Street Railway Journal

VOL. XVI. NEW YORK AND CHICAGO, DECEMBER 1, 1900. No. 48.

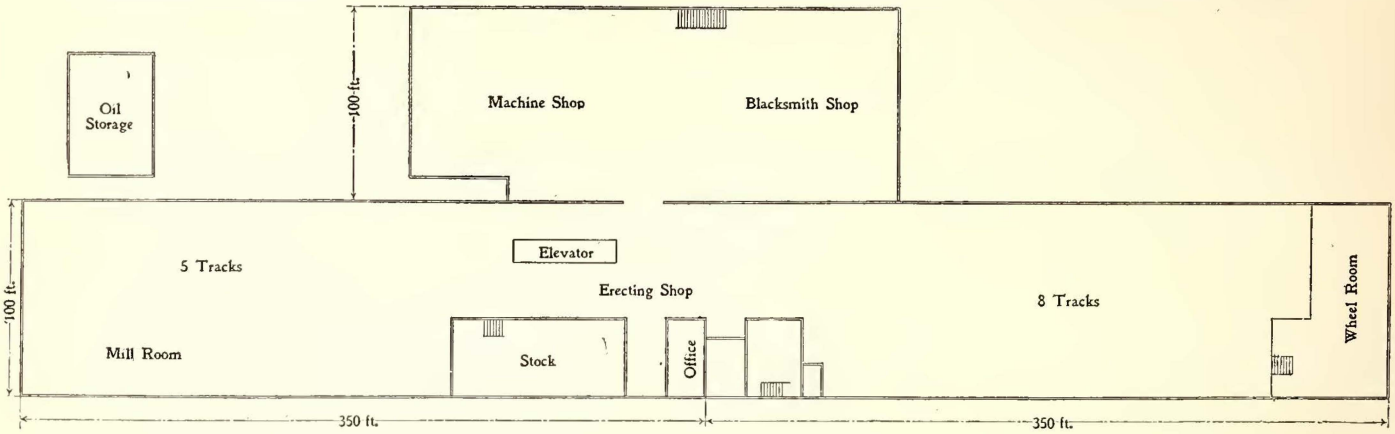
THE REPAIR SHOPS OF THE BROOKLYN RAPID TRANSIT COMPANY

The main shops of the Brooklyn Rapid Transit Company present to-day one of the most complete examples of modern methods in the systematic handling of street railway repairs. The shops are located at Fifty-Second Street and Second Avenue, South Brooklyn, near one of the company's largest power stations. They are the mechanical head of a system of auxiliary repair shops which includes eleven depot shops and four elevated railway shops, the entire system being controlled from the Fifty-Second Street office. During the past year the shops have been thoroughly reorganized and greatly extended, and, although there are still many contemplated additions to both buildings and equipment, the plant as it now stands is of such positive interest that it merits a comprehensive description. The engravings which accompany this article illustrate many of the novel features of the methods used in the shops, and the plans given will enable the reader to thoroughly understand the general arrangement. Two maxims have been adopted by which all work in the shop is guided: One is to move large material as seldom and as short a distance as possible, and the other to never pass the same point twice with any piece of apparatus under repair. The latter is as applicable to a description as to the actual work, and in the following outline of the methods employed the same general order is retained as is followed by the cars and equipments.

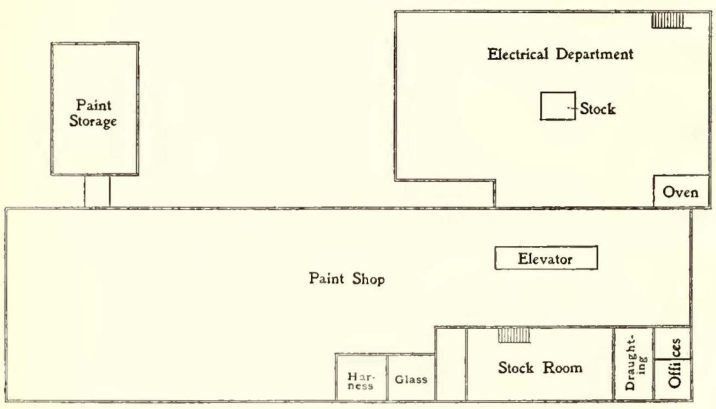
GENERAL VIEW OF ELECTRICAL DEPARTMENT

The cars are run into the shops from the Second Avenue end, there being five receiving tracks, holding from six to nine cars each, in the front part of the main floor, and eight tracks of about equal capacity in the rear portion. There are under construction pneumatic hoists, which are soon to be installed, which will be used to lift the car body from the

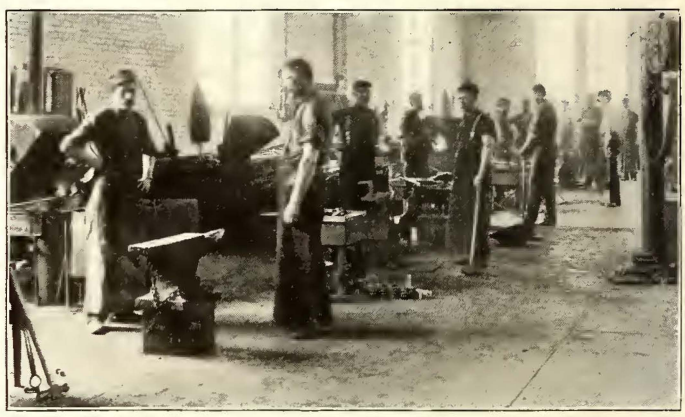
trucks. These can then be rolled on to one of the two electric transfer tables running across the shops, and transported to any desired point. The transfer table nearest the receiving tracks will carry the truck to a point midway between the machine shop and the blacksmith shop or forge room, where it can be run over any one of the fourteen repair pits, which is most conveniently located for the supplying of its necessary requirements. Here, the armatures, and, if necessary, the entire motors, are removed and the truck thoroughly renovated, the facilities for heavy repairs being close at hand in the machine shop and blacksmith shop. The latter is equipped with twelve down-draft forges, made by the Buffalo Forge Company, Buffalo, N. Y., which give excellent service. These forges are particularly adapted to work of this kind, as the entire absence of overhead draft tubes allows of much better illumination,



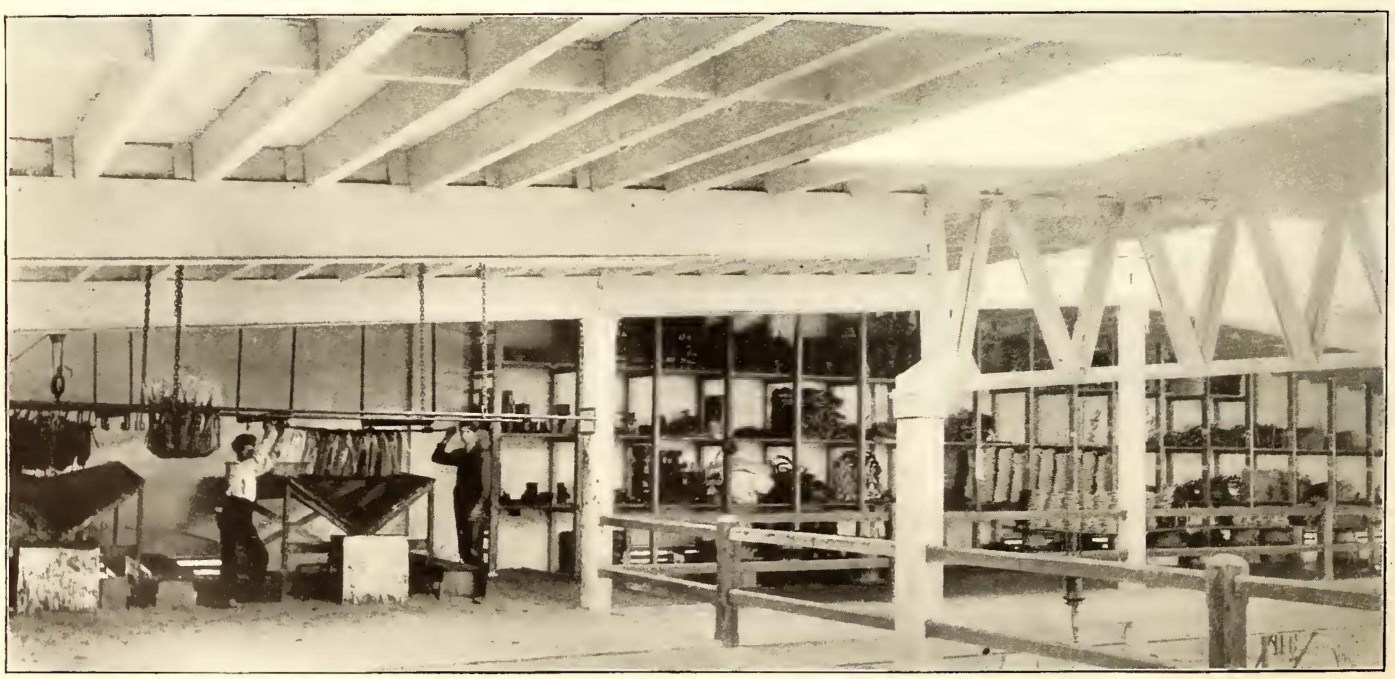
PLAN OF GROUND FLOOR



PLAN OF SECOND FLOOR

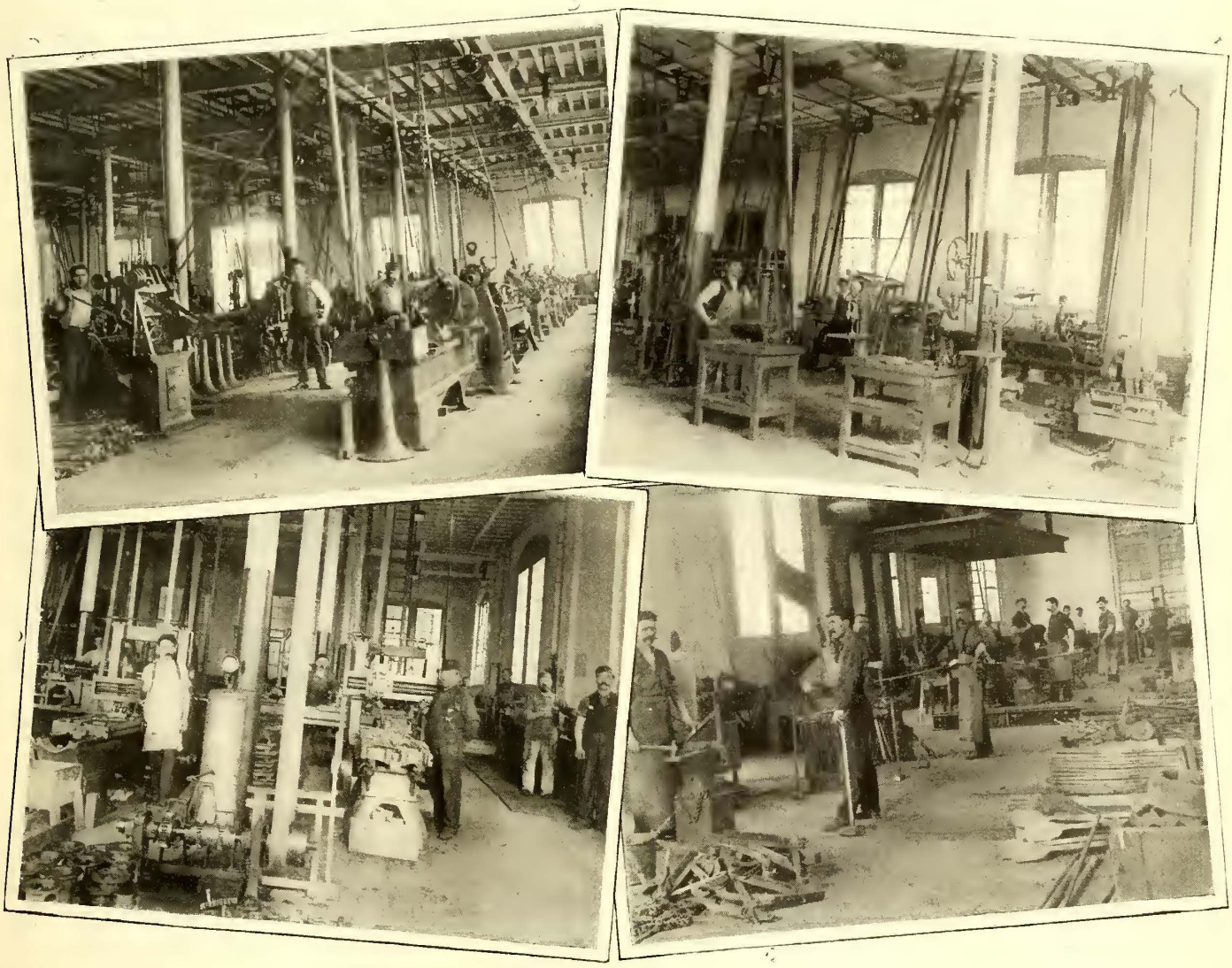


A LINE OF FORGES



GALLERY OF ELECTRICAL DEPARTMENT, SHOWING DIPPING VATS AND STORAGE RACKS FOR ARMATURE COILS

and the efficient regulation of the heat, which can be accomplished by the hood, enables the workmen to turn out the most faultless material. The mechanical draft for these forges, as well as for a large reheater used in bending motor-supporting cross bars, is furnished by the blower and exhauster, which are shown on the suspended platform in the illustrations of this room. These are both driven by a 25-hp General Electric motor. The blacksmith shop also contains a combination punch and shear, which will cut off a piece of iron 8 ins. by 1 in., and will punch a 1¼-in. hole in 1 in. iron. The machine which bends the motor-suspending bars after they leave the reheater mentioned above is known as the "Bulldozer," and its appearance and operation



