, William B. Thomas, George W. Webb, E. J. Sawyer and Governor Brown were named as the incorporators of the Westminster & Union Mills Electric Railway Company. The capital stock was fixed at $250,000.

Worcester, Mass.—A new street railway corporation is being formed by Boston and Worcester capitalists to build a new line of electric road within the city limits. The capital is $100,000. It is understood that two of the leading spirits in the movement are G. F. Brooks, of Boston and Edw. Buxton, of Worcester.

The Acme Cable Grip.

The Hell Gate Machine Works of New York, Geo. Rothenbücher, proprietor, have designed and put on the market, a new cable grip entitled the Acme cable grip. This cable grip permits the crossing of all cable car tracks, without the attention of the motorman, thereby making it more safe, as no damage or accidents can occur at junctions or crossings through the negligence of the motorman. As soon as a car comes to a junction or a crossing of another cable car track, the grip opens automatically and, releasing its hold, passes the crossing or junction without the special attention of the motorman which is now necessary. It again takes hold when the crossing is passed. It can be attached to any regular cable car with little loss of time and expense. It is a very simply constructed affair, yet very strong and durable. The factory of the Hell Gate Machine Works, is at 304–306 East 95th Street.

New Publications.

The Twenty-seventh Annual Number of Poor's Manual of Railroads. Published by H. V. and H. W. Poor, 44 Broad Street, New York. Price $7.50.

"Poor's Manual of Railroads" has come to be recognized as an authority on the subjects upon which it treats, and we believe that the twenty-seventh annual report will be as popular, if not more so, among investors, as previous numbers. Data in regard to street railway corporations are included now in the manual, and the book contains some 300 pages more of reading matter than that of last year.

The Banker's Almanac and Register and Legal Directory for 1894. 663 pages, cloth. Price $4 or $7 per year. (July edition.) Published by the Homans Publishing Company, New York.

The July number of this valuable compilation, which is issued half yearly, has just been published, and contains the usual data corrected to date. This almanac and register is published under the supervision of the "Banker's Magazine," and covers the entire banking field, giving a list of the national, state and private bankers of the United States, with president, cashier, capital, etc., the banks and bankers of Canada and the principal cities of Europe, the savings banks, trust companies and safe deposit companies of the United States, and other allied information. The work has been published for forty-four years, and is properly regarded as the standard in the field which it covers.

Personal.

Mr. Albion E. Lang, of Toledo, O., sailed for Europe last month.

Mr. P. S. Bemis, Jr., is no longer Western representative of the Peckham Motor Truck & Wheel Company.

Mr. H. M. Littell, general manager of the New Orleans Traction Company, was in New York last month on a business trip.

Mr. E. S. Goodrich, president of the Hartford Street Railway Company, of Hartford, Conn., was in New York last month.

Mr. B. J. Jones has resigned his office of superintendent of the Riverside Park Railway and the Sioux City & Leeds Electric Railway.

Mr. T. H. McLean, general manager of the Citizens, Street Railway Company, of Indianapolis, was in New York for a short time during August.

Mr. John Brolles, assistant secretary of the Third Avenue Railway Company, New York, was united in marriage August 26, to Miss Jennie E. Jourdan.

Mr. F. A. Christensen, owner of the Christensen Air Brake Company patents has entered the employment of the Edward P. Allis Company, of Milwaukee.

Mr. F. H. Stanwood, of the Stanwood Manufacturing Company, of Chicago, was in New York last month, and visited the office of the STREET RAILWAY JOURNAL.

Mr. R. T. White, of Boston, well known by street railway men as the inventor and promoter of an elevated railway system of certain types of track specialties, died about the middle of August.

Mr. G. E. Pratt, was in New York last month. Mr. Pratt reports an increasing demand for the Jackson & Sharp cars especially in the New England States and Michigan, and that an order from any company is usually followed by a second order for cars.

Major H. C. Evans, the well known representative of the Johnson Company, in New York, met a sad bereavement last month in the death of his only child, John Evans, 2d, at the age of ten months. This death occurred at Lawrence Beach, L. I., and was caused by inflammatory rheumatism.

Messrs. R. T. Baker, president of the Columbia Railway Company, W. B. Upton, engineer of the Columbia Railway Company, and W. Y. Stephenson, president of the Metropolitan Railway Company, R. D. Weaver and O. C. Green, all of Washington, D. C., were in New York last month, and called at our office.

Mr. W. C. Wood, who is well known to street railway men throughout the country by his work in the design of special track work, has recently taken a position with the New York Frog & Switch

Works, at Hoboken, N. J. This company has added a street railway department of which Mr. Wood will be in charge.

Mr. W. E. Cooke, engineer and sales agent of the Peckham Motor Truck & Wheel Company, is now in charge of the Chicago office of that company in place of the former agent, Mr. P. S. Bemis, Jr., who recently resigned. Mr. Cooke is thoroughly acquainted with the mechanical as well as the commercial branch of the street railway business, and will undoubtedly meet with a cordial reception from the Western trade.

Mr. D. W. Sharpe, who resigned his position as superintendent of the Consolidated Traction Company, of New Jersey, last month, was tendered a complimentary by his friends and former associates, August 9. About 100 guests were present and before the close of the evening Mr. Sharpe was presented a handsome gold watch and chain. We understand that Mr. Sharpe will soon accept the management of another electric railway company.

Mr. Frank A. Rogers, who for the past twelve years has been connected with the Brush Electric Company and the Short Electric Company, of Cleveland, O., as special sales agent, has associated himself with the Fulton Truck & Foundry Company, of Mansfield, O., in the same capacity, with headquarters at Cleveland. Mr. Rogers has an extensive experience in the street railway and electrical business, and he is well known to street railway people.

Mr. W. Frank Carr, general manager and superintendent of the Roanoke Street Railway Company, resigned that position on August 10. Mr. Carr went to Roanoke in April, 1892, and since his connection with the company has changed the system from horse cars and steam to electricity. Mr. Carr was for a number of years connected with the St. Paul and Minneapolis system as chief engineer. He expects to return North during the fall or early spring.

Mr. H. J. Quigg, has recently been appointed general superintendent of the entire system of street railways in Jersey City, Newark, Elizabeth, Orange and adjacent cities, operated by the Consolidated Traction Company of New Jersey. Mr. Quigg has had long experience in railroading and is well qualified to fill the important and responsible position which he now holds.

Mr. Quigg is a native of New York City, and was born in January, 1857. He studied at the New York public schools where he was graduated in 1873, and in March of the following year entered the service of the Long Island Railroad Company, in its transportation department. Here he remained in continuous service for eighteen years, during the last four of which he had entire charge of this department with complete supervision of 325 miles of track, operating over 900 trains daily.

H. J. QUIGG.

In August, 1891, Mr. Quigg received a flattering offer from the New York, Lake Erie & Western Railroad Company which he accepted, that of superintendent of the Erie Terminal at Newburgh. Two years later, in May, 1893, he resigned this position to accept that of superintendent of the western division of the New York & New England Railroad. In this capacity he had entire supervision of the New England Railroad, from Springfield Mass., to Hartford, Conn., and from that city to Fishkill, N. Y., also the line from Waterbury to Cromwell, Conn. Mr. Quigg's record here was excellent, showing a decrease in operating expenses and accidents together with a noted improvement in freight and passenger service, as well as in the discipline and condition of the employees. He also introduced improved methods of handling the freight and passenger business, which met with special commendation, and the physical condition oft he road was improved in a marked degree.