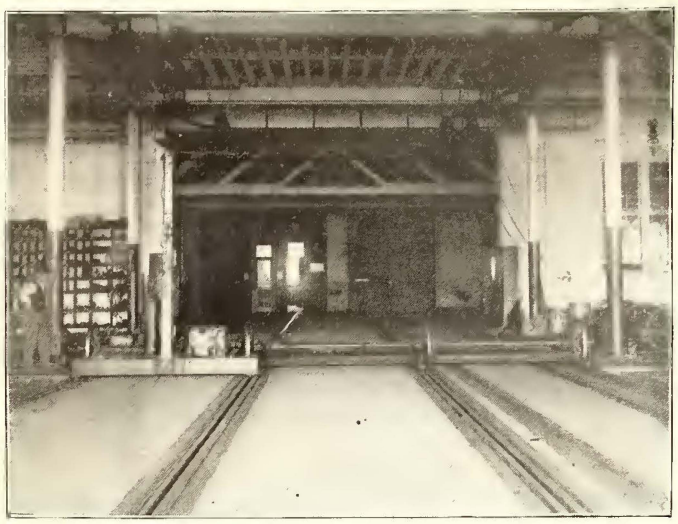
VIEWS ABOUT THE MACHINE AND BLACKSMITH SHOPS

surely merit the name; one man could formerly turn out three bars per day, whereas, by the use of this machine, sixty bars can be easily finished. The shop is completely equipped with steam and trip hammers, shears, punches, etc., so that every variety of repairs can be made. At the other end of the room, on the other side of the transfer table tracks, is the machine shop already referred to. This department contains lathes, shapers, slotters, etc., etc., of the best construction, and capable of handling a great variety of work. The machines are placed in line, and like machines are placed near together in order that one man can attend to two or more similar operations at once, thus rendering possible large economies in labor. Some of the work done in this department is of quite a heavy character, as many of the power station repairs are made in this shop. Among the special machines which are installed may be mentioned multiple drills, which will drill four holes at one operation, and turret and monitor lathes, finishing six operations without further attention as to chucks. The machinists are also employed in fare register repairs. At one side of the shop is a tool room, separated from the shop by a wire net partition; the tools being delivered to the workmen by a check system, which enables the foreman to account for the disposition of every article.

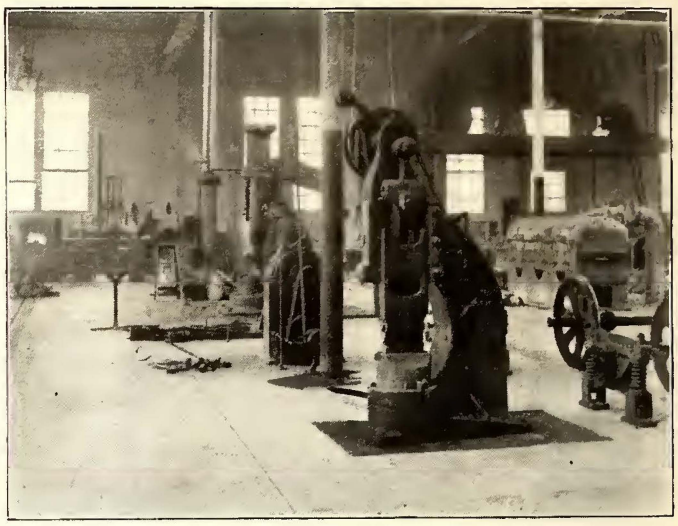
After the armatures and fields have been removed from the motors, they are taken up stairs on electric hoists to the winding room, which is immediately over the forge room. This department is large, light and airy, and the progress of the armature through it is so arranged that no interference or blocking occurs. The armature, after entering the room is thoroughly inspected, and a statement of necessary repairs made. It is then delivered to the winders, who are furnished with two pairs of the armature stands shown in the cuts. These stands are of a peculiar design, and give most efficient service. They consist of a heavy cast-iron base, with the fork and sheaves which support the armature shaft on the end of a longitudinal screw, thus enabling the height of the stand to be readily varied. The box, with which one of the stands of each pair is provided, forms not only a convenient receptacle for the workman's tools, but can be used by him as a rest or seat. It is a great advantage to supply each winder with two sets of stands, as the armatures are tested out thoroughly before leaving the stands, and if only one set per man was provided, he would necessarily lose a great deal of time during the testing op-

eration. With the present system, however, as soon as he is finished with one armature, he can immediately commence upon another. The armatures are moved about the shop on the carriages shown in the illustration, and their construction, as can be easily seen, is such as to facilitate greatly the handling of such heavy and delicate apparatus. While out of their shells, they are never placed directly upon the floor, but are either on the stands or else in boxes made especially for the purpose. These boxes provide for their safe transportation to any part of the shops or outside.

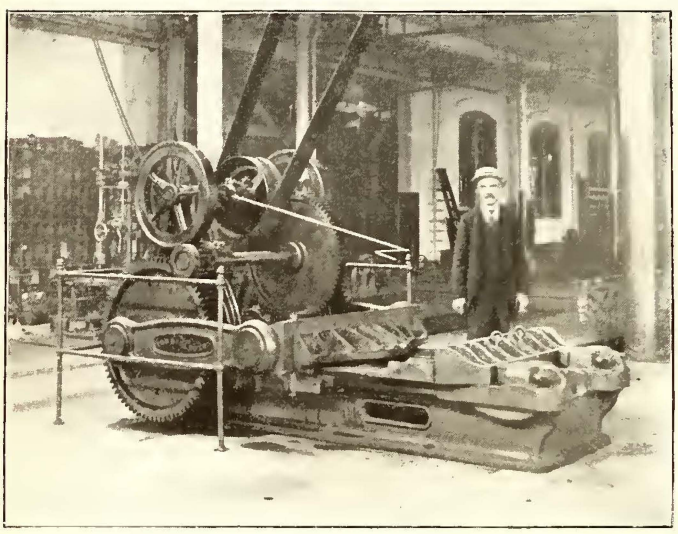
The coils are all wound in this room on the ordinary style of machines. After being wound they are placed upon a carriage, and conveyed by a hoist and overhead track to the dipping vats, which are placed upon the gallery of the room. The floor of the gallery, in the neighborhood of these vats, is covered with sawdust, which entirely pre-



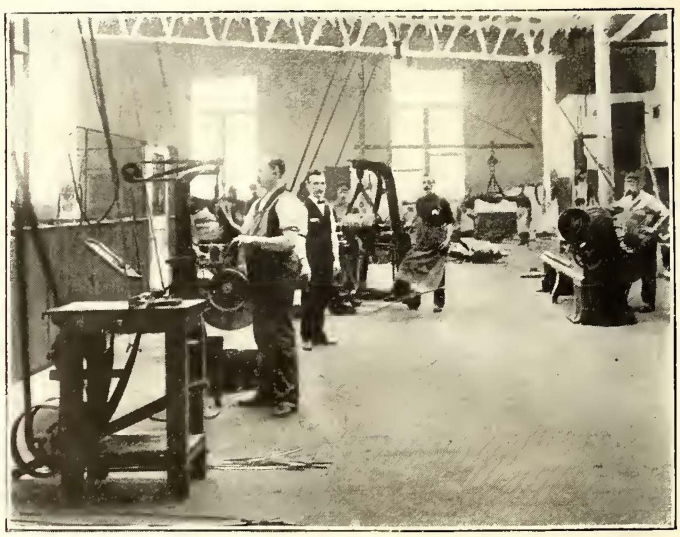
ONE OF THE TRANSFER TABLES



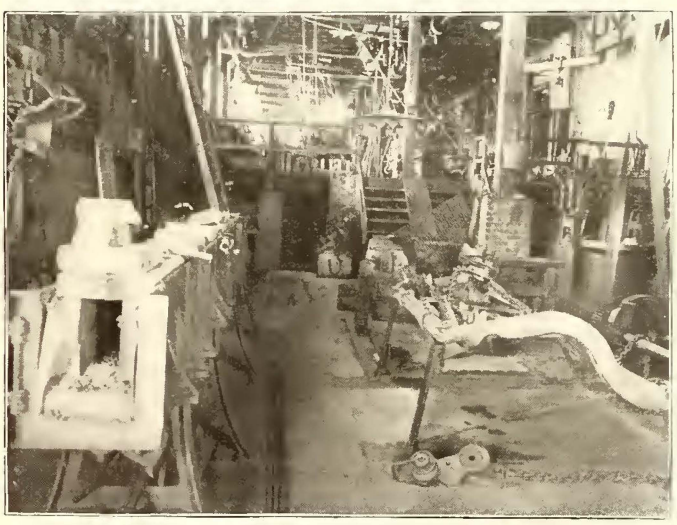
HAMMERS IN BLACKSMITH SHOP



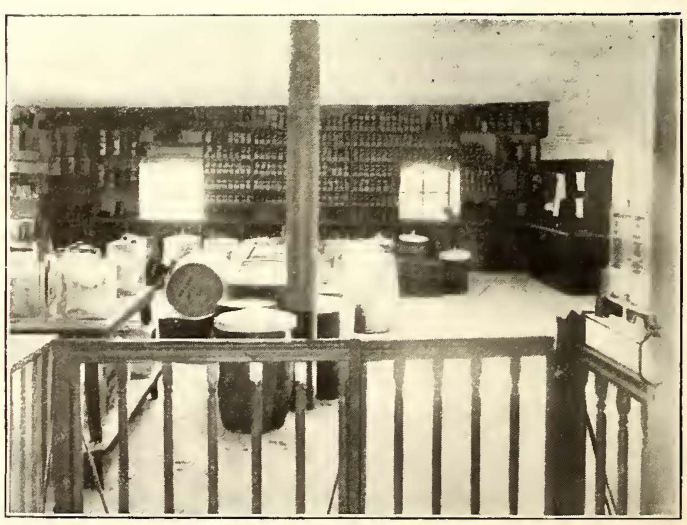
THE BULLDOZER



METHOD OF MOVING ARMATURES



FENDER BENDING MACHINE AND ELECTRIC HEATER



PAINT STORE ROOM

vents the workmen from tracking the insulation about the buildings. Both armature and field coils are placed in racks or separate divisions of the floor of the gallery, arranged according to their various types and sizes. Thus, when an armature is to be repaired, it is very easy to obtain the correct coils. In this room also are repaired controllers, resistance boxes, etc. On all the tables and benches are testing wires, the terminals of which have a potential of 500 volts. This enables the operator to quickly prove his work, and prevents him from allowing short circuits or other defects in the apparatus from being covered up as the work proceeds, with the consequent repetition of the repairs.

REPAIRING ARMATURES

The baking oven in one corner of the room is sufficiently large to never hold the work back, and is kept continuously at a temperature of 200 deg. F., which is produced by steam pressure of 60 lbs. in a system of heating pipes. In the center of the room is an auxiliary stock room, which is supplied every three days from the main stock room with materials likely to be used in this department. The top of the racks in which this auxiliary stock is kept is used by the foreman as his office. He thus not only keeps directly in touch with the distribution of material, but at the same time has a comprehensive view of his entire force of workmen.

Returning now to the car bodies, which have been lifted from the trucks by pneumatic hoists on the receiving tracks, a description of the mill room, which is adjacent, is in order. This shop contains cut-off saws, planers, etc., the machines being staggered so as to prevent, as far as possible, interference of the long pieces of lumber which it is desirable to handle. The floor of the mill is made of concrete, and a rotary blower furnishes an exhaust for the blowing out of shavings and sawdust. The power for the machines is furnished by a 100-kw Edison, bipolar, undertype motor, which is enclosed in a wooden closet or box in the center of the room. This box is so made that in case of an accident to the motor its sides can be readily detached from one another, and falling out, leave it entirely exposed.

After the motor parts have been returned to the trucks and the latter painted, it is run under the car body, and the complete car taken to the paint shop on the floor above the receiving tracks. This is accomplished by an electric elevator, which delivers the car to an electric transfer table, from which it can be run on to the most convenient track of the paint shop. Overhead trolley wires are provided so that the car is run by its own power. Adjoining the paint shop is the "harness" shop, where all leather work, such as repairing window curtains, hand straps, etc., is done, and the glass shop.

Near the offices, which are situated about the center of the main building, are the men's locker rooms, and above them the pattern room. This latter, as well as the blue-print and draughting room, is in charge of Charles Peterson, and a complete system of receipt tags is employed for accounting for each pattern. Behind the locker room is the foundry and wheel room, which also contains the fender bending machinery, shown in one of the views. This machine bends the steel tubing for the fender in one operation, taking it from the electric furnace shown on the left, which has heated it to redness.

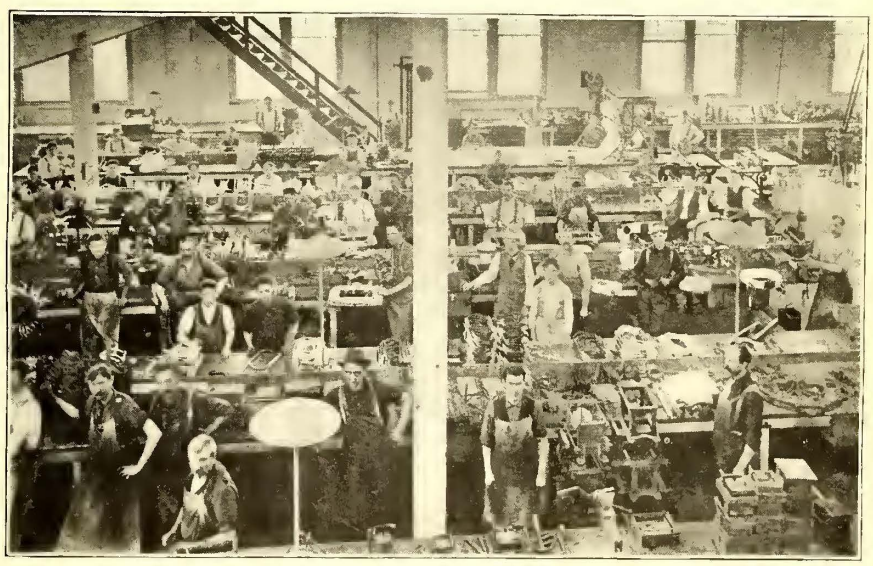
The following is a list of the tools in the different departments:

Blacksmith Shop.