He is a man of pleasing personality and combines the qualities of a good organizer and disciplinarian with those of popularity among his employes.

Obituary.

THOMAS M. SAYRE.

Thomas M. Sayre, for fourteen years superintendent of the Jersey City & Bergen system of street railroads, died July 28 of typhoid pneumonia. Mr. Sayre was born at Madison, N. J., fifty-five years ago, and entered the office of the Jersey City & Bergen Railroad Company thirty-one years ago as a clerk. At that time the company ran lines of stages. He later filled the office of paymaster before being appointed superintendent.

A Drawn Steel Trolley Pole.

The United States Projectile Company, of Brooklyn, N. Y., which is the manufacturer of the patent hot pressed motor pinion, which has met with such marked success, has, after much experimenting, perfected a decided improvement in trolley poles. The process is unique and original. The poles are made in the same way that the company makes its bicycle tubing, and of the same material. The pole is started from a solid block of steel, three and three-quarters inches in diameter and is seven inches long, and is gradually drawn out until it is the standard length, *i. e.*, twelve to thirteen feet. It is tapered, making a very neat looking pole, very smooth and clean. The steel used being a very fine grade of Swedish, very tough and strong, the poles are 25 per cent. lighter than those now in use, and are very much stronger. This alone is quite an item, as it relieves the tension on the wire just this much, which will certainly make the life of the wire greater. The Brooklyn Heights Railroad Company, which, is probably the hardest road on trolley poles in this country on account of the elevated structures, reports that, while with the common poles it has often from six to ten a day broken, with these poles, during all the time they have been used, which is now about six months, and upwards of 200 have been in service, only one pole has been broken so that it could not be used again. The reason for this is, that on account of the tough and tenacious material from which the poles are made, if a pole is bent, it is very easily straightened without injuring the metal.

Decision on Car Heaters.

Judge Swan, of the United States Circuit Court, at Detroit, in a decision rendered August 21, denied the motion for rehearing in the Cody patent case, thereby affirming a previous decision of the same court in favor of the Consolidated Car Heating Company, of Albany, N. Y.

Equipment Notes.

The Graham Equipment Company, of Boston and Philadelphia, is sending out a postal card giving a few verses from the *Providence News* upon the jolting of electric cars, and illustrated by an engraving of the way a man feels after leaving a pounding car. The company says, "All this bangerty business is avoided by using the Graham truck."

The Washburn & Moen Manufacturing Company, of Worcester, reports that the Chicago rail bond has been adopted by the Chicago City Railway Company, the Chicago North Shore Street Railway Company, the North Chicago Street Railroad Company and the West Chicago Street Railroad Company. A total of 450 miles of electric railway now under construction will use this bond.

The Storm Manufacturing Company, of 161-3 Washington Street, Newark, N. J., has recently purchased a controlling interest in the "H & C" trolley wheel for the United States and Canada. This wheel can now be obtained only from the Storm Manufacturing Company in the United States, and from Robert Mitchell & Company, of Montreal, for the Canadian provinces. This last named firm is manufacturing the wheel in Montreal under a royalty which it pays to the Storm Company.

Chas. A. Schieren & Company, of New York, write us that they have recently received orders for the following: Two forty-six inch, three-ply belts, each about 110 ft. long, and about twenty-four dynamo belts for the Citizens' Electric Illuminating Company, DeKalb Avenue and Rockwell Place, Brooklyn, N. Y.; forty-eight inch, three-ply belts, and some other belts, for the Capital City Gas & Electric Company, Des Moines, Ia.; four thirty-six inch, double belts for the Union Light & Power Company, Nashville, Tenn. The demand for Schieren belts seems to be constantly improving.

The Fuel Economizer Company, of Matteawan, N. Y., reports the following additional street railroads as using its economizers: Toronto Street Railroad Company, of Toronto, Ont., 3,000 H. P.; St. John Railroad Company, of St. John, N. B., 1,500 H. P.; Springfield, Street Railroad Company, Springfield, Mass., 500 H. P.; Jamestown Street Railroad Company, Jamestown, N. Y., 400 H. P. Orders have recently been taken for equipping the Boston pumping station and a number of mills in the New England States. The company is fortunate in being able to keep its works running full time during the dull season.

The Fiberite Company, of Mechanicville, N. Y., is kept busy supplying the Medbery insulating material which is now in use on a large number of the principal street railway companies in the country, including the Electric Traction Company, of Philadelphia; the Buffalo City Railway Company, of Buffalo; the New Jersey Traction Company, the Brooklyn City Railway Company; the Union Railway Company, of Providence; the Consolidated Traction Company, of New Jersey, and many others. The metal used in this material is claimed to be of a very high grade of aluminum bronze, showing a tensile strength of 90,000 lbs. to the square inch. This insulation is also claimed to show a higher heat test and greater strength than any similar composition.

Ford & Bacon is the name of a new firm of electrical engineers whose headquarters are at 421 Chestnut Street, Philadelphia. The company's New York office is at 203 Broadway, in the *Mail and Ex-*

press Building. The firm is composed of Frank R. Ford, well known to electrical engineers through his former connection with the Brush and Short companies, of Cleveland, and the La Roche Company, of Philadelphia, and George W. Bacon, who is in charge of the Philadelphia office. The new firm will do business as consulting electrical engineers. Mr. Ford will be in charge of the New York office. They are making a specialty of railway work, and have already been retained by several companies.

The Correspondence School of Mechanics and Industrial Sciences, of Scranton, Pa., is doing an excellent work, and one which seems to meet a public need. We understand that a large number of students have availed themselves of the advantages afforded by this school, which was started especially for those who are now in practical work and who cannot spare the time necessary for taking a regular course of instruction in the usual scientific schools. For these, the next best thing is to study at home during their leisure hours. A valuable feature of the Scranton school is that the managers guarantee instruction until the student is proficient in his scholarship, no matter how long it may take. The instruction courses are prepared by those actively engaged in teaching in schools.

The Electric Storage Battery Company, of Philadelphia, Pa., has contracted with the New York Edison Electrical Illuminating Company for a large storage battery installation. The installation will consist of 150 elements of chloride accumulators, type G, forty-one plates, having a capacity of 8,000 ampere hours at 150 volts, at normal rates, or a total capacity of 1,200 kilowatt hours. The installation will be furnished with the most modern and complete appliances for the control and operation of the battery, and everything possible will be done to make it a model, and at the same time the most modern and complete battery plant ever installed. The battery is to be installed immediately, to be ready for the heavy winter load.

The Wilson-Whiting-Davis Oiling Company, of New York, of which Morton E. Davis is first vice-president and general manager, is receiving excellent testimonials from those who are using its system of oiling for engines and dynamos. The chief engineer of the plant in the Equitable Building, New York City, which was illustrated and described in the August issue of the STREET RAILWAY JOURNAL, refers to its working as entirely satisfactory, as does also the chief engineer of the plant in the Women's Temple Building, Chicago, where the Wilson Whiting-Davis system is in use. Mr. Davis, whose New York office is at Broadway and Duane Street, is making every effort to bring the system to the attention of the engineers of power plants.

William H. Hopper, of Paterson, N. J., proprietor of the Paterson Handle Works, is well known throughout the country for the excellent handles for mechanics' tools which he manufactures. The Hopper works are over half a century old, having been founded in 1840 by Henry Hopper, father of the present proprietor. The premises are quite extensive, and mechanics' tool handles of every description are made here. Mr. Hopper makes a specialty of work for railroads, mining and coal companies and street railway companies in making handles to order. He supplies a considerable number of railroads and other large corporations with handles for their tools, and the material used by Mr. Hopper is the best of New Jersey white heart hickory, and any size or shaped handle can be made to order.

The New Process Raw Hide Company, of Syracuse, N. Y., is meeting with its usual success in the sale of raw hide pinions. A recent letter received by the company is from Henry P. Merriam, master mechanic of the Albany Railway Company. The grade of State Street Hill, Albany, is one of the longest and heaviest that any surface railway in this country has to contend with. Mr. Merriam says: "Regarding the two raw hide pinions sent us on trial, I can say that they were put on a car running on State Street Hill soon after your last call at Albany, and have been running every day since. I have examined them frequently, and they appear to be good for some time longer. The cast iron gears put on at the same time are as good as new. The result has been a great surprise to me. The bill for the two pinions has been approved and entered for payment."

Geo. S. Whipp, formerly with the J. W. Fowler Car Company, is now connected with the Lewis & Fowler Manufacturing Company. Mr. Whipp was formerly prominently identified with the latter company before his connection with the J. W. Fowler Company and is well and popularly known among the street railway fraternity. He reports an excellent demand for Lewis & Fowler appliances. He has just sold to the Hartford Street Railway Company, of Hartford, Conn , eight electric snow sweepers and fourteen Acme jacks. He has also a contract to equip all the cars of the Bridgeport Traction Company, of Bridgeport, Conn., with the Lewis & Fowler Company's improved register. 100 improved registers also go to the Newark & South Orange Street Railway Company, and 200 to the Providence Street Railway Company, of Providence, R. I.

The Joseph Dixon Crucible Company, of Jersey City, N. J., manufacturers of lead pencils and other graphite products, has felt the necessity of stiffening the backbones of its salesmen who have complained of competitors' cut prices and do it after the following fashion. In times like these when work is none too plenty, and the manufacturer is anxious for orders and the salesman likewise, there is great temptation to cut prices for the sake of getting a quantity of business and thereby deluding ourselves into the idea that we are prosperous because we are busy. forgetful of the fact that the more business one does at a loss the slimmer will be the bank account at the end of the year. There is neither money nor reputation to be gained in doing work for less than a fair price, and the very men who profit by beating the salesman down, respect him and his house less than if he had stuck manfully to the principle that first class goods demand a fair price.

The Berlin Iron Bridge Company, of East Berlin, Conn., writes us that the Worthington Hydraulic Works at Brooklyn, N. Y., have decided to make large additions to their already extensive plant, and have placed the contract for this work with them. The Berlin Iron Bridge Company is also putting up a gas house roof for the New Jersey Gas & Construction Company, at South Amboy, N. J., and for the new boiler and dynamo room for the Larchmont Electric Company at Mamaroneck, N. Y. The Geo. W. Helme Company, at Helmetta, N. J., has also placed the contract for its new roasting house with the Berlin Iron Bridge Company. The roof will be covered with the Berlin Company's patent, anti-condensation, corrugated iron roof covering. This company has also received the contract for the new plant of the Fairfield Copper Company, at Monroe, Conn. The plant will be entirely of iron and steel, no woodwork being used about the construction. The new power station for the Hartford Street Railway Company, at Hartford, Conn., will also be designed and built by the Berlin Iron Bridge Company. It will be 66 × 233 ft., with a steel frame covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron covering. When completed, it will be one of the most complete stations of the kind in the country, and will be absolutely fireproof.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., whose safety appliances are so well known has closed a number of orders recently, among them being pick-up fenders for the North End Street Railway Company, of Worcester, Mass. Apropos of the meeting of the Pennsylvania Street Railway Association at Reading this month, on September 5, the success of the Crawford Company in its native state of Pennsylvania is interesting. Philadelphia and Pittsburgh, the two largest cities in the state, have purchased liberally of Crawford fenders. In Philadelphia about 1,000 wheel guard fenders are now in use, in Pittsburgh 250 wheel guards and 400 pick-up fenders are employed. The Williamsport (Pa.) Railway Company is another line which is equipped with the wheel guard fenders. In Pennsylvania over 40 lives have been saved since February 1 by the use of Crawford fenders. The fenders are manufactured in Pittsburgh, and are the invention of a native born Pittsburger. The sales and delivery of fenders, it is claimed, have exceeded all other manufacturers, and the fenders have been adopted in all sections of the country. Since February 1, the Crawford Company has delivered over 2,500 fenders, and the company tells us that its correspondence is rapidly increasing with the various street railway companies throughout the United States, Canada and Europe. Among the recent inquiries was one from Tokio, Japan, indicating that a good fender is in demand all over the world, and that the fenders of the R. A. Crawford Manufacturing Company are giving full satisfaction and receiving the endorsements of the leading railway men.

The Industrial Mutual Insurance Company, of Boston, Mass., seems to possess the confidence of the owners of electric light and street railway properties in a remarkable degree, as many of them have insured in this company. The first electric policy was written October 1, 1893, and in ten months, or up to August 1, the policies written amounted to $6,199,286. A partial list of the street railway companies is given below: Altoona (Pa.) & Logan Valley Street Railway Company, Augusta (Ga.) Railway Company, Aurora (Ill.) Street Railway Company, Chester (Pa.) Traction Company, South Chicago City Railway Company, Cayadutta Electric Railroad Company, Consolidated Street Railway Company, of Grand Rapids, Mich., Hamilton (O.) & Lindenwald Electric Transit Company, Ithaca Street Railway Company, Johnson City (Tenn.) & Carnegie Street Railway Company, Kokomo (Ind.) City Street Railway Company, Twin City Rapid Transit Company, of Minneapolis, Central Railway & Electric Company, of New Britain, Conn., Omaha Street Railway Company, St. Joe (Mich.) & Benton Harbor Street Railway Company, City & Suburban Street Railway Company, of Savannah, Ga., Winston (N. C.) & Salem Railway & Electric Company, Worcester (Mass.), Leicester & Spencer Street Railway Company. The directors of the company are: Henry C. Morse, Boston, Mass; O. H. Sampson, Boston, Mass.; Robert Batchellor, No. Brookfield; B. F. Taft, Ayer, Mass.; Benj. Taft, Ayer, Mass.; E. H. Clark, Hartford, Conn.; C. T. Plunkett, Adams, Mass.; J. J. Banigan, Providence, R. I.; Benj. F. Peach, Jr., Boston, Mass.; C. G. Goodrich, Minneapolis, Minn.; F. A. Gilbert, Boston, Mass.; H. A. Royce, Malden, Mass.; J. Howard Nichols, Boston, Mass.; C. C. Fry, Lynn, Mass.; Lester Leeland, Malden, Mass. Since October 1, 1893, the company received for premiums $65,477.64, and paid losses $1,069.