1 steam hammer.
1 trip hammer.
1 combined punch and shear.
1 separate power shear.
1 separate power punch.
1 "Bulldozer."
2 drills.

Machine Shop.

1 multiple drill.
1 power punch, shear and die cutter.



WINDING AND TESTING ARMATURE COILS

1 automatic hack saw.
11 lathes.
1 monitor lathe.
3 shapers.
3 automatic tool grinders.
2 planers.
4 milling machines.
9 drills.

4 bolt cutters.
3 double-spindle sensitive drills.

Mill Room.

1 swinging cut-off saw.
2 surface planers.
3 slitting saws.
2 molders.
1 jointer.
1 sandpapering machine.
3 gang saws.
1 single spindle shaper.
1 double spindle shaper.
2 vertical mortising machines.
1 hollow chisel mortising machine.
2 tenoning machines.
2 side lathes.
2 knife grinders.
2 boring machines.

Wheel Room.

1 axle lathe.
2 wheel boring machines.
2 hydraulic presses.

The stock room, under the charge of W. J. O'Connor, contains everything which is required for the entire Brooklyn system. It is, in fact, the main storage for the Fifty-Second Street repair shops, as well as for the fifteen auxiliary shops distributed throughout the city. The system of accounting is most complete, and the arrangement of the stock has been greatly simplified. Heavy stock, such as gears, iron castings, etc., are received in a yard adjoining the shop, which is surrounded by bins. This yard is tracked and floored so that either cars or wagons may be used to deliver the material. In the center of the yard is a fireproof, brick, two-story building, the first floor of which is used for lubricating oils, and the second story for paints, varnishes, etc. A complete system of overhead tracks and differential pulley blocks facilitates the handling of the heavy oil barrels. Lumber is racked according to size in an adjoining yard, a large stock being always on hand. Scrap is all carried to a location convenient to the street, and is removed from the premises daily.

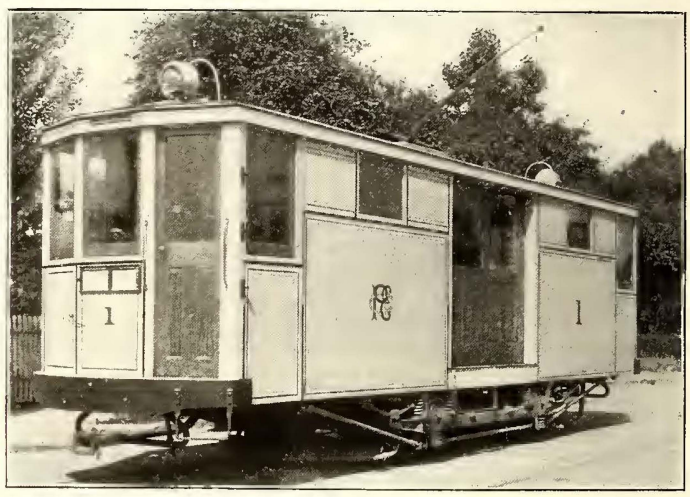
The work done in the shop is almost entirely on the piecework system, only the laborers who are used for transferring apparatus from one part to another being paid by the day. The satisfactory operation of this system is largely due to the care taken to never enforce idleness upon a workman, nor to have one employee delayed by the operation of another. The precautions taken to avoid danger from fire are most complete. Fire plugs are distributed throughout the buildings, upon which weekly tests are made, and these plugs are manned by three workmen when an alarm of fire is turned in.

The entire work of reorganizing the shops was planned by Eugene Chamberlain, superintendent of equipment, and has been carried out under his personal supervision. Mr. Chamberlain's long experience in steam railroading has given him a thorough understanding of the value of detail and small economies, and in every part of the shop one finds typical examples of efficient management, giving to one of the largest street railway systems in the world the means of repairing and renovating its cars and equipments in a systematic and efficient manner.

The Street Railway Express Service in Pittsburgh

The Pittsburgh Express Company, Pittsburgh, Pa., is now conducting an electric express car service with most satisfactory results. There are at present in operation ten cars of the type shown in the accompanying engraving, which have a capacity of 8 tons each. The length of the cars is 29 ft. 10 ins. over all, and they are equipped with a single truck, having 7½-ft. wheel base and 33-in. wheels, with 3½-in. journals. This car has a solid bulkhead in each end, thereby forming a vestibule, or cab, for the motorman and messenger, which is necessary to avoid the shifting of the load on heavy grades. The style of car adopted suits the purpose, and gives good results in operation. However, as the main problem is always to cheapen the cost of transportation, if the conditions are such that double-truck cars can be used advantageously, and the traffic of such a character as will warrant it, a car of greater length would be more desirable, as it gives greater capacity and reduces the cost of operation.

The company is now making an average of sixteen round trips per day to seven different terminals, at distances of 7 miles to 14 miles, and a total daily mileage of 270 car miles,



PITTSBURGH EXPRESS CAR

or 7020 car miles per month. It handles both express packages and heavy freight of all kinds. Packages that are collected by the company's wagons and delivery completed at destination by wagon are classed as express, while goods that are brought to the station and are either called for at destination station or delivered along the line from the car, are classed as freight. There is a central downtown warehouse, equipped with offices, high platform, and a double track running into it, where the express that is collected by the wagons is received and loaded into cars, and also where shippers deliver their freight for forwarding by car to different points reached. Other stations at certain points in the city, as well as in the surrounding towns, are supplied with wagon equipment, and make delivery and collection within certain limits. The express rate is about the same as is charged by regular express companies operating over steam railroads, and runs from 20 cents to 35 cents per 100 lbs., according to the distance hauled, and for packages less than 100 lbs., the rate is graduated to a minimum of 10 cents. All express and freight are receipted for in accordance with the ordinary practice of express and freight companies, and are manifested, and a receipt taken from consignee in the usual way. While the schedule provides for as many regular trips as the traffic warrants, special cars are sent out any time when there is a carload.

On level and through runs, when there is not too much local street delivery, express trailers can be operated satisfactorily, even during the busy part of the street car day, and for night runs their use is a great aid in reducing the cost of transportation. C. V. Wood, general manager of the Pittsburgh Express Company, has taken a great interest in this work, and it is largely due to his efforts that the system is in its present successful state.

The Fond du Lac Street Railway and Light Company

The city of Fond du Lac, Wis., in June, 1900, had a population of some 16,000, but those figures by no means indicate the city's future. The location of the Wisconsin Central car shops there has given the place an impetus such as few towns of its size ever get, and will probably insure a population of from 20,000 to 25,000 in the next decade. The car shops' plant, when completed, will be among the finest in the United States, if their size be taken into consideration. Before work was commenced on them great care was taken to have the plans as near perfect as possible, that every up-to-date feature of value might be included, and, as a result, the shops will be models in every way. This fact testifies to their permanency in this locality and their beneficial influence on the town.

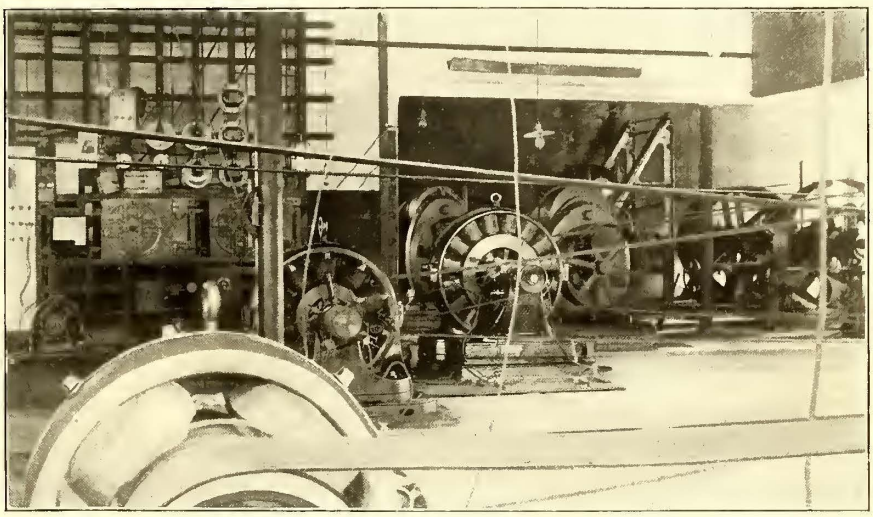
While thus starting out on a new growth in a most substantial way, Fond du Lac has lost none of its prestige as a summer resort. Situated at the head of beautiful Lake Winnebago, it is in itself an ideal summering point for all who love water, woods and parks, while all along the east shore of the lake are clusters of cottages, besides the more pretentious resorts of Lakewood, Taycheedah and Winnebago Park. All of these it is expected will, at no distant day, be connected by an electric railway line, which, in connection with the city lines, park lines and the North Fond du Lac line, will constitute a system of considerable proportions.

The Fond du Lac Street Railway & Light Company was organized April 1, 1899, at which time it consolidated with the Fond du Lac Electric Company. This latter company had just received a fifty years' franchise from the city of Fond du Lac for electric railway and for electric and gas lighting, and also controlled the entire electric lighting system of the city. The new company immediately commenced the construction of a street railway system extending from Lakeside Park on the north to Athletic Park on the south, traversing the entire city, the line being opened for traffic June 27, 1899. In December 1899, construction was commenced on the extension of the line to North Fond du Lac, the new home of the Wisconsin Central car shops. This road was opened for traffic Jan. 21, 1900, the entire line having been built during the months of December and January, a rather unusual achievement in that climate of severe winters. In this instance, however, there were few interruptions on account of weather, or for any other cause, and exceptional rapidity of construction was made possible.

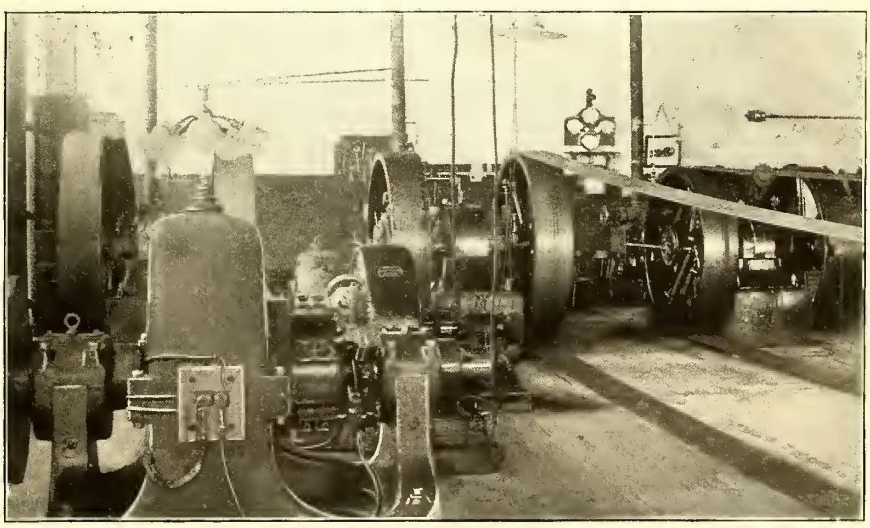
The power station is of brick, and is situated on West Rees Street, near Main Street, and along the tracks of the Chicago & Northwestern Railroad and the Chicago, Milwaukee & St. Paul Railroad, almost in the center of the city. Its general dimensions are 100 ft. x 150 ft. It is not only a power house for the street railway, but from it is furnished the current for private and city lighting and power, which consists of 190 2000-cp arc lights and 8500 incandescent lamps, as well as about 150 hp in small motors.

There are at present four 16-ft. x 6-ft. return tubular boilers and one Aultman & Taylor horizontal type water tube boiler with 3000 sq. ft. of heating surface. The latter boiler has recently been installed, and is so located that all future boilers to be added to the plant will be of the same type.

The engines, which are all compound condensing, consist of three 9in. x 13-in. x 12-in. Ball tandem-compound, which were originally installed for the lighting system; one 16-in. x 30-in. x 36-in. tandem-compound Corliss engine, manufactured by the E. P. Allis Company, of Milwaukee, belted to a 6-in. Hill self-oiling countershaft, and a 16-in. x 30-in. x 36-in. cross-compound Corliss engine manufactured by the Allis Company, direct belted to a 250-kw, three-bearing Westinghouse railway generator, and a 75-kw, 500-volt Western Electric power generator. The condensing apparatus consists of one 500-hp jet condenser, manufactured by the Buffalo Steam Pump Company, installed with the original lighting plant, and one 600-hp jet condenser, manufactured by the Dean Steam Pump Company, of Holyoke, and recently added.



SWITCHBOARD AND LIGHTING GENERATORS



RAILWAY GENERATORS

Including the machines mentioned above, the electrical equipment consists of one 250-kw generator, one 100-kw generator, and one 75-kw generator, all of 550 volts; two 125-light Western Electric, latest type, bipolar are dynamos; three alternators and one 50-kw, 500-volt motor,

which operates a 50-kw alternator for day lighting. By this latter arrangement the entire day load is carried by the cross-compound Corliss engine, the motor receiving its power, as well as all other small motors in the city, from the power generator, which is operated independently of the railway generator, and is a metallic circuit. It is usually

WAITING STATION AT PARK TERMINUS

supposed that operating lighting machines from railway engines will show considerable fluctuation, but in this instance, the engine being of the cross-compound type and having a very heavy fly-wheel, the regulation is very close. The motor which drives the alternator is a shunt-wound machine, and is operated with a weak field, the change in voltage on the lighting circuit never being more than 2 per cent, with a variation from no load to full load on the engine.

This equipment is entirely new, the engines, generators and motors having only been started within the past few months, and has proven a valuable and economical addition to the plant. It should be borne in mind that the present power house has been added to the equipment of what was formerly the Fond du Lac Electric Company's lighting plant, it being necessary to keep the lighting plant in continual operation during the extension. Both the lighting plant and the railway plant are kept in operation during the entire twenty-four hours, making it necessary to install new machinery, piping, etc., without shutting down. The steam piping has been entirely rearranged with all high-pressure pipe and fittings, and Crane extra-heavy valve guaranteed for a pressure of 250 lbs. to the square inch. The average steam pressure carried is about 140 lbs. per sq. in.

The overhead construction is principally side-pole construction. The poles are of cedar, and are 30 ft. long with 8-in. top, the first 8 ft. above ground being painted black and the rest white. No. 00 trolley wire is used throughout the entire system, double wire being used from the power station to the junction of the North Fond du Lac and Lakeside Park lines at Scott Street, thus dispensing with feeder wires and overhead switches. All bells, ears, etc., were manufactured by the Ohio Brass Company.

Both double and single track are used. Within the city proper the streets are paved with cedar blocks. Here 80-lb., 7-in. girder rail is used in 30-ft. and 60-ft. lengths. The line to North Fond du Lac and to Lakeside Park is 60-lb., 30-ft. T-rail. All bonding is with No. 0000 Atkinson bonds. Cedar ties, laid on 2-ft. centers, are used throughout the entire system.

The road is practically level, the steepest grade not being more than 1 per cent. During the summer months the traffic is exceedingly heavy, considering the population of the city, cars being operated with trailers during certain hours on six-minute headway. The drop in voltage on the line at the extreme terminus, which is about 5 miles from the station, is about 50 volts. At the present time the company operates nine closed, full-vestibuled motor cars, manufactured by the American Car Company, of St. Louis, with rattan cross reversible seats. Seven of these are equipped with Peckham 7-B trucks and Westinghouse 12-A 30-hp double-motor equipment, with K-10 controllers, while two are equipped with the American Car Company's maximum traction, double trucks and 38-A 50-hp West-

STANDARD OPEN AND CLOSED CARS

inghouse double equipment, with K-11 controllers. There are also operated four 10-bench, reversible seat, open cars equipped with Edison No. 6 motors, three closed trailers with side seats, and two open trailers with ten reversible benches. The latter cars were manufactured by the Stephenson Car Company.

The company proposes to erect extensive car houses and repair shops, as well as a new office building in the near future. This new building will be located at the corner of Main and Rees Streets, adjacent to the power house, and will occupy a space 110 ft. x 170 ft. Many important extensions have also been planned for the future.

The line at present passes through the business district of the city, reaching all the principal hotels and business houses, as well as Athletic Park and Ingram's Grove on

the south, Lakeside Park on the north, and Central Park and the Wisconsin Central car shops at North Fond du Lac. Band concerts are held at Lakeside Park weekly, and sometimes oftener. Besides this, other forms of entertainment are provided at this delightful park, and at such times the patronage is so large that the street railway is taxed to its utmost capacity. The line to North Fond du Lac is exceedingly well patronized at all times, cars being operated all night on this line in order to accommodate train crews, etc. On mornings and evenings it is necessary to use trailer cars, while trailers and extra motor cars are also pressed into service on Sundays and holidays.

The officers of the company are: T. F. Grover, president, under whose direct management the system was planned and built; William E. Cole, secretary and treasurer; F. M. Bingham, chief engineer at power station.

Demerara Electric Company, Ltd., of British Guiana

This month has seen the completion of the first standard, up-to-date trolley road and electric plant in northern South America. Montreal capitalists have undertaken it.

The city of Georgetown and suburbs has a population of about 75,000, consisting of English, Dutch, French, Spanish, Portugese, East Indians, etc. It is well laid out, with broad streets and avenues at right angles, many being 80 ft. and 120 ft. wide, with fresh water canals in the center.

This Canadian company was formed with Sir William Van Horne as president, and bought the existing electric plant and mule tramway with their rights. The old track, although only down two or three years, was taken up, and 11 miles of 62-lb. rails were laid on steel ties, with tie-rods —the whole being imbedded in solid concrete stringers, 20 ins. x 10 ins. The poles are of steel, and no wood is used either above or below ground. This makes a track of great strength and rigidity, besides being very smooth running, and with great wearing power, as the entire rail and joints are equally supported on concrete.

The company has a contract for city lighting, and a large number of lamps are in circuit for private houses and stores. The company has a capital of $850,000, with $500,000 5 per cent bonds.

The franchise, like that of the West Indian Electric Company, Ltd., of Jamaica, is for thirty years, but subject to renewal every twenty years, unless the government buys the company out. Thus there is always an alternative. Fourteen eight-bench open cars will run all the year round, as Demerara is close to the Equator, with a daily temperature of 85 deg. to 90 deg. for the twelve months. The power station has seven engines, of about 1300 hp, with B. & W. and Stirling boilers.

An Electric Railway in Corea

The Seoul Electric Railroad is the only electric road in Corea, and was the first railway of any sort to be built there. It extends from the Queen's Tomb, east of the city of Seoul, through the center of the city, and beyond the southern wall to the Han River. The main line runs through the east and south gates, while a branch line runs through the west gate, and nearly surrounds the terminal of the Seoul and Chemulpo steam railroad, which is located just outside the city walls on the southwest. The total length of the road is 10 miles, 5 miles of which are inside the city walls and 5 miles outside. An extension from the Queen's Tomb eastward to Toksoh, a great distributing center, 6 miles away, on the Han River, is now being constructed.

The roadbed is comparatively level. The heaviest grade is one of 5½ per cent, half a mile long, near the west gate. Besides this there are one or two small hills. The gage is 3 ft. 4 ins. There are some pretty sharp curves, two or three on a 60-ft. radius, being made necessary by the peculiar defensive work in front of the city gates. One of these curves, near the east gate, is shown in the illustration. The cars are 28 ft. long, single truck, combination, open at both ends, after the manner of California cars. The power house is located just inside the east gate. The equipment consists of five units of 230 kw, and one of 175 kw. These are double-current machines, supplying both direct and alternating current, the latter being used for lighting the city and palace at night.

The road is owned by the Corean government, but was built, and is still operated, by Collbrand & Bostwick. The road carries about 110,000 people per month, out of a total

ELECTRIC CAR AT SEOUL

population of about 400,000. Besides the passenger traffic the road handles a large quantity of freight from the river and the railroad terminal. The road is divided into six sections, and the fare is 5 sen, or 2½ cents, on each section, making 15 cents for the whole line. The motormen and conductors, which were at first Japanese, are now entirely Coreans. The employees at the power house, car houses, etc., are Americans, supplied by the Market Street Railway Company, of San Francisco. The cars are run at the rate of 9 miles an hour inside the city wall, and 17 miles an hour outside the walls, and are operated from 6 a. m. until midnight.

The prejudice of the people against the road, which was very strong at first on account of a superstitious belief that the power house was the cause of a dry season, has now almost entirely disappeared. Only one serious disturbance has occurred. At that time two of the cars were burned and several demolished by the mob, partly because of the above mentioned superstition and partly on account of the accidental killing of a boy by one of the cars.

The South Orange & Maplewood Traction Company, of Orange Valley, N. J., has decided to enter the freight business, and it will be first electric railway company in New Jersey to make this a feature of its business. The line extends from Orange to South Orange, chiefly over a private right of way, and connects at Main Street, Orange, with the Orange branch of the Greenwood Lake Railway, which is owned by the Erie Railroad. The company will construct sidings in the different towns through which it runs, and will haul freight and coal cars direct to their destination.

PROCEEDINGS OF THE INTERNATIONAL STREET RAILWAY CONGRESS

(From Our Own Correspondent.)

The official programme of the International Street Railway Congress, held in Paris in connection with the Paris Exposition, was published in the Street Railway Journal for April, and abstracts of the papers presented have been published in subsequent issues, most of them in November. The date of the meetings was Sept. 10 to 13, and the sessions were held in the "Hall of Congresses," located on the Champs de Mars, Paris. The "Congress" was organized under the auspices of the International Street Railway Association, which comprises most of the important street railway companies on the continent of Europe, and which holds regular biennial meetings in various cities in Europe. The last convention of this association was held in Geneva in 1898.* At the time of the Geneva meeting it was decided to hold the 1900 convention at Paris during the time of the Universal Exposition, and make the session an International Tramway Congress.

A committee of organization was appointed as published in these columns during September of this year. Pierre Baudin, Master of Public Works in France, accepted the position of Honorary President of the Congress. The different governments of Europe and that of the United States appointed delegates, selected for the most part from prominent representatives of the industry. Those from the United States were Col. Truesdell, of Washington; Prof. Wilkins, assistant in the Department of Transportation in the Paris Exposition, and W. Allen, secretary of the Massachusetts Railroad Commission.

The number of persons attending the Congress was about 500. Throughout the work of the organization was excellent, and great interest was taken in the questions treated. Much of the credit for this is due Messrs. Géron, of Cologne, and Nonnenberg, of Brussels, the latter secretary of the association, who had charge of the very difficult work of translating alternately into German and into French all of the reports and discussions. The papers and reports themselves were published in both languages, as were also the extended appendices which accompanied all of the papers. The delegates themselves, in speaking and in discussing the questions, used the language with which they were most familiar.

Through the courtesy of Mr. Fuster, general secretary of the French Street Railway Association, and who also acted as chairman of the executive committee, and in this capacity had charge of the social end of the convention, this portion was very successful. The excursions were undoubtedly the most interesting of any which were held during the different congresses at the Universal Exposition, and all the attendants took back an excellent remembrance, not only of the social side of the convention, but also of the technical questions which were discussed.

On Sunday, Sept. 9, an informal reception was given at the Continental Hotel, for the purpose of making the delegates acquainted with each other. An attractive lunch was served and music was discoursed during the reception.

On Monday morning the Congress held its first session, and the delegates were called to order by the representative of the Minister of Public Works, Mr. Pérouse, Councillor of State and Director of Railways. In a charming address Mr. Pérouse welcomed the delegates in the name of the French government. He referred to the great mission which the street railways were carrying out, and especially those operated by mechanical traction. Public officials, he stated, took a great interest in this industry, and the proceedings of the Congress would be followed with great attention. The government would appreciate especially any study which might be given by the Congress to questions relative to tramway legislation. Most of the existing statutes on this subject were based on antiquated methods of operation, and many of them were not applicable to those of the present day. This was particularly true in regard to interurban and long-distance lines, which had come undoubtedly to remain. The French law of June 11, 1880, for instance, made no difference between the city and the interurban railway, in which the methods of operation are now so dissimilar. Mr. Pérouse thought that sessions of the International Street Railway Association, in the future, would undoubtedly have to be held annually.

HALL OF CONGRESSES, IN WHICH THE STREET RAILWAY CONVENTION WAS HELD

After this address Mr. Pérouse resigned the chair in favor of Mr. Janssen, chairman of the committee on organization, after which the list of chairmen for the association was announced. It comprised the following:

For chairman of the association on Monday, Mr. Aigoin; for chairman of the association on Tuesday, Mr. Lavalard; for chairman of the association on Wednesday, Mr. Lévy. The association was presided over on Thursday by Mr. Janssen himself.

The business of the association was then immediately commenced. Abstracts of the papers and reports presented to the association have already been published, and the discussions to which these gave rise are given later in this article.

On the afternoon of Monday the delegates visited the power station and the plant of the Metropolitan Under-

*See Street Railway Journal for December, 1898.

ground Railway of Paris, the exposition at Vincennes, the Bastille—Charenton electric tramway and the electric tramway of the Est Parisien Company, which is equipped with the Diatto system. On Tuesday the City Council of Paris received the delegates in its magnificent rooms in the Hotel de Ville. From here the delegates went by special boats to visit the electrical plant and line of the Orleans Railroad Company. On Wednesday a visit was made to the compressed air power station at Billancourt, and to the Westinghouse electric power station which supplies current to the Ouest Railroad Company and to the cars of the Tramway Company of the Ouest Parisien, and of the left side of the river. A lunch awaited the delegates at the Billancourt power station, and they were shown around this plant. On Thursday the system of the Northern Tramways Company and of the Company of Mechanical Tramways of the Environs of Paris received the delegates, carried them over their lines and took them to St. Germain-en-Laye. The cars were decorated with flowers and presented a tasteful appearance. Upon arriving at St. Germain the delegates were met by the municipal officers, and were tendered a lunch at which high-potential champagne, at great frequency, was served. On Thursday evening a banquet was held, at which nearly the entire number of five hundred delegates were present. It was extended to the delegates by the French Street Railway Association in the large Salle des Fêtes of the Palais d'Orsay at the terminus of the electric railway at the Orleans depot. On Friday an excursion was made to Versailles and the Trianon by means of the compressed air cars of the General Omnibus Company. All of these pleasant meetings and excursions contributed not a little to the charm of the Congress, and the termination on Friday caused general regret to all the delegates. There was a feeling of satisfaction, however, at the thought that a great deal of valuable work was done by the association in the business meetings, and this portion of the proceedings will now be described.

In the meeting on Monday the first paper presented was that by Messrs. Géron and de Pirch. On Tuesday, reports of Messrs. Gunderloch, Thonet, d'Hoop, Van Vloten and Fischer-Dick were given. Wednesday was devoted entirely to the discussion on the report of Messrs. Broca and Johannet on accumulators. On Thursday the four remaining papers were received and discussed.

I. STREET RAILWAY FARES

MR. GERON read his report in French; it was then translated into German. He considered the consequences occasioned by the recent general reductions in tramway fares which had been made in Europe, basing his paper on the replies received to a set of questions which he had sent to the companies of the International Street Railway Association. The conclusions, which he gave at the end of his paper, and which he requested the association to adopt as its sentiments, were as follows:

1. The fares to be charged upon city tramways ought to be simple and low; their actual amount must depend upon local conditions.