W. R. Fleming & Company, representatives of the Harrisburg Foundry & Machine Works, in New York and New England, have handed us a list of engines and engineering work which they have taken contracts for since May 1. A few of the sales made are given below: One 200 H. P. Ideal tandem compound engine, direct connected to a Siemens-Halske generator, for the Broadway cable road; two 40 H. P. simple engines for friction driving Thomson-Houston dynamos, for the new 250,000,000 C. P. lamp for the Fire Island lighthouse; one 60 H. P., standard Ideal engine, boiler and complete steam plant for electric sewerage purification, for the city of Danbury, Conn.; two 60 H. P. Ideal engines arranged for direct connection to General Electric apparatus for the new City Hall building, Brockton, Mass; one 70 H. P., standard Ideal engine for the Bangor Steamship Company, Boston, Mass.; two 40 H. P., standard Ideal engines for the new steamships just built for the Old Dominion Steamship Company; two 100 H. P. Ideal engines for the electric plant of the United States Post Office, Brooklyn, N. Y.; one 50 H. P. Ideal engine sold to the Brooklyn Electric Equipment Company, Brooklyn, N. Y.; two 80 H. P., direct connected engines for the New York Electric Equipment Company, New York; one 150 H. P., two 100 H. P. and one 60 H. P. Ideal engines for the General Electric Company, New York; two 100 H. P., standard

Ideal engines for the Morrison Southern Electric Construction Company, Baltimore, Md. The contract has also been awarded to Messrs. W. R. Fleming & Company for supplying the station equipment of the complete central lighting and power station plant for the Port of Spain, Island of Trinidad, West Indies. This plant consists of four 250 H. P., tandem compound Ideal engines, four Harrisburg high pressure, steel tubular boilers with Weitmeyer furnaces, 2,000 light, incandescent dynamos, two 50 arc machines, and one 100 K. W. railway generator. The entire equipment of this plant is in the hands of Messrs. W. R. Fleming & Company, who are to erect the same and turn over to the owners, an Anglo-American syndicate, in complete operation.

WESTERN NOTES.

The Hill Clutch Works Company, of Cleveland, O., has been incorporated to carry and extend the business formerly done by the Hill Clutch Works, at Cleveland, O. H. W. Hill is president and general manager of the new organization.

The Correspondence School of Technology, of Cleveland, O., has engaged J. N. Dodd, a graduate of Princeton and last year Fellow in Mathematics at Princeton, as Instructor in Mathematics. The school reports growth even though the times are so exceedingly bad, and also has received letters from its students commending the work.

W. R. Garton, inventor of the Garton lightning arrester, has been appointed manager of the railway department of the Central Electric Company, of Chicago. Mr. Garton is well qualified for the position, on account of his ability and experience in electrical work, as well as on account of his hustling qualities, and the Central Electric Company is to be congratulated upon having secured his services.

C. E. Loss & Company, of Chicago, are doing good business, having lately received some very flattering orders. This progressive contracting firm is now busy closing up the work on the Indianapolis & Broadripple Street Railway, where it is doing all the track and overhead construction at Hartford City, Ind. The firm is building the entire plant and furnishing all the cars and trucks, which have been bought of the J. G. Brill Company.

The Wallace Electric Company, of Chicago, has been especially busy recently in its railway department, notwithstanding the dull times. The company's combination pole bracket, which affords a flexible support for the insulator, is meeting with a ready sale and with great success. The various devices for overhead construction handled by the company are also favorites with railway superintendents, as the different forms give perfect protection against moisture at all points.

The Bass Foundry & Machine Works, Ft. Wayne, Ind., reports that it has under construction for New Castle, Pa., a tandem compound, condensing Corliss engine with high pressure cylinder 36 in., low pressure cylinder 70 in. with 60 in. stroke. The driving pulley is 25 ft. in diameter, has a 9 ft. face, and is designed for rope transmission, having 32 2 in. grooves to accommodate the ropes. The engine is rated at 200 H. P., being the largest tandem engine ever built. The pulley weighs 120 tons.

The Lodge & Davis Machine Tool Company, of Cincinnati, writes us that the plant of the R. R. Howell & Company, Minneapolis, Minn., which was recently destroyed by fire, is now being rebuilt and that it will be equipped, among other machinery, with a Lodge & Davis fifty four inch planer and thirty inch lathe. The Company has also made shipment to Arequipa, Peru, and Santiago, Chili, on orders received from its salesman, who is now traveling in South America. It has also made shipment of one of its large engine lathes to the port of Odessa, Russia.

The Scarritt Furniture Company, of St. Louis, Mo., has appointed Harry O. Nourse as the representative at Chicago of the old and reliable Scarritt car chairs and seats, which have done so much towards making life worth living in furnishing comfortable seats to a discriminating public. Mr. Nourse was born and bred a railroad man, and is well known and highly esteemed in the department of steam roads. With the high reputation of the Scarritt's seats to back him, we are confident he will soon be favorably known to the trade.

The Hoppes Manufacturing Company, of Springfield, O., is now busily engaged installing four of its live steam feedwater purifiers of 3,000 H. P. total capacity in the new electric railway station of the Lindell Railway Company at St. Louis, Mo. The Hoppes Company justly feels somewhat elated in securing this contract, as it was only secured after a hard fight, and in the face of very strong competition. Among other recent sales we note the following: Live steam feedwater purifiers of 500 H. P. to the Proctor & Gamble Company, of Ivorydale, O.; 1,500 H. P. to the Indianapolis (Ind.) Light & Power Company; 150 H. P. to Wm. Coombs, of Coldwater, Mich.; 400 H. P. to the National Milling Company, of Toledo, O.; 150 H. P. to the Cincinnati Street Railway Company; 150 H. P. to Chas. H. Suppes, of Johnstown, Pa.

The Aultman & Taylor Machinery Company, of Mansfield, O., is meeting with excellent success in the sale of its boilers. Among its latest customers for two 150 H. P. boilers is the Citizens' Street Railway, Light & Power Company, of Mansfield. This company states that the saving in fuel with these boilers, in comparison with an excellent battery of horizonal tubular boilers that was in use, is in the neighborhood of 15 per cent. We understand that a large plant will be built in Mansfield for constructing these boilers. An arrangement has recently been made with H. E. Collins & Company, of Pittsburgh, by which the firm will have the exclusive sale agency of the boilers for the United States. This firm comprises among its members William C. Temple, formerly the agent for the Babcock & Wilcox Company, at Pittsburgh.

The Standard Railway Supply Company, of Chicago, reports that orders for "Standard" stoves have been coming in during the last month. In, fact more orders were received during the month of August than last year, principally from companies that were customers in 1893. This goes to show that they were thoroughly satisfied with the result of the stoves in use last winter, and that they will continue to use them wherever they have an opportunity. The company also reports that it is selling its share of steel gongs, and has recently taken several very good orders for line material and track scrapers. Very gratifying results are also met with introducing the Nuttall Company's gears and pinions. The sales in this territory have been the best the company has had, so far in the month of August, and indications are that the trade will increase.

Frank J. Lewis, of Cleveland, O., formerly manager of the Steel Motor Company, and subsequently vice president and manager of the Eastern Electrical Equipment Company, has sold out his interest in the latter business. He is now maturing plans for the establishment of a general supply business on an extensive scale, with headquarters at Cleveland, O. The company will publish a monthly journal entitled *The Magnet*, devoted principally to the interests of purchasing agents, containing bargains in every thing electrical. In the same journal will be published news and articles of instruction and interest to the electrical world. The company invites correspondence from parties having any second hand or new equipment to dispose of. All such goods are advertised in *The Magnet* free of cost. Frank J. Lewis will be president and manager of the company, and together with two brothers retain the controlling interest.