2. For large cities it is best, as a general rule, to have a considerable area, covering the greater part of the center of the city, in which a uniform fare is charged, but this fare is not to include transportation on the suburban lines.

3. The general use of transfers (or "correspondence", tickets is to be recommended. There are places, however, where an additional fare should be charged for a transfer. (The word "correspondence" cannot be exactly translated by the English word transfer, as a "correspondence" ticket, under the usual European rule limiting the carrying capacity of cars, can be used for passage only if the second car which the passenger wishes to board is not already filled to its capacity.)

MR. MONMERQUE, operating manager of the General Omnibus Company, of Paris, spoke against the third conclusion. The association, he thought, ought not to accept this, especially when stated in so positive terms. He thought that the expression "transfers are to be recommended" should be modified. This proposition is not true in all cases; in fact, it is a debatable question. In many cases the transfer system has undoubtedly been of great service. It has been the means of popularizing and developing the traffic on omnibuses and tramways in cities

THIRD-RAIL SYSTEM, OUEST RAILROAD CO. EXPOSITION TERMINUS

where it has been adopted, but these conditions are never the same, and there are many drawbacks. In every case where they have been adopted, transfers have also proved a source of great trouble in operation, on account of the supervision and inspection which they entail, not only on the public, but also on the employees. The loss of time to both public and company, which results from their use, is also considerable. In conclusion, M. Monmerqué demanded that the third conclusion ought to be modified before being adopted by the association.

MR. LAVALARD, associate manager of the General Omnibus Company, of Paris, expressed himself as of the same opinion as Mr. Monmerqué. He admitted that the transfer system was serving an excellent purpose. It might have been indispensable, while cars were run exclusively by horses, and each line had to be necessarily of short length. With mechanical traction, however, the companies were giving much longer rides for the same fares, so that there was no longer the same reason for giving transfers. Mr. Lavalard had made a number of trips into foreign countries, and had studied the subject of the use and growth of transfer systems. He remarked that while it was possible to create a system of transfers which would obviate, to a

large extent, any great loss of time, he did not believe that such a system was universally applicable, and particularly that it could not be used in Paris.

Mr. Thonet, general manager of the Liége tramways, also expressed the same opinion as the two preceding speakers. Any transfer system is vulnerable to numerous frauds. Where fares are low it should be possible to dispense with the issuing of transfers. The speaker had also given considerable attention to the subject of trying to devise a system of transfers which would get rid of the most serious objections to the system, but he acknowledged that up to this time he had not been able to find or invent any system which would give satisfaction.

Mr. Grialou, manager of the Lyons tramways, made a particularly interesting contribution to the debate, for he had collected and presented to the Congress various figures and results derived in actual practice by the Société des Omnibus et Tramways de Lyon, of which he is manager. He stated that his annual receipts, under the fares formerly charged, reached from f.5,500,000 to f.6,000,000 ($1,100,000 to $1,200,000). Then the fares were lowered to f.0.10 (2 cents) for second class and f.0.20 (4 cents) for first class. As a result, the average receipts per passenger carried amounted to only f.0.085 (1.7 cents) on account of the employment of transfers. The loss of receipts which resulted was then from f.500,000 to f.600,000 ($100,000 to $120,000). But this was not all; the frauds practiced on the company were considerable. It was impossible to make sure that the passengers would use their transfer tickets from the transfer point, and that they would use them immediately. It was also impossible to make sure that the conductors themselves did not turn in to the head office transfers instead of cash fares received, or else did not exchange transfers with the conductors of connecting lines, and then turn them in in the evening in the place of cash. To determine how much of this was being done, and to find out a way to stop it, the company employed from 150 to 180 inspectors to check up the transfers and eliminate fraud if possible. As each one of these inspectors was paid annually f.1,800 ($360), the company's expense for this item alone was about f.300,000 ($60,000) per year. The total loss caused to the company by the employment of the transfers was then not far from f.1,000,000 ($200,000) per year. This expense was not justified, for without transferring the public can travel from 10 km to 12 km (6 miles to 8 miles) for 10 centimes (2 cents). Under these conditions the earnings of a company are not satisfactory.

Mr. Köhler, manager of the Grosse Berliner Strassenbahn, expressed the same opinion as the preceding speaker. He did not believe in introducing a general system of transfers. When the fares charged on street railway lines are high, they might, perhaps, be lowered, but when the fares are reduced, as they have been in Europe during the few years, it is impossible to allow passengers to transfer one or two times without paying an additional fare. In Berlin it is possible to travel 20 km for 10 pfennigs (12½ miles for 2½ cents). This fare does not carry with it any transfer privileges. Mr. Köhler demanded that the association should not recommend the employment of transfers.

Mr. Debray, manager of the Ouest-Parisien tramways, remarked that the proceedings of the Congress were read with great interest by the public, and that it would be very undesirable for the Congress to pass a resolution indorsing transfers, for the public would then consider itself justified in opposing any decision adverse to transfers on the part of any tramway company.

Mr. Scheidtweiler, official delegate from the municipality of Cologne, expressed himself in the same way as Mr. Debray, but from the standpoint of a municipal officer. Municipalities do not wish to impose impossible burdens on the companies, but if the association should indorse the third conclusion in Mr. Géron's report, or if they should not express their disapproval of it, it might be very difficult for a street railway company to avoid giving transfers under all conditions.

Mr. Monmerque, in resuming the preceding debate, proposed a change in the third conclusion of the report.

Mr. Janssen suggested that this change should be referred to a special committee, who could study the terms of the resolution, and should submit the result to a vote of the association at its next annual convention.

Mr. Lavalard stated that the importance of the question was too great to allow the thing to be dropped. It was necessary to record some decision on the proposition. In consequence, he proposed that the association adopt the first two conclusions of the report of Mr. Géron, but that it should not take any action on the employment of transfers. This question should be the subject of a special report, which should be the basis of a discussion at the next meeting of the International Street Railway Association, which would be held two years from date. This proposition was unanimously adopted.

II. RESULTS OF THE APPLICATION OF ELECTRICITY TO STREET RAILWAY SERVICE

Mr. de Pirch, manager of the Barmen-Elberfeld Electric Railway, Germany, made a study in his report as to what had been the result of the application of electricity to traction purposes, from the standpoint of increase of traffic, expenses of operation and net profits. He concluded as follows: "The system of electric traction by the overhead system is to be recommended in place of that by steam locomotives, when the operation is one of short trains following each other at short intervals on lines of long distance and heavy traffic. It is especially desirable for existing lines on their own right of way, whenever the length of franchise is sufficiently long, and when impossible conditions or exorbitant burdens are not imposed to reduce or destroy the profits possible from the introduction of electricity."

Mr. Monmerque demanded that the wording of this conclusion and the text of the paper should be modified so as to emphasize the fact that the advantages mentioned from the use of electrical traction applied only to electrical traction by overhead wires. He stated that railway managers did not have yet enough experience with other systems, such as the conduit and the surface-contact system, to allow them to recommend such systems.

Mr. de Pirch was of the same opinion as Mr. Monmerqué, and proposed the same changes as demanded by the latter. The conclusions given in the report were true only when the trolley system is used.

Mr. Köhler, of Berlin, agreed with the conclusion in the report of Mr. de Pirch. The latter had expressly stated that the system recommended was the trolley system. As, however, there had been some doubt in the minds of some of the delegates, which doubt was, to a certain extent, justified, Mr. Köhler proposed that the conclusion of Mr. de Pirch be adopted, but that it should be distinctly specified that the reference to the electric traction referred entirely to the trolley system. This proposition was unanimously adopted.

III. ADVANTAGES AND DISADVANTAGES OF STANDARD AND NARROW-GAGE TRACKS FOR ELECTRIC RAILWAYS

The speaker, Mr. Gunderloch, not having been able to be present at the meeting, his paper was read by Mr.

Géron. Mr. Gunderloch in his report considered the question from the standpoints of the possibility of mounting the electrical apparatus on the truck, and of the exchange of rolling stock and equipment with trunk lines so as to avoid the reloading of freight. He concluded by saying that standard gage should be adopted in every case as far as possible, and that narrow-gage tracks should not be laid except where the standard gage was practically out of the question.

MR. JANSSEN asked Mr. de Burlet, manager of the Société Nationale des Chemins de Fer Vicinaux, of Belgium, the reasons which had led that company to adopt the narrow gage, almost exclusively, on its very extensive system.

MR. DE BURLET, in reply, stated that he thought a greater distinction should be made than was done in the report between city lines, suburban lines, and steam trunk railroad conditions. For the first class of these roads, *i. e.*, the city lines, the conclusions as given in the report are justified, but for the second he wished to dissent from the rules laid down by the writer of the paper. The gage of such lines should be narrow. Thus in Belgium there are more than 100 interurban lines in operation. The total length is about 2500 km (1500 miles). All are narrow gage with the exception of three. The only reason which led to the adoption of the narrow gage was that of economy in first cost. In many places it is only possible to build these interurban roads by reducing the first cost, for the reason that the standard trunk lines have ramified their branches to such an extent that they already cover the best territory. As a consequence, the interurban light railways must be built cheaply or they will not be profitable; and it is absolutely necessary to make the first cost as low as possible. The capital invested in all of these narrow-gage lines in Belgium averages only about f.47,000 per km ($1,500 per mile); while that invested in standard-gage roads is as much as f.100,000 per km ($32,000 per mile). These figures are enough to justify the almost exclusive employment of narrow gage for this class of road. If in the first place the company had decided to use standard gage exclusively, the return on the capital invested would not have been adequate, and it is certain that there would not have been any such remarkable development in the light railways of Belgium if this had been the case. It is true that, under certain conditions, the receipts exceed the figure at which a change to standard gage is justified. In Belgium, however, this case has occurred in only one instance. The company had built one narrow-gage line in a region which, according to all appearances, would furnish only a small business. Since the construction of the line, however, some important quarries had been developed in the region, consequently there had been an immediate development of traffic, and the company was planning to replace the narrow gage with a standard-gage track, in order to avoid the reloading of freight. But it ought to be understood that when the line was built there was no suspicion of the richness of the country. If the line had not been constructed it is very probable that the first quarry would never have been worked, and the others would never have been discovered. It was the railway which had created the mining business. In the convention held at Amsterdam in 1890 a resolution was passed by the association stating that the narrow gage was the best to employ for light railways, and that the standard gage should only be adopted in special cases. Mr. de Burlet asked whether the association intended to reverse its former ruling on this subject.

MR. KESSELS, general manager of the Société des Chemins de Fer Economiques, of Brussels, differed entirely from Mr. de Burlet on the subject. He argued that the cost of reloading freight in passing from a narrow to a standard-gage road is very small, and does not usually justify the additional capital required to build a standard-gage track. Thus his company, which is an Italian corporation, received only f.0.20 per ton for all the expenses involved in the reloading of freight, including switching, labor, etc. This price, though low, covered all expenses. The company's terminal stations, it is true, are designed to facilitate this reloading of freight, which consists principally of coal and granite.

MR. HASELMANN, manager of the tramways in Aix-la-Chapelle, differed also from the conclusion as expressed in the paper. He thought that, instead of endeavoring to ally themselves with the trunk lines, the light railways ought to endeavor to make a separate system and serve those regions where the standard-gage roads cannot go, on account of their high cost of construction.

MR. TRAUTWEILER, chief engineer of the Strassburg tramways, took the opposite position, defending the conclusions of the reader of the paper. He observed that the paper presented had treated the question as applied to the operation of electric lines, whereas it had been discussed principally in its relation to steam railroad operation. He thought that, when the electric system was employed, the investment was very little different whether a standard or a narrow-gage track was used. The conclusions adopted by the Congress at Amsterdam, he thought, were justified by the conditions presented at that time. Those given in the paper by Mr. Gunderloch, he thought, were justified when the use of electric traction was considered. The association ought certainly to adopt them.

MR. KÖHLER, of Berlin, said he thought that the members had wandered somewhat from the subject of the paper. It seemed as if some of the delegates had confused the needs of tramways with those of light railways. Electric traction would not be adopted on lines of great length for the reason that the first cost of installation was too high.

MR. LAVALARD, who was in the chair, inquired whether it was the sentiment of the association to adopt any conclusions in the absence of the author of the paper. Under these circumstances he thought that the discussion should be continued later, and another subject taken up. This proposition was adopted.

IV. THE EQUIPMENT OF A CENTRAL POWER STATION.

This report was presented by two gentlemen—Messrs. Thónet, of Liége, and d'Hoop, chief engineer of the Brussels Tramways, the latter having treated specially the auxiliary apparatus.

MR. THONET regretted that the companies to whom a list of questions had been sent out had not replied to the greater part of them, and especially that they had not given more figures in detail relating to the cost of operation. There were no longer, he said, any secrets to conceal in the manufacture of engines and electric apparatus. All the machinery which enters into an electric railway power station is well known to every one. That which it is desirable to know, however, is how each collection of machinery operates under different local conditions. This information, far from being opposed to the interests of the manufacturers, should be of the greatest value to them in drawing the attention of engineers and of railway managers to the possibilities of economy which could be secured by certain arrangements. The speaker asked whether this question of cost of operation could not be made the order of the day for the next session of the International Street Railway Association. He asked especially for detailed infor-

mation on the employment of storage batteries as station auxiliaries, on their efficiency, life and the cost of maintenance; also on the advantages and disadvantages of triple-expansion engines, and on the cost of maintenance of the different types of boilers.

Mr. d'Hoop then spoke on the portion of the report relating to the auxiliary appliances. He gave some interesting information on the cleaning of cotton waste filled with oil. This cleaning resulted, in Brussels, in the saving of f.15 per day.

Mr. Baumgardt arose to oppose the statement of the readers of the paper that storage batteries when used to equalize the load on power stations were useful only when used in power stations of moderate sizes. He believed that they gave excellent satisfaction when used in connection with the largest stations. In support of this he stated that many important companies in the United States were using batteries in this way.