The Phœnix Iron Works, of Cleveland, O., has completed the two story addition to its works, and has added a number of new machines, greatly increasing its capacity. It is interesting to note that this company never had so prosperous a year as the present, and now has orders to keep it busy for several months. This seems remarkable considering the dullness of trade throughout the country. The company's long experience in crane building has earned for it a world wide reputation, and owing to the largely increasing Western trade, the company has established a Chicago office, under the management of Jas. T. Gardner, at 932 The Rookery Building. The company's manufacture embraces every style of cranes, foundry ladles, crab winches, hydraulic presses and machinery and railroad turntables. Correspondence is invited in regard to the designing and building of special machinery. A new crane catalogue, which is now in press, will be issued shortly, and will be sent free on application.

Fisher & Porter, of Chicago, write us that they have just installed two eighty horse power M. A. Green engines in the Leland Hotel, where they are running two National dynamos for incandescent lighting. They have sold one 150 H. P. M. A. Green engine to the Freeport Electric Company, of Freeport, Ill., for electric street railway work, and one 300 H. P., improved Greene engine to the Hammond, Whiting & East Chicago Electric Railroad Company, at East Chicago, Ind. Messrs. Fisher & Porter are Western representatives of the Altoona Manufacturing Company, building the M. A. Green engine, and of the Providence Steam Engine Company, building the improved Greene engine, and report that the works of both companies are running full time, and that they see prospects ahead for a good business. This firm has received the following letter from the Farmington Electric Company, of Farmington, Ill., where was installed last fall, the first M. A. Green engine which had then been placed west of Pittsburgh: "Your letter enquiring about our plant received. In reply would say that everything is running smoothly. The M. A. Green engine is a dandy, keeps right along doing its work without a jar or stop, giving us a steady, uniform light. We consider that our plant, purchased through and put in by Albert Fisher last winter, is one of the best in the West outside of the large cities. We are satisfied that we could not have done better. (Signed) E. M. Rose, secretary."

The Ohio Brass Company, of Mansfield, O., reports orders of considerable size during the month of July for its type W material from the following roads: Middletown (N. Y.) & Goshen Traction Company; Elyria (O.)-Lorain Electric Railway Company; Consolidated Street Railway Company, of Toledo, O.; Cincinnati (O.) Street Railway Company; Toledo (O.) & Maumee Railway Company; Keokuk (Ia.) E. L. & Power Company; Des Moines (Ia.) Railway Company; East Liverpool (O.) & Wellsville Railway Company; Beaver Valley (Pa.) Traction Company; Lake Cities Electric Railway Company, of Michigan City, Ind.; Consumers' Electric Light & Street Railway, of Tampa, Fla.; Citizens' Street Railway Company, of Memphis, Tenn.; Ft. Wayne (Ind.) Electric Railway Company; Warren (Pa.) Street Railway Company; Chillicothe (O.) Electric Railway Company; Akron (O.) Street Railway Company; Punxsutawaney (Pa.) Passenger Railway Company; Union Street Railway Company, of Saginaw, Mich; West End Street Railway Company, of Knoxville, Tenn.; Riverside Park Street Railway Company, of Saginaw, Mich.; Brightwood Railway Company, of Washington, D. C.; Nashville (Tenn.) Traction Company; Delaware (O.) Electric Railway Company; Marion (O.) Street Railway Company; West End & Riverside Electric Railway Company, of Montgomery, Ala.; Columbus (O.) Street Railway Company; Lansing (Mich.) City Electric Railway Company. This company has had a large increase in the number of its orders of motor bearings, owing to the superior workmanship and quality of the metal which is employed, and the company numbers among its patrons many of the largest roads in the country. These bearings are made of guaranteed bell metal, and are turned and trued up, and milled by special machines lately installed for this purpose. The extraordinary care taken with the finish of these insures a perfect fit and an even and smooth bearing for the shaft. The Ohio Brass Company, has prepared a revised list of bearings, and the figures at which these are now offered to the trade will, no doubt largely increase their output.

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., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	116	120
Watervlelt Turnpike & R. R. Co	100	240,000	.....	...	1863	10	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	101½	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	101½	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	111	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	112	114
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	111½	113

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Aug. 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	.....	58	59
City & Suburban Ry. Co	50	3,000,000	.....	1	.....	33	35
Central Pass. Ry. Co	50	300,000	.....	...	.....	67	69
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	14½	15

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort	1892	500,000	.....	5	.....	111½	112
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	106½	107
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	106	107
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	99½	101
" " "	1891	1,250,000	M. & S.	6	1901	102¾	103¼
City Pass. R. R. Co	1891	2,000,000	"	5	1911	113	113½

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange, Aug. 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	78¼	78¾
West End Com'n	50	9,085,000	J. & J.	3	1890–1892	54¼	54½

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Aug. 23. 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	.....	165	170
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	65	.....
" " common	100	6,000,000	.....	...	1893	14	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	147	.....
Long Island Traction Co	100	30,000,000			1893	14	17

BONDS.	Date of Issue	Amount Out-standing.	Inter-est 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	102	.....
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	112	115

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Aug. 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	.....	.....	70
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est 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., Aug. 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	306	310
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	.....	236½	238
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	126¾	127¼

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est 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	105	110
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	....	101
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	.....	103½
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101⅞	102½
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	100	101½
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	102	102½

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Aug. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$7,500,000	Q.—J.	5	.....	105⅝	105⅞
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	106½	107
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	59¾	60¼
" " " Pref.	100	100,000	.....	6	.....	98	99
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	.	.....	22½	24

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est 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
" " extended	.....	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	De. '94-1924	102½	....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104⅞	105¼
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	107	108
" " " "	.....	300,000	J. & J.	6	Jan. 1914	105	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	113½	114½

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co	100	12,000,000	.....	....	1893	46½	47½
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	56	57½

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	100	102½
" " City " "	1893	2,349,000	.....			100	102

DETROIT STOCKS.—Corrected by Cameron Currie & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Aug. 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., Aug. 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	.....	200	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	125	150

LOUISVILLE STOCKS AND BONDS.—Corrected by Almstedt Bros. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Aug. 19.

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	86	87
Louisville St. Ry. Co., com....	100	4,000,000	.....	...	Jan. 1891	36	38

Bonds.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	100	100½
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. Aug. 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 & Centville H. R. Co.	.....	.....	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

Bonds.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est 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
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., Aug. 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	119	123
Crescent City R. Co.....	100	1,150,000	"	3	.866	75	85
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	36	40
New Orleans City & Lake Co.	100	1,500,000	Quart.	2½	1860	104	.....
Orleans R. R. Co.....	50	185,000	"	2	1868	.....	38
St. Charles Street R. R. Co..	50	600,000	"	2½	1865	54½	56

Bonds.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	.....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	.....	.....
do do	1893	2,000.000	J & J	6	1913	85	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	113½	.....
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	85	.....
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, Aug. 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.	153¼	154
" " (new stock)	50	2,000,000	.....	...	May, '94.	149	149¾

Bonds.	Date of Issue	Amount Out-standing.	Inter-est 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, Aug. 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	180	184
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	1'2	155
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	150	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	132	135
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4½	.....	300	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	49	52
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	132	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	200	206
Third Avenue.....	100	5,000,000	M.—N.	4½	.....	184	186
23d St.....	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	139	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	108	111
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	106	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	103	.....
Broadway Consolidated.....	.....	7,650,000	J. & J.	5	 1943	109¾	110
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	115	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	109	.....
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	117	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by Huhn & Glendinning, 143 South Fourth st. (Bullitt Building), Philadelphia, Aug. 19. 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	260	265
Continental.....	50	1,000,000	J.—J.	6	1873	124½	126
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	310½	312
Germantown.....	50	1,500,000	Q.—J.	2¾	1858	110½	112
Green & Coates...	50	500,000	Q.—J.	3	1868	124½	126
Hestonville...	50	2,050,000	.....	...	1859	47	49
Lombard & South.....	25	500,000	A.—O.	8	1861	90	91
People's Traction Co.....	50	10,000,000	.....	...	.....	52½	52¾
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	155	160
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	80	85
*Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	95	95½
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	221	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	209½	213
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	225	230
Union.....	50	1,250,000	J.—J.	9½	1864	199	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	195	200
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	116½	117¼
Baltimore Traction.....	25	5,000,000	.....	1	1889	14	14¼
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.	...	.....	12½	12¾

Bonds.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	107¾	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., Aug. 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., Aug. 23. 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	.....	..	.....	19½	20
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	59¾	60
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	12⅝	12¾
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	. . .	63½
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	...	.....	19⅝	20¼
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	35	38½
West End R. R. Co.	50	1,000,000	J. & J.	1	.....	16	20
Second Avenue R. R. Co.	50	1,000,000	J. & J.	2	.....	.....	.....
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	.....	...	.....	26	26½

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	107	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	106	110
Pitts. & Birmingham Traction Co	1892	.....	.....	5	.....	90	92
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	104¼	104½
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	101¾	.....
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	101	102
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, Aug. 24.

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	8,000,000	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, Aug. 23.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	25	29
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	57	59
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	13	20
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	37	40
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	65	75
do do Common.	100	4,000,000	.....	...	1892	18	20
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	70	80
do do Common.	100	3,000,000	.....	...	1892	13	18
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	36	38

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	95	96
Buffalo (N.Y.) Ry.	1891	5,000.000	F & A	5	1931	99	101
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	97	98
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	90	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	86	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	...	.....	98½	.....
Geary St., Park & Ocean R.R.Co	100	1,000,000	Monthly	...	.....	.....	105
Market Street Cable Co.	.....	18,750,000	.....	..	.....	40¼	41
Metropolitan Electric	.....	1,000,000	Monthly	...	.....	22½	27
Oakland, S. L. & Haywards	.....	.....	.....	...	.....	.....	100
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	12½	14
Sutter St. R. R. Co.	.....	2,000.000	Quar't'ly	...	.....	90	.....

Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	J. & J.	5	.....	105	.....
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	107	110
Geary St., Park & Ocean	.....	671,000	A. & O.	5	.....	104½	105¼
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	.....	120
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	.....	117
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	112	.....
Park & Cliff House R. R.	.....	350.000	J. & J.	6	.....	99	.....
Powell Street R. R.	.....	700.000	M. & S.	6	1912	112	.....
Sutter St. Cable Co.	.....	900,000	M. & N.	5	.....	104½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., Aug. 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	55	60
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	135
Lindell	100	2,500,000	.....	...	1890	90	92
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	151
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	13	15
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	101½	102½
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	1889–1914	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	104	105
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	84	86
St. Louis & Suburban (Incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Aug. 23. 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	285	310
Metropolitan R. R.	50	750,000	Q. J.	2	1864	85	90
Columbia R. R.	50	400,000	Q. M.	1	1870	61	65
Belt R.R.	50	500,000	Q. J.	...	1875	...	30
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	30	40
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	35

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'tn & Geo'tn conv't. 1st.	'83-'99	3,000,000	J. & J.	6	1899-1929	134	137
" " " 2d.	.....	500,000	J. & J.	6	1903-1943	134	137
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	99	102
Belt.	1921	240,000	J. & J.	6	1921	.....	80
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	101	103½
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

Financial.

THE Bowling Green (Ky.) Street Railway Company has been leased to George and Clarence Claypool of that city.

$ $ $

THE net earnings of the North Shore Traction Company for the nine months ending June 30 were $263,372, an increase of $105,090.

$ $ $

AT a meeting of the board of directors of the Lebanon & Ann-

ville Street Railway Company, held July 25, a semi-annual dividend of 2½ per cent. was declared.

$ $ $

THE Carbondale (Pa.) Traction Company line, it is reported, has been sold to the Lackawanna Valley Rapid Transit Company. H. B. Jadwin is president of the latter company.

$ $ $

THE Atlantic Avenue Railroad Company, Brooklyn (N. Y.), statement for the quarter ended June 30: Gross earnings, $241,484; operating expenses, $151,131; other income, $8,221; fixed charges, $71,221; net income, $27,352; cash on hand, $63,587.

$ $ $

HOWARD CALE, receiver of the Queen City Electric Street Railway, of Marion, Ind., in his first report filed in the United States Court, shows that the receipts of the company from March 27 to June 30 were $2,045.69, and the disbursements $2 054.84.

$ $ $

THE Eighth Avenue Railroad Company of New York City, makes the following report for the quarter ending June 30: Earnings, $207,892; expenses, $144,139; net, $61,753; other income, $416; charges, $24,095; surplus, $38,074; cash on hand, $27,324; profit and loss surplus, $16,984.

$ $ $

THE statement of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railroad (New York) for the quarter ended June 30, shows: Gross earnings, $170.900; operating expenses, $128,632; other income, $1,000; charges. $30,687; surplus, $12,581; cash on hand, $9,136; profit and loss, $56,821.

$ $ $

THE 22d Street line of the Chicago General Street Railway Company carried 283,947 passengers during the year ending June 30, 1894. The report by weeks shows a steady increase in the traffic on the road from 352 passengers during the week ending July 8, 1893, to 22,989 during the week ending June 30, 1894.

$ $ $

A. M. BILLINGS, of Chicago, Ill., who owns and operates the street railway system of Memphis, Tenn., has recently purchased the Memphis & Raleigh Springs Railroad for $110,000. It is believed that Mr. Billings will convert the road to the electric system and run it in connection with the street railway system which he operates.

$ $ $

THE following is a comparative statement of the operations of the Scranton Traction Company for the month of June: Gross earnings, 1894, $22.082.06; 1893, $20 185 62; increase, $1,896.44. Operating expenses, 1894, $12,142.89; 1893, $12,286.68; decrease $143.79. Net earnings, 1894, $9,939.17; 1893, $7,898.94; increase, $2,040.23.

$ $ $

THE recent change in the management of the Lake Street Elevated Company of Chicago, has been followed by a general reduction of expenses in every department. Director Lauderback, who is mainly responsible for the policy of retrenchment, says that he estimates the saving at the rate of $60,000 a year. This sum would pay the interest at 5 per cent. on $1,200,000 of bonds, and is a matter, therefore, of a good deal of moment to the stockholders.

$ $ $

THE Northwestern Elevated Railroad Company, of Chicago, has placed on record a mortgage for $15,000,000 in favor of the Illinois Trust & Savings Bank as trustee to secure an equal amount of bonds. A mortgage for $1,000,000 was placed on record by the North Chicago Electric Railway Company, and still another mortgage for $2,000,000 was recorded by the Chicago Electric Transit Company. The trustee in each instance was the Illinois Trust & Savings Bank.