Mr. Monmerque, who was prevented from attending the session, asked through a letter addressed to the president that the first conclusion in the report should be modified. Triple-expansion engines are now employed in many installations. The conclusion in the report referred to should then be modified to read: "In very large installations compound or *triple-expansion* engines should be direct coupled to the generators."

Mr. Thonet supported the suggestion of Mr. Monmerqué, but did not think that the report presented should be changed so far as the reference to the employment of accumulators was concerned. The association did not possess sufficient information on the subject of the use of storage batteries as station auxiliaries in large power plants to justify the alteration suggested. The members could hardly then commit themselves on this important subject. If the resolution was passed many station engineers would believe they could adopt batteries for this purpose. It did not seem advisable absolutely to recommend them for large systems, because in the latter the fluctuations in the current are relatively small on account of the large number of cars in service.

As a result of this discussion the conclusions contained in the report, but modified in the way indicated by Mr. Monmerqué, were adopted.

V. SYSTEMS OF POWER DISTRIBUTION FOR ELECTRIC RAILWAYS

Mr. Van Vloten being absent, his report was presented to the Congress by Mr. Pedriali, electrical engineer of the Brussels Tramways. The object of the report was to point out the advantages and disadvantages of each of the principal methods of power distribution for electric railways, and indicate under which conditions, speaking broadly, each system could be adopted most advantageously.

Mr. Monmerque, who was also absent, sent a written communication to the president, making the following requests: First, that the third paragraph of the conclusions should not be adopted, as accumulators ought not to be considered as a method of distribution; second, that in the fifth paragraph it should be distinctly stated that the reference applied exclusively to distribution by three-phase currents and not by polyphase currents in general.

Mr. Debray demanded that the association should not indorse any of the conclusions, and that it should extend its thanks to Mr. Van Vloten for his very remarkable and very complete report. The subject which it treated was not one which permitted an absolute answer. The question of power distribution requires a special investigation in each case, and as no concrete examples were given, no certain conclusions were possible. Mr. Debray insisted that in the future the questions proposed should be more precise in their character.

Mr. Thonet expressed himself as being of the same opinion as Mr. Debray, but he thought that the association should indorse the conclusions of the report, these conclusions being really that the general rules suggested in the paper ought to be applied with discretion in favor or against each system mentioned.

Mr. Janssen thanked Mr. Debray for the suggestions which he had given on the subject, of the necessity of formulating exact questions. This suggestion would be followed in the future. He thought also that the association need not take a vote on the conclusions on so general a subject, and proposed that the association should send a vote of thanks to Mr. Van Vloten for his valuable and conscientious paper. This motion was passed unanimously.

VI. THE FALK JOINT

The paper by Mr. Fischer-Dick, associate manager of the Grosse Berliner Strassenbahn, was a most favorable indorsement of the Falk joint. This opinion had all the more weight from the fact that the writer has devoted a large part of his time recently to a study of the joint question on tramways, and has himself invented a number of joints, which have been widely adopted in Germany. The paper brought out the fact that the first cost of a street railway track joint is not of very great importance, provided the more expensive joints add considerably to the life of the rails, on account of the high cost of the latter, which in Berlin is as high as f.220,000 per km of double track, when laid in an asphalt street.

Mr. Thonet stated that it had not been the custom to use rail bonds in connection with the Falk joint, as the joint itself gave sufficient electrical contact between the ends of the rails. Bonds were considered by some necessary at first, but general practice now is to omit them. He suggested that the Congress thank Mr. Fischer-Dick and accept his conclusions.

Mr. Grialou stated that the Falk joint had been first adopted in France on the system of the Lyons Tramways, and that there the rails had been bonded on the first line which was cast welded, but that this precaution had proved unnecessary. The only breaks which occurred were produced in the winter, and were extremely rare. The measurements of track resistance, which should be made periodically, would soon determine these breaks, and they could be repaired.

The conclusions given in the report by Mr. Fischer-Dick were adopted.

VII. TRACTION BY ACCUMULATORS

The report of Messrs. Broca, manager of the Tramway Company, of Paris, and of the Department of the Seine, and Johannet, engineer of the General Traction & Electric Company, of Paris, which immediately followed that by Mr. Fischer-Dick, provoked a very long and most valuable discussion. The writers of the paper, without declaring themselves partisans of the accumulator system of electric traction, thought that it ought not to be condemned offhand. The certain advantages which it did possess should receive recognition, and they suggested to the association that it should indorse the following conclusions, which differed from those presented in the report, and which read at follows: "The International Tramway Congress, after having read the report of Messrs. Broca and Johannet, decides that traction by accumulators is much more expensive than traction by overhead wires, and ought not to be considered except under exceptional conditions. In fact,

the overhead system is the only one which insures reliability of reducing fares, and the only one which will give satisfaction to the real needs of the public.

MR. JANSSEN rehearsed the fact that from 1892 to 1898 experiments were made continually at Brussels with storage battery cars. The results of these experiments were most unfortunate, and storage battery traction was abandoned as a result. At the convention at Geneva a request was made for a report on the "improvements made" in storage battery cars. As a consequence, the report was written, but it showed that there had been no improvements. Municipal authorities generally seem to think that it is only the high cost of this method of operation which keeps the companies from adopting storage battery cars. The speaker thought, then, it was very important for the association to go on record as stating that this was not the principal reason. Certain companies had adopted systems of electrical traction which were certainly as expensive as accumulators. The real reason why storage battery cars could not be used on city streets was that they could not be depended upon to give the regularity in service which the public had a right to demand.

MR. BOULVIN, of Ghent, declared himself absolutely opposed to accumulator traction, and based this opinion on the experience which he has acquired, especially in Ghent. He thought that all railway managers who have had anything to do with storage batteries would agree with him in this opinion. For more than ten years his company had been trying to make storage battery cars work. The only result of this extended trial had been absolute failure, and theoretically it could not be otherwise. One of the principal reasons is because the chemical reactions to which an accumulator plate is subjected require a certain surface depending on the size of the current. If this surface is insufficient, disastrous results follow, which, moreover, last through the life of the accumulator and become aggravated when an excessive demand is put upon them even for an instant. The surface of the plates should then be so large as to support this discharge rate, and should be as large as in stationary batteries. This plate area, for example, should be large enough to admit a discharge rate of the maximum current required while the car is going up the steepest grade when the track is covered with snow. These being the conditions, it is very easy to see that the employment of accumulators on cars is impossible by reason of the weight and size at which the cells would have to be made. A battery designed for the average rate of discharge, even for the average maximum rate, would not withstand the peak of the maximum discharge, which would often be called for on a trip.

In the installation which he had made, Mr. Boulvin had found that the consumption of coal per car kilometer with storage batteries was double that which it would have been with the trolley. Mr. Boulvin then considered the report of Messrs. Broca and Johannet. The conditions announced, he thought, were sometimes justified from a theoretical standpoint, but they were not always possible. Thus, centralization is possible with a single line or with a system of lines which crosses at some point, but on most tramway systems this is out of the question. It is certainly a good thing for a company to make its own plates, but this involves a large force of employees and many processes. It is not only necessary to cast the lead, but the company must treat it with sulphuric acid, make the cells, etc., and a tramway manager has his own troubles without embarking in such outside work. A slow rate of charging is certainly preferable to a rapid charge, but there are often many practical difficulties in charging batteries slowly, and, again, there is trouble in providing sufficient room in the cars to accommodate both the passengers and the batteries. Again, the arrangement of the car houses and termini depend largely upon local conditions, and cannot be placed exactly as the best theory would dictate. Mr. Boulvin expressed himself especially against the favorite claims made for storage battery cars of independent operation. He considered these claims illusionary. "With accumulators," he said, "there is so little independence that the cars cannot run to satisfy either the public or the company, but exclusively for the satisfaction of Mr. Accumulator." The great aim in operating tramways is to obtain flexibility to car service, and to proportion the number of cars to accommodate the traffic. This is absolutely impossible when storage battery cars are used. They are certainly not adapted to the service of large systems, and if they can be employed to advantage at all, it is only in very rare and peculiar cases.

MR. MICKE, director of the Grosse Berliner Strassenbahn, stated that the mixed system of storage batteries and accumulators had been employed in his city. The company had not wanted to use it, but it had been forced upon them by the municipal authorities. The section operated by accumulators included 20 km of double track, and formed a considerable part of the entire system. It was early recognized that even if it was possible to regulate the discharge from the battery so as to give long life to the plates, it was impossible to regulate the charging rate in the same way, as the batteries were charged while they were running in the sections equipped with the trolley. The storage batteries gave very unsatisfactory service, especially during winter, when the rails were covered with snow and ice. At this time the demands for current on the overhead sections were so great that the accumulators were charged under most adverse conditions. If the cars had been kept at the end of the overhead system until the batteries had become sufficiently charged before starting on the battery sections, at least sixty-four cars would have been held at one point on the system; at other points there would have also been blocks of cars almost as large. Briefly, during the winter and while the snow lasted, the cars frequently had to stop running, and the service was so poor that the municipal authorities finally authorized the employment of trolley wire temporarily on the storage battery sections. The company then took up the subject very carefully with the municipal authorities, pointing out the objections to this method of traction exclusively from the standpoint of the public, and asked authority to adopt the overhead system, except at certain points where it agreed to install the underground conduit. Mr. Micke added that the storage batteries should be absolutely condemned, except for extremely rare conditions.

MR. KRÜGER, manager of the Hanover Tramways, then undertook a defense of accumulators. He thought, in the first place, that Mr. Micke's conditions had been unfortunate, and he had become prejudiced against accumulators and wished to get rid of them. The trolley system, he added, still produced in the minds of certain people the effect of a red rag on a bull. However, storage batteries ought not to be absolutely condemned. He referred to the results obtained in Hanover, and given in detail in the paper which he had presented to the association at Geneva. The manufacture of plates by the tramway company itself had given good results, for the cost of production amounted to only 2 pf. more per kilogram than the cost of the lead itself. The cost of maintenance amounted to only 0.5 pf. per car km. on the total length of track equipped with trolley and accumulators (the mixed system), and to only 1.02 pf. per car kilometer, considering the length of the section operated by accumulators only.

Mr. Röhl, manager of the Hamburg Tramways, differed from the opinions expressed by Mr. Krüger. The figures which he cited seemed to be contrary to those which had been obtained by the company of which he was the manager in Hamburg. In fact, his own figures showed a cost of current in pfennigs double that which resulted from the operation in Hanover. Moreover, the Hanover Company made its own current under very economical conditions, while in Hamburg the company bought its current from another company and paid quite a high price for it.

Mr. Krüger explained that the figures which he had given applied only to the maintenance of batteries. The cost of current should be figured by itself. This cost per kilowatt in Hanover varies from 6.5 pf. to 4.8 pf., and the transportation of the accumulators on the cars consumed about 50 watt-hours per ton-kilometer. Finally, account also ought to be taken of a loss of about 30 per cent in the accumulators themselves. Mr. Krüger, however, stated that he did not wish to appear as an advocate of accumulators, for he would be very glad to be able to dispense with them on his own system.

Mr. d'Hoop then discussed the question from the standpoint of ease of operation, which, he stated, is the most important point of view. To give the best satisfaction to the public and to carry all the passengers who want to ride, every manager recognizes that on certain days and at certain hours it is necessary to double or quadruple the number of cars. This is impossible where accumulator cars are used, and consequently they cannot give a satisfactory service from the standpoint of the public. Much stress is often laid, he said, on the inconvenience of storage battery cars, but experience has shown that they are much more productive of accidents than are trolley cars. Mr. Van Vloten laid down as a general rule that accidents on storage battery roads varied almost directly with the number of cars, while with a trolley road they vary with the length of the line. They increase very rapidly on the storage battery line with the number of cars used, while with the trolley system they remain almost constant with an increase of cars.

Mr. Köhler, of Berlin, excited considerable laughter in saying that the sympathies of Mr. Krüger had evidently been touched by the condemnations directed against accumulators, but that the latter, through their misdeeds, had merited the most severe condemnation in Berlin, where 400 accumulator cars had been in use. The results had been deplorable, but Mr. Micke had not told everything about them. There the cost of maintenance had reached ten times the figures given by Mr. Krüger. This maintenance cost was defrayed in part by the tramway company and in part by the company which had sold the accumulators. The total cost of maintenance was the same in each case. Again, the accumulator companies had tripled their charges. Under these conditions they had lost all.

Mr. Johannet replied in a few words to each of the criticisms directed against the report which he had read. He referred particularly to a paper which had been presented about two years ago before the International Society of Electricians by Mr. Sarcia on accumulator traction in Ghent. The cost of traction, which included all the details, such as, for example, the cotton waste employed for cleaning, was given as not over f.0.20 per car kilometer, that is to say, a figure considerably less than that for trolley service. The statements made by Mr. Boulvin did not accord with this statement. Again, the cars at Ghent had also been tried in Paris. They did not give satisfaction, and this was largely because they had not been well designed. The cars employed in Paris on the St. Denis line had been built especially for the service for which they were intended. Since 1892 they had run 32,000,000 km, and during this time had been under the direction of Mr. Johannet. It was on the experience which he had acquired in connection with this line that he prepared his report. He defended himself strenuously from being an *a priori* partisan for the accumulator. On the contrary, he thought that it was less desirable than the trolley system. The calculation of the cost of the batteries on the basis which had been indicated in the report read was, in general, 100 per cent better than that which had as a basis the average expense per ton-kilometer. He thought that, as stated by Mr. Boulvin, the capacity ought to be calculated so as to be sufficient for the service.