$ $ $

REDMOND, KERR & COMPANY, of New York, offer $1,300,000, of a total issue of $2,000,000, 5 per cent. thirty year gold bonds of the Bridgeport (Conn.) Traction Company. The remaining $700,000 is reserved in the treasury of the company, and can only be issued for improvements at 75 per cent., the actual cost thereof. The bonds are a first mortgage on the entire street railway system in the city of Bridgeport, covering thirty-two miles in operation or under construction.

$ $ $

THE following is a comparative statement of the operations of the Buffalo Railway Company for the month of July: Gross earnings, 1894, $139,797.20; 1893, $147,286.86; decrease, $7,489.66. Operating expenses, 1894, $73,607.56; 1963, $81,731.58; decrease, $8,124,02. Net earnings, 1894, $66,189.64; 1893, $65.555.28; increase, $634.36.

Seven months ending July 31: Gross earnings, 1894, $866,964,21; 1893. $834,949.63; increase, $32,014.58. Operating expenses, 1894, $498,741,69; 1893, 534,954.77; decrease, $36.213.08. Net earnings, 1894, $368,222.52; 1893, $299,994.86; increase, $68,227.66.

$ $ $

THE following is a statement of the earnings for the month of July of the companies operated by the Brooklyn Traction Company: Gross earnings, Atlantic Avenue Railroad, $86,027.66; Brooklyn, Bath & West End Railroad, $24,950.58; total, $110,978.24. Operating expenses, Atlantic Avenue Railroad, $51,017.64; Brooklyn, Bath & West End Railroad, $11,022 20; total, $62.039 84. Net from operation, $48,938.40. Miscellaneous earnings, Atlantic Avenue Railroad, $6,485.67; total net earnings, $55,424.07. The gross earnings of the above system increased $7,577.30 on the corresponding month of 1893.

$ $ $

As announced in the STREET RAILWAY JOURNAL, the capital stock of the Cincinnati Street Railway Company will be increased $500,000 on September 1. The increase is to be apportioned and paid for as follows: The stockholders of record on September 1, 1894, and who make remittance for the same, which shall reach the office of the company not later than September 3, shall be entitled to purchase at par, $50 per share, one share for each fifteen shares owned. Stockholders owning less than fifteen shares will be permitted to purchase at par one share only. The books for the transfer of stock will be closed from Thursday, August 30, to Thursday September 6, inclusive.

$ $ $

THE operations of the Worcester Traction Company for the month of July during the last two years is given as follows: Gross earnings, 1894, $37,495.49; 1893, $31,998 79; increase, $5,496.70. Operating expenses, 1894, $16,636.36; 1893, $24 181.89; decrease, $7,545.53. Net earnings, 1894, $20,859.13; 1893, $7.816.90; increase, $13,042.23.

For the ten months ending July 31 the company's report states: Gross earnings, 1894, $285,169.48; 1893. 280,142.71; increase, $5,026.77. Operating expenses, 1894, $168,502.86; 1893, $211,189.97; decrease, $42.687.11. Net earnings, 1894, $116,666.62; 1893, $68,952.74; increase, $47,713.88.

$ $ $

A COMPARATIVE statement of the operations of the Columbus Street Railway Company for the month of July is presented in the following: Gross earnings, 1894, $51,287.72; 1893, $49,882.99; increase, $1.404.73. Operating expenses, 1894, $22,924.96; 1893, 28,155.18; decrease, $5,230.22. Net earnings, 1894, $28,362.76; 1893, $21,727.81; increase, $6,634.95.

For the seven months ending July 31 the operations were as follows: Gross earnings, 1894, $315,560.02; 1893, $310,445.04; increase, $5,114.98. Operating expenses, 1894, $151,200.93; 1893, $199,293.48; decrease, $48,092.55. Net earnings, 1894, $164,359.09; 1893, $111,151.56; increase, $53,207.53.

$ $ $

AT a meeting of the directors of the People's Traction Company of Philadelphia, held August 10, it was decided to give the stockholders the privilege to subscribe to the 40,000 shares now in the treasury. The new shares will have the same status as those now outstanding, and will be issued to stockholders at $47.50, netting thereby to the company a premium of $22.50 per share. The right to subscribe will expire on September 15, and any of the shares not subscribed for at that time will be taken by an underwriting syndicate, composed of the banking houses of Drexel & Company, George S. Fox & Sons and C. & H. Borie. The money realized from this stock, together with that in the treasury, will, it is stated by a director of the company, be more than sufficient to complete all the work now under contemplation.

$ $ $

THE Binghamton (N. Y.) Railroad Company presents the following table of earnings and operating expenses for the fiscal year ending June 30:

	1893.	1894.
Receipts	$90,217.35	$108,710.18
Operating expenses	50 275.50	64 585.40
	$39,941.85	$44,124.78
Taxes and interest on funded debt	14,078.73	21,001.55
Surplus for stock	$25,863.12	$23,123.23

The earnings from June 30 to August 6 (thirty-six days) were, 1893, $14,562.38; 1894, $16,633.20; gain, $2,070.82. The receipts for the year ending August 5, 1894, were $111,371.69. It is estimated that upon the completion of the electrical equipment of the system the gross earnings will amount to $150,000; operating expenses and taxes, $82,000; $68,000. Interest (when entire system is completed), $37,500, leaving as a surplus for stock $30,500.

Balance Sheet, July 1, 1894.

Assets:	
Cost of road and equipment	$1,020,097.05
Due on open accounts	2,068.67
Supplies on hand	1,651.83
Cash on hand and in bank	7,864.20
	$1,031,681.75
Liabilities:	
Capital stock	$324,810.00
Funded debt	590,000.00
Loans and bills payable	98,200.00
Accrued interest	3,000.00
Due on open accounts	9,857.99
Profit and loss	5.813.76
	$1,031,681.75

A stock dividend of 20 per cent. was declared during the past year, the same being the surplus earnings which were expended in construction of the road.

The total amount of bonds authorized to be issued, and upon which interest is to be paid under the $900,000 5 per cent. mortgage, is $700,000. Until the road shows net earnings sufficient to pay twice the amount of interest on all bonds outstanding, together with the amount to be taken from the $200,000 remaining in escrow, the escrow bonds cannot be used and then only to the extent of 85 per cent. of the actual amount expended in construction and equipping, and then only upon the presentation of sworn certificates of expenditures to the trustee as provided in the mortgage.

$590,000 of the $700,000 have been issued. the remaining $110,000 being held in the treasury to provide for bills payable and contracts at present under way for construction.

More Comments on Our New Publication, "American Street Railway Investments."

The North East Street Railway Company of Kansas City, writes, "We have examined it carefully and must pronounce it an excellent work."

"This is a large work, giving a great deal of information to those interested in street railroad securities, etc. * * * We should think it would be invaluable to street railroad officers and investors."—*Locomotive Engineering.*

Francis R. Cooley, dealer in investment securities, Hartford, Conn., says: "I have looked over the copy of 'American Street Railway Investments' sent me, and think it very valuable to dealers and investors in street railway securities."

J. & W. Seligman & Company, bankers, Mills Building, New York City, say: "We have examined with interest your publication, 'American Street Railway Investments.' It seems to have been compiled with much care and thoroughly to cover the field."

"The importance of the street railway has led to the publication of a new annual devoted exclusively to that industry, the first issue of which has just been published. It is called 'American Street Railway Investments,' and deals with the history, capitalization, equipment and management of the surface roads of the American cities, whether operated by horse, cable or electric power."—*The Argonaut* (San Francisco).

Emerson McMillin & Company, bankers, of 40 Wall Street, New York write: "We are in receipt of a copy of your manual 'American Street Railway Investments,' and hasten to congratulate you on the conception and execution of so valuable a work. The information contained in your manual is at once concise and comprehensive, and while you are entirely justified in feeling proud of your effort, the investing public has every reason to be grateful for the opportunity to avail itself of the result of your enterprising labors."

Joel Hurt, president Atlanta Consolidated Street Railway Company, Atlanta, Ga., says: "Since examining your supplement, the 'American Street Railway Investments,' I desire to thank you for furnishing this very valuable work to all investors in street railways. You have given very full information touching the operation of companies, and it is quite interesting to note the results of operations from different systems and managements. This publication is destined to fill a long felt want and is worth many times the price of same."

"The first issue of this volume, which is hereafter to be published annually, is corrected up to June 15, 1894, and (presuming that we are safe in assuming the figures presented to be correct) it is a most creditable and ought to be a valuable publication. * * * * * It is reasonably certain that street railways are destined every year to attract more and more attention from investors, and their securities, both here and abroad, will be very much more largely dealt in than they are at present. With each year the demand for such a volume as this will increase, and the completeness with which the essential statistics are presented in the book before us ought to commend it to very general use as a book of reference."—*Railway Age and Northwestern Railroader.*

The *Engineering Magazine*, August issue, says: "Nothing that could be asked for in a reference book for the use of investors and intending investors in street railway securities, has been omitted in the compilation of 'American Street Railway Investments.' The utmost pains seem to have been taken in compiling the statistics of capitalization, the physical condition and the details of operation of all the street railways in the United States. This field, though but recently developed, is a most promising one for judicious investors, and this volume is the first comprehensive guide to those who are interested in this field. The book will be found none the less valuable to engineers who are engaged in street railway construction or are contemplating such work."

Consolidation at Yonkers.

A consolidation of the two lines of street railway in Yonkers, N. Y., was brought about recently. At a late meeting of the directors of the Yonkers Railroad Company and the North & South Electric Railway at the banking house of T. R. Wilson & Company, 35 Wall Street, Charles H. Montague, having sold all his securities to R. T. Wilson & Company, resigned as director and president of the Yonkers Railroad Company. The Messrs. Wilson & Company, having purchased a controlling interest in both companies, the directors of both resigned and a new board was named, of which R. T. Wilson, R. T. Wilson, Jr., Albert L. Johnson and James M. Edwards are the leading members. Albert L. Johnson was elected president.

Recent Shipments of the Ball Engine Company.

The Ball Engine Company's shops, at Erie, Pa., present a scene of activity, in spite of the unfavorable condition of trade generally, and are running full time. There have been shipped from the works lately the following: Edison Electric Light & Power Company, Erie, Pa., one 350 H. P., vertical compound engine and one 300 H. P., cross compound engine; Eureka Light Company, Eureka, Cal., one 300 H. P. engine; Industrial Home for the Blind, Chicago, Ill., one 80 H. P. engine; J. H. Houghton, Boston, Mass., one 50 H. P. engine; Minneapolis General Electric Company, Minneapolis, Minn., one 35 H. P. engine; Bronx Gas & Electric Light Company, Van Nest, N. Y., two 250 H. P., tandem compound engines; Hotel Newcomb, Quincy, Ill., one 60 H. P., engine; Gen. A. J. Bushnell Building, Springfield, O., one 60 H. P. engine; Lexington Electric Light Company, Lexington, N. C., one 50 H. P. engine; Greenwich Gas & Electric Light Company, Greenwich, Conn., one 150 H. P. engine, and one 125 H. P. engine; Kennard House Company, Cleveland, O., one 50 H. P. engine; City of Griffin, Griffin, Ga., one 135 H. P. engine; Howe Pump & Engine Company, Ladd, Ill., one 50 H. P. engine; Sykes & Wagner, Minneapolis, Minn., one 80 H. P. engine; F. F. Vater & Company, Minneapolis, Minn., one 35 H. P. engine; Risdon Iron Works, San Francisco, Cal., one 150 H. P. engine; Electric Supply & Engineering Company, Detroit, Mich., one 70 H. P. engine.

To the Trade.

Please take notice that P. S. Bemis, Jr., our former Chicago agent, is no longer in our employ, and we caution everybody against cashing any drafts for or advancing any money to him on our account.

The Peckham Motor Truck & Wheel Company.

Map of the United States.

A large handsome Map of the United States, mounted and suitable for office or home use, is issued by the Burlington Route. Copies will be mailed to any address on receipt of fifteen cents in postage by P. S. Eustis, General Passenger Agent, C., B. & Q. R. R., Chicago, Ill. ***

Cheap Excursions to the West.

An exceptionally favorable opportunity for visiting the richest and most productive sections of the West and Northwest will be afforded by the Home Seekers, low rate excursions which have been arranged by the North Western Line. Tickets for these excursions will be sold on September 11, and 25, and October 9, to points in northwestern Iowa, western Minnesota, North Dakota, South Dakota, Manitoba, Nebraska, Colorado, Wyoming, Utah, Montana and Idaho, and will be good for return passage within twenty days from date of sale. Stop-over privileges will be allowed on going trip in territory to which the tickets are sold.

For further information call on or address ticket agents of connecting lines. Circulars giving rates and detailed information will be mailed, free, upon application to W. A. Thrall General Passenger and Ticket Agent, Chicago & North Western Railway, Chicago.***

The Lake Shore Route.

The Lake Shore Route, between Buffalo and Chicago, is celebrated all over the world as affording the embodiment of luxury in travel. Its new Day Coaches are sixty feet in length, and will seat fifty-eight people, comfortably. They are fitted with the Gould platform and automatic coupler, Westinghouse air brakes and signal, heated with steam taken from the locomotive, and at night are brilliantly lighted with Pintsch gas, for which purpose five elegant bronze chandeliers depend from the roof of the car.

The interior of the coaches is finished in mahogany, highly polished and paneled. Each coach has a nice lavatory and toilet. The latest models contain separate toilet rooms—one for ladies and one for gentlemen. The car seats are of the style known as the Mason tilting, with high spring backs and broad seats. They are richly upholstered in crimson plush. The windows, which are of plate glass, are large, and each is fitted with a spring-roller curtain, in shade to blend with the interior finish, and every feature is of the best.

The dining cars in service on the trains of the Lake Shore & Michigan Southern Railway are operated by the company. The cars are neat and tasty in all their appointments. Great care is exercised to provide the patrons of the Lake Shore Route with a service which shall prove satisfactory. As a result, dining on the trains of the road is accomplished in a very satisfactory and comfortable way.

The sleeping cars in service on the Lake Shore Route are of Wagner build. Ordinarily, they contain twelve sections a state-room, a smoking apartment, and toilets for ladies and gentlemen. In some instances, however, there are cars containing sixteen sections, the state-room being omitted. Every valuable device is embodied in their construction.

The Lake Shore operates a most perfect sleeping car service between the cities of Chicago, Cleveland Buffalo, New York and Boston, in connection with the New York Central and Boston & Albany Railways. This is not only the direct, best and only double track route between the cities mentioned, but the Lake Shore is the only line from Chicago conveying passengers into New York City without a ferry transfer.***