There seemed also to be some misapprehension of the significance of the word "independent" as applied to accumulator cars. Accumulator cars are independent because they run over any track. They are also independent because an accident which happens to one car does not cause the stoppage of the other cars. This condition often occurs in Paris, where a car stops with its passengers and has to be drawn or pushed by a second motor car. With the trolley system, however, an accident to the system of distribution paralyzes the entire service. The conclusion of Mr. Van Vloten, as cited by Mr. d'Hoop, was then not quite fair. If the mixed system had not given good results in Berlin, it was because the system was not suited to the conditions of the service. Mr. Micke himself acknowledged that the length of the system equipped with the trolley was too small, as compared with the length operated by the storage battery cars. It would be unfair, then, to hold the accumulators responsible because they could not perform impossible conditions. Snow is certainly an important obstacle, but why should it be more so in other cities than in Paris? In Paris the snow is removed and the tracks are salted; as a result the service has never been paralyzed. As for the question of first cost, even if that is not a dominating condition in the case of long franchises, there are in Paris certain systems which have an important traffic, and for which the franchises now have only nine years to run, so that whatever investment is made on those lines must be recouped within that time. Again, a tramway manager ought not to be slavishly wedded to electricity. If the trolley system is not permitted and there are grave objections in the mind of the managers to the use of storage battery cars, why employ them? There are other systems not electric. It has been said that the time for experimenting with accumulator cars is past, and that they should be condemned, but this same argument is not applied to the underground conduit system, which is, as yet, in an experimental stage. As for the surface contact system, who can yet say what its service will be?

Mr. Monmerque, in reply, claimed that one branch of the subject had not been touched upon, and he thought that some light was thrown upon it by the preceding discussion. Everyone agrees as to the troubles given by storage batteries, and that the cost of operation is so high that the method is recognized as a disagreeable alternative. But the public knows very little, and cares less, about this. The only thing that can affect the comfort of the public is irregular service. What the manager ought to do is to enlighten the public as to this defect of storage battery traction; in other words, he should take pains to make it clear that adequate service cannot be given by storage battery cars, that they are not adapted to flexibility of operation, that they are more productive of accidents, that their service is accompanied by a disagreeable and noxious odor, and that they unduly block the public traffic on the streets. As it is not always possible to locate a car house and charging station at the end of a line, a company operating stor-

age battery cars has often to use a quick rate of storage and to charge the cars on the streets. On the Cours de Vincennes-Louvre storage battery line in Paris, where a headway of three minutes is used during certain hours, there are often at the terminus at Vincennes from sixteen to eighteen cars being charged on the street. These are the arguments which ought to be impressed upon the public.

So far as the cost of maintenance is concerned, it has been shown that in Paris an accumulator company demanded at first to maintain batteries f.0.10 per car-kilometer, and then insisted upon raising the price to f.0.30 per kilometer. The figures submitted by Mr. Krüger seem, then, impossible. It would be interesting to have tables on the cost of maintenance prepared by the accumulator companies, for they certainly would not put the price too high, but would prefer to maintain the batteries at a loss.

MR. BOULVIN asked leave to correct an error in a name submitted by Mr. Johannet. The communication referred to by Mr. Sarcia before the International Society of Electricians had not been based on accumulator service carried on in Ghent, but on some trials conducted in Ostend. This correction should be made, as otherwise there might be some confusion, since it was stated in the communication that the Ghent tramways had been put in operation after those of Ostend. But the delegates should not take this communication too seriously. As Mr. Johannet had said, the smallest details in cost were given. The only item in the cost of operation which had been omitted was that of the maintenance of the batteries! This single fact was sufficient to condemn the report. Mr. Krüger should certainly be congratulated for the figures which he had obtained, and also because he was the only one who had ever been able to obtain anything like them. But Mr. Boulvin himself, after the experience which he had acquired in Ghent, and after a very long study of the subject in all its details, thought that horse traction was preferable in every way to that by accumulators. A company would certainly be able to give a better service with horse cars and pay higher dividends.

MR. JANSSEN then reviewed the previous discussion and proposed that the Congress should adopt the following conclusions: "The International Tramway Congress believes that traction by accumulators has made no real progress up to the present, and that it ought not to be used except in very extraordinary and unusual conditions, because, first, with it it is impossible to give a satisfactory service to the public, and second, because the cost of operation is extremely high."

MR. GRIALOU thought that the exceptional cases referred to in the resolutions, in which the accumulator traction could be used, ought to be specified. He insisted upon this point, because to establish an exact comparison between two systems the total cost of operation ought to be considered. This cost should include not only the expense of operation, but the general expenses, interest and sinking fund on the capital engaged, so as to determine in each case the net result in its relation to the length of the franchise and the density of the traffic. Under these conditions it will be seen that, from an economical standpoint, accumulators would show up very disadvantageously, as compared with other electric systems, even if the length of franchise was not long. The first consideration in the mind of a street railway manager ought to be how to carry all the people who wish to ride, for if he does this, his receipts will be a maximum, and he will give the best satisfaction to the public.

MR. BERTINI, manager of the Italian Edison Company, stated that two municipalities in Italy, those of Rome and Turin, had insisted on the installation of the mixed accumulator and trolley system. The companies in those cities had shown the authorities the disadvantages of the system, as explained by the preceding speakers, and the city authorities had finally become so impressed with them that they consented to the abolition of accumulators and the adoption of the overhead system over the entire systems in question.

MR. JANSSEN said that it did not seem to him possible to specify those cases in which accumulators could be employed as required by Mr. Grialou. The resolutions, as offered by Mr. Janssen, were put to vote and adopted.

VIII. HEATERS FOR STREET RAILWAY CARS

MR. DE BURLET, manager of the Société Nationale des Chemins de Fer Vicinaux, of Belgium, considered in his report the different methods of heating by direct combustion, by warm air, by hot water, by steam and by electricity. So far as concerns the heating of cars, he thought the Congress ought to adopt the resolutions presented in a report on the same subject to the Congress in 1894. It said that the heating of street railway cars was not to be recommended and that the association was not able to suggest any desirable method. So far as the heating of light steam railway cars is concerned, his investigations did not show any improvements made during the past two years. As a matter of fact, the question of economy is the most important thing for this class of roads, as has already been explained in the discussion on the third question. Under these circumstances, the speaker did not wish to recommend any existing system, and requested that the subject should be continued and taken up at the next convention.

MR. MONMERQUE stated that in Paris the authorities had insisted that the street railway cars be heated, even those cars which are not entirely closed. They had also prescribed certain methods of heating. Under these conditions the cost of heating amounted to about a franc per car-day.

MR. VON LEBER, member of the Council at Vienna, cited a particular case which had come to his notice in Austria. A tramway company had adopted electric heaters, but had abandoned them after a short time. It was found that this method of heating was too expensive. The cars were then run without any heaters, but the company was obliged to replace the electric heaters, because the absence of heat had lowered the receipts to a marked extent. The climate there was very cold, and the inhabitants often used to board the cars simply to get warm—"to get 2 sous' worth of heat"—as Mr. von Leber jocosely expressed it.

MR. BLONDEL, professor at the Schools of Bridges and Highways, Paris, differed from the conclusions of the writer of the paper so far as the heating of tramway cars in his country (France) was concerned. The authorities insisted that the cars should be heated. The best way of doing this was rather an open question, so he thought a further report on the subject was advisable; besides, the public is used to warm cars. What they wish principally is to keep their feet warm. Under these circumstances, the expense ought to be low. On the Chemin de fer Nogentais the rate is only 0.78 francs ($0.156) per car-day. With certain systems of electric heating similar results can be obtained.

MR. DE BURLET indorsed the suggestion of Mr. Blondel, which was adopted.

IX. METHOD OF OPERATING SECONDARY OR LIGHT RAILWAYS

MR. ZIFFER, president of several railways in Austria, read his report on the advantages and disadvantages of the operation of secondary railways, first by the steam railroad trunk lines, of which they are feeders, and second by independent corporations. He reviewed the different methods by which the operating companies lease these lines from

the owning companies, and concluded by saying that "if it is not impossible, it is certainly very difficult, to make the interest of the operating company and the owning company the same; also that it does not seem possible to lay down any definite rules as to whether these lines had best be operated independently, but that each case should be considered in the light of local conditions."

Mr. de Burlet thought that the conclusions of the speaker should be modified. In Belgium, where the secondary or light railway system is of great extent, the owning company has leased the operation of its lines for the most part to other companies, and in every case the interests of this owning company have been conserved by the company which has had the operation of the line in charge. He demanded then the passage of a set of resolutions in which the conclusions drawn by Mr. Ziffer should be modified. Mr. Ziffer recognized the justice of these remarks.

Mr. Scotter, of London, regretted the almost entire absence of English representation at the Congress. This absence should not be construed as a manifestation of lack of interest on the part of his compatriots in the tramway and light railway industry, but it was a fact that up to within the last few years the English statutes had been such that it had been exceedingly difficult to obtain franchises, and this condition had practically paralyzed the electric railway development. During the last three years a new law, much more desirable, had been passed, and the tramways of that country, which for thirty years had never included more than 2000 km of track, had been within the last three years almost doubled in length. This statement was sufficient to show the interest which was being taken in England in this industry. A new law to cover the construction of tramways and light railways is now under consideration, and it will give a great stimulus to the industry. Mr. Scotter stated that in England it had been found advisable to draw an absolute distinction between trunk line railroads and light railways. The first, on account of their important traffic, can pay interest on a much higher initial cost, and employ a much more substantial kind of equipment than the second could even dream of. This second class of road ought to use a narow-gage track. Mr. Scotter terminated in expressing the wish that at the next Congress England would not be represented by six or eight persons only, but by ten times that number.

The conclusions of Mr. Ziffer, as modified by the views expressed by Mr. de Burlet, were adopted unanimously.

X. ADOPTION OF A STANDARD RATING FOR TRAMWAY MOTORS

Mr. d'Hoop read the report on this subject written by Mr. Macloskie, who was prevented from attending the session. The report concluded by recommending that all motors should be designated by three numbers, represented by the letters C, A, B. The first should indicate the output in kilowatts which the motor could furnish continuously for one hour without its temperature being raised more than 75 degs. C. above the surrounding air; the second figure should be the number of milli-amperes necessary to produce a tractive effort of 1 kg at the periphery of wheels 800 mm in diameter; the third should be the voltage in amperes of the "dead current," or the current required to make up for the mechanical and electrical losses in the motor and gearing.

Mr. Janssen stated that the report had been presented with the object only of suggesting that before making a decision the members of the association should discuss the question fully.

Mr. Hospitalier, of Paris, outlined quickly the method which he believed the most desirable for rating electric railway motors. The power of an electric motor is equal to the product of a torque by an angular speed. At starting, the torque is at a maximum and the speed is zero. The power then is also zero. The speed commences immediately to increase while the torque lessens until finally it becomes zero. At this point the counter electromotive force of the motor is equal to the applied electromotive force. During this transition the power of the motor passes through a maximum. To designate an electric motor it is necessary then to know: (1) its maximum power; (2) its maximum torque; (3) the torque corresponding to the maximum power; (4) the maximum angular speed.

Mr. d'Hoop asked if the manufacturers of electric motors had been asked to express their opinions on the subject.

Mr. Grialou supported the suggestion of Mr. d'Hoop, and insisted on certain conditions to which consideration should be given in treating the subject, viz.: that tramway motors are subjected in city service to very severe conditions. At the time of starting they take very heavy currents. Then when electric brakes are used they furnish for each stop a very heavy current. At Lyons, for example, on one line stops are made every 100 m to 150 m (300 ft. to 450 ft.) The motors do not have time to cool off under these conditions, and burn out very often. These conditions ought to be well understood before any decision can be made on the most advisable method of rating motors.

The association decided that the question should be taken up again next year, and that manufacturers of motors should be requested to contribute their opinions on the subject.

XI. STREET RAILWAY BRAKES

Mr. Monmerque, chief engineer of the General Omnibus Company, of Paris, had not been able to write a paper on this subject, as arranged, the replies to the list of questions sent out having been too few. He reviewed the conclusions of Mr. Fromm, presented at the Geneva meeting in 1898. These conclusions were as follows: First, for horse cars, the ordinary brake is sufficient; second, for cars operated by mechanical power, two brakes should be used, the hand brake and a mechanical brake; third, for railways operating on steep grades, a third special brake should be used, such as track brakes, etc.

This year only four replies were sent to the writer. They did not give any new information. Mr. Monmerqué asked that the association should adopt the following conclusions:

On account of the recent developments in mechanical traction, the subject of brakes can well be postponed till the next convention. The subject ought to be considered from both the standpoint of the local statutes on the subject and from a technical point of view.

These conclusions were unanimously adopted.

Mr. Monmerque then discussed the subject, giving some interesting information on the employment of brakes in Paris. Up to within recently the French companies were regulated on this subject by the law of Aug. 6, 1881, which is popularly called the rule of the "three-twenties." A car operated at a speed of 20 km an hour on a grade of 20 mm per meter (2 per cent) ought to be able to stop within a length of 20 m. This law has several practical inconveniences. In the first place it presupposes that the coefficient of adherence is constant and is equal to 0.14, but this coefficient varies enormously according to the condition of the rails, whether they are wet, dry or covered with mud. Under these circumstances it is very much lower than that assumed by the statute. As a result, a committee was appointed to draw up a modification of the rule of the

"three-twenties," taking these things into consideration. After six or eight years of investigation and discussion this committee decided to adopt the following rule, which was made public on Feb. 13, 1900: "A car operated at a speed of 20 km per hour on a *level* track with *dry, clean* rails, ought to be able to stop in 20 m." This modification is very important.

But in Paris this new rule has not been considered sufficient. There the rule of the "three-twenties" is in force, modified by the condition that the rails should be dry and clean. Article 152 of the police ordinances for July 10, 1900, reads as follows:

All brakes for motor cars and trail cars ought to be so powerful that if the vehicle be running at a speed of 20 km an hour on dry and clean rails and on a track having a down grade of 20 mm per meter, the vehicle will be able to stop within a space of 20 meters from the moment when the brakes are applied.

All tramway cars should be equipped with two distinct systems of brakes, or else two independent systems for operating the brakes, which should act on the wheels of the car. The brakes on the trail cars ought to be so powerful that where their action is added to the braking on the motor car, trains running with a speed of 20 km an hour on dry, clean rails and on a down grade of 2 cm per meter, will stop within a space of 20 meters or less.

Each system of brakes must be capable of being put in service rapidly, and of being applied by the motorman, conductor, brakeman or any employee on the train, by handles placed near each door of the car or cars.

One of these systems should be continuous, permitting the motorman or his assistant or any of the other employees on the train to brake all the wheels of the train instantaneously. This continuous brake should be capable of graduation, and should be exempt from all danger of breaking as well as of freezing.

On all trains operating on lines where the grades are more than 25 mm per meter (2½ per cent) the continuous brake used should in addition be so arranged with an automatic attachment so that, in case the coupling between the motor car and the trail car should break, the brakes will be immediately applied to the wheels of the trail car.

The braking apparatus should also be maintained in perfect condition, and it should also be so that it can be applied instantaneously at any moment.

Motor cars and trail cars should also be provided with the apparatus necessary for preventing the slipping of the wheels on the rails. The devices used for this purpose should be so efficient that the adherence between the wheels and the rails is as great as mentioned in the first part of this statute. The operation of this apparatus should also be within the easy reach of each of the employees to whom the operation of the motor cars, trail cars or train is confided.

These rigorous conditions are partly justified by the state of the streets in Paris, where the vehicular movement is very active, and where the rails are often covered by a slimy mud and grease, which greatly diminishes the coefficient of adhesion, but they do not prevent accidents, although it is probable that these accidents would be much more numerous were the conditions imposed less stringent. It seems as if every precaution had been taken. The cars of the General Omnibus Company are equipped with not less than five means of applying the brakes. Three can be applied by the motorman and two by the conductor. The motorman has at his disposition, (1) a compressed air brake, which can be operated gradually or for an emergency stop; (2), a hand brake; and (3), a brake secured by reversing the motors. The conductor can apply (4) the automatic air brake, and (5), the hand brake.

The direct-acting air brake gives a quick stop, and is intended for emergency service. It is liable, however, to flat the wheels. The automatic air brake gives a more graduated stop, and can be applied by the conductor in case of necessity. The hand brake does not call for any particular remark. The braking secured by reversing the motors can be applied to cars run by compressed air, steam or electricity. The best results are secured in connection with the first two. With electricity the results are less desirable, for if reversing is done too rapidly the armatures are burned out.

No car can be put in operation until its brakes have first been inspected by the engineers of the company, and then by the engineer of the municipality. Each morning the motorman tries his brakes to see whether they are in good condition, and this test is repeated during his trip. He is obliged to report promptly at the head office in case any defects should be noticed when the car is withdrawn.

The following example will give a good idea of the solidity of the brakes. A motorman having abandoned his post when his car had stopped at the top of a steep grade, the car commenced to run backward down the hill. The speed accelerated until the car was at the bottom, when it reached 60 km (40 miles) an hour. There the car entered a curve and was derailed. It crossed the street and commenced to mount the opposite curb, where it cut through a tree, the trunk of which was more than 30 cm (12 ins.) in diameter. The car was fortunately stopped by the curbstone. Many persons were killed and others wounded. The car was then put under seal and taken back to the car house. When the inquest had concluded, the car was taken out and all of its apparatus was found to be in perfect condition, and no repairs were needed.

Considering their number, their power, the care taken in their installation and in testing them, and in their maintenance, the brakes on the Paris cars seem to afford a guarantee of safety as absolute as could be secured; nevertheless, accidents are numerous. Why? Because, and this was the conclusion of Mr. Monmerqué, the employees do not use the brakes, or use them improperly.

MR. VON LEBER, government engineer of Austria, stated that in his country the first and foremost consideration for brakes was simplicity. It was not that the local conditions are favorable. Far from it. The ground is usually hilly and the grades steep and numerous. He remembered one grade with a length of 1500 m (4600 ft.) and of 11 per cent. However, they had never dreamed there of employing so many brakes as in Paris. Electric traction is used. The motorman has only to operate a single brake handle. This handle, turned in one direction, sends the car forward; turned in the other direction, it puts on the brakes. They have never had any accidents. Mr. von Leber explained that he and his colleagues did not consider themselves as looking upon the question in exactly the same light as a railway manager would. He and his colleagues are interested in not having accidents only so far as the protection of the public is concerned. They tried to secure this without specifying the exact methods to follow, because often a very short time after any rules have been formulated the discovery is made that these rules do not cover the case, or more improved apparatus has been designed, which renders them antiquated. The adoption of this simple method of braking gives good results. Each motorman knows his duty and can easily perform it. Simplicity leaves him at liberty to act according to his best judgment in the case of an emergency. Not even the most powerful brakes could stop a car within 20 m if the motorman allowed the car to run 30 m before applying the brakes. Mr. von Leber also remarked that in Austria the trains never consisted of more than two cars—a motor car and a trail car. When trains were longer than this it would doubtless be necessary to adopt special rules to secure safety, and especially to employ continuous brakes, operating on all the wheels of the train at the same time, but the speaker had not studied this question in a practical way, and did not wish to give any advice on it. In all cases the hand brake ought always to be employed as reserve brake.

On the subject of electric brakes, Mr. von Leber gave

the following information. Braking by reversing the motor had been tried, but had been abandoned as dangerous, as the motors burned out too often. They had then adopted definitely a method of braking by short circuiting the motors on a rheostat. The results obtained were very satisfactory. It is often said that this method deteriorates the motors. This claim is not well founded; thus on the steep line referred to above, where a grade of 11 per cent exists for a length of 1500 m, the experiment was tried of running the car down the grade at a speed of 25 km (15½ miles) per hour and closing the motors on a circuit through the rheostat. Immediately afterward the car stopped and the test was made a second time. At the foot of the hill it was impossible to notice any abnormal heating in the motors. All the heat seemed to be concentrated in the rheostat.

Mr. Fromm, of Kelsterbach, referred to the report made by the German Street Railway Association on the subject of brakes. Sixty-three companies have replied to the list of questions sent out by that association, and experiments have been made with different types of cars. The speed of the car being 22 km per hour, the minimum distance in which the car was stopped was as follows:

The rail being sanded, 9.50 meters to 10 meters (28.1 ft. to 32.8 ft.)

The rail being dry, 9.90 meters to 10.90 meters (30.2 ft. to 35.5 ft.)

With a wet rail 14 meters to 21 meters (45.9 ft. to 68.9 ft.)

The conclusions of the German report, so far as it concerns electric brakes, are that the system of braking in which the motors are short circuited gives satisfactory results as an emergency brake, but is liable to accidents if employed in regular service. When trains are heavy and there are many grades, the electro-magnetic brake should be adopted. Air brakes have given excellent results, but the use of these brakes has not been sufficient on any lines of sufficient length to allow the committee to draw any very definite conclusions about them.

Mr. Köhler, of Berlin, supported the proposition of Mr. Monmerqué that the question ought to be carried over to the next Congress. He asked that the companies should be more liberal with information. Brakes are extremely necessary in railway service. City officials are right in demanding their use, but extravagant claims are often made for them, and the companies ought to consider the question well before adopting any particular type. It is to the common interest that companies furnish all the information available on the subject.

Mr. Röhl, of Hamburg, stated that German companies, in studying the subject of brakes, had for their immediate object the disapproval of the claims made by certain municipal authorities who wished to compel all the authorities to use wheel guards or fenders. The companies thought that the best wheel guard is a good brake. They had made experiments and had endeavored to find out the *minimum* distance in which a car could be stopped. But since the report recited these tests and was to be made a part of the public proceedings of the Congress, it was only necessary to state that the length of stop obtained in the experiments was not the same as that which would be obtained in practice. The motormen knew that the purpose of the test was the operation of the brakes, and they commenced to apply the brake when they reached a pole indicated in advance. The conditions in practice are entirely different, as motormen are often obliged to apply the brakes at a moment when their mind is on something else. For this reason, allowance should be made for the coolness and quickness of the motorman, which form a most important factor. A new motorman, for example, would be apt to apply his brake so hard as to lock the wheels, in case of an emergency, when it is well known that the quickest stop can be produced by a more gradual application of the shoes against the wheels. In other words, consideration must be made of the coefficient of intelligence in studying this subject.

The figures contained in the report of the German Street Railway Association as regards the quickness of stops cannot then be considered as an exact criterion of the stops made in actual service, nor should they be so regarded either by the municipal authorities or by the local boards.

Mr. Janssen, who was in the chair, then closed the discussion, and the Congress voted unanimously to postpone final decision on the subject until the next session. The president then announced the business of the Congress as closed. After having thanked the delegates for the attention and the speakers for their papers, he declared the proceedings at an end.

Mr. Pavoncelli, of Naples, thanked the president for his courteous words, after which, upon motion of Mr. Köhler, a vote of thanks was tendered Mr. Janssen for the able manner in which he had conducted the sessions of the Congress.

Discussion of the International Steam Railroad Congress at Paris on Electric Traction

(From Our Special Correspondent.)

This Congress was held in connection with the Exposition at Paris, Sept. 20 to Oct. 1, 1900, and was attended by steam railroad managers and engineers from all parts of Europe and from the United States. About 1500 delegates were present, although the attendance was limited to official delegates of the principal trunk line railroads. The organization of the Congress was in charge of a committee appointed for the purpose by the International Railroad Association, the president of which is A. Dubois, general manager of the Belgian government railroads. The sessions were held under the honorary presidency of Pierre Baudin, Minister of Public Works of the French Republic, and had as its chairman Alfred Picard, Inspector General of Bridges and Highways, president of the Public Works Division, of Agriculture and of Commerce and Industry of the French Council of State, and also Commissioner-General of the Paris Exposition.

The programme contained forty papers, ranging, according to usage, under the following subject divisions:

First Section—"Tracks and Track Construction," 10 papers.

Second Section—"Rolling Stock and Equipment," 10 papers.

Third Section—"Operation," 9 papers.

Fourth Section—"Miscellaneous," 5 papers.

Fifth Section—"Light Railways," 6 papers.

Of these forty papers, two related principally to the subject of electric traction. A resumé is given below of the discussion of these subjects, as they proved of interest to readers of the Street Railway Journal.

The broad subject of electric traction, it should be stated, took an important position in the work of the Congress, and it was the first time which the delegates had considered the practical operation of electric railways. The power station at Moulineaux, which supplies current to the trains of the French Western Railway for its new line from Paris to Versailles; the Austerlitz electric power station and substation, which supplies current to the trains of the Orleans Railroad Company from Place Walhubert to the d'Orsay station; the electrical plant on the Champs de Mars, and that of the Invalides, which supplies current for the trains of the Western Railway Company between the Invalides and the Champs de Mars; the electric traction experiments

by motor cars of the Italian-Mediterranean Railroad Company, between Melun and Corbeil, were also visited by the delegates and inspected. All these excursions were repeated after several days' intermission to permit every one of the delegates, who were exceedingly numerous, to see them altogether and make a study of them.

The first subject of electric railway interest considered by the Congress was No. 20 of the second section, entitled,

INDEPENDENT MOTOR CARS

MR. E. SARTAIUX, of the Italian-Mediterranean Railroad, presented the paper on this subject, which was prepared by him in conjunction with Messrs. Kéroumès and Léchelle. He gave full details of the electric accumulator motor cars on the Belgium State Railways, of the steam cars of the same company, and of those of the Baldwin Locomotive Works; also of the electric accumulator cars on the system of the Italian-Mediterranean Railroad, of the Russian State Railway cars, of the steam dummy, narrow-gage cars of the Rowan system employed by the Société des Chemins de Fer Vicinaux, of Belgium; of the steam motor cars of the local railways of Vienna, which are practically locomotives; of the steam motors car of the French Northern Railway, designed especially for postal service, and of the electric motor cars of the same company.

MR. KRAMER added certain information about the electric cars of the Hungarian State Railway.

MR. E. SARTIAUX thought that motor cars (steam or electric) filled a certain province in railway work, not only on lines of light traffic, but also on suburban lines. On the former they could often be used to advantage instead of long trains, especially where the latter would have to be run at long intervals. On lines of greater traffic they could also be used to advantage; for example, in the belt lines of several large cities, where a short headway was required; also either ahead of or just behind regular trains to care for local traffic. He spoke particularly of the use of accumulator cars as being advantageous.

THE PRESIDENT of the second section spoke in favor of the conclusions of the speakers, and adduced some other facts in support of them.

MR. BAUDRY thought that the conclusions drawn from the paper were a little optimistic, for it seemed to him that motor cars hardly answered the purpose, in spite of some excellent results which had been secured in trials.

THE PRESIDENT of the third section said that most of the trials with this class of car had been very recent, and that sufficient time had not yet elapsed to determine definitely the cost of operation.

MR. BAUDRY, in his reply, said that some of the trials had been conducted long enough to determine this.

MR. E. SARTIAUX explained that, on the contrary, especially in the tests made by the Belgian and Italian railway companies, that all the trials had been recent, and that the results could be relied upon.

MR. BAUDRY objected to this, stating that the steam dummy had been used for a long time. Even if the electric motor car was a recent invention, he added that the inconveniences in the operation of motor cars more than counterbalanced their advantages, except under certain conditions.

MR. A. SARTIAUX thought that the advantages secured by the use of motor cars in the ability to increase the service without adding greatly to the expenses was important. He insisted that a difference should be drawn between motor cars run by themselves and motor cars which drew others. The report, although its title did not convey the idea, referred to both classes of cars. He added that it would be very valuable if the authorities would redraw the statutes which now cover the operation of motor cars so as to secure simplicity.

After a considerable discussion the section adopted the following resolution: "The employment of motor cars, either run by themselves or drawing one or two trailers, has been on a very limited scale up to the present, but it seems as if there is an opportunity for this development. It would be very interesting if trials could be made on this subject not only on lines of light traffic, but also on lines of heavier traffic. It would be very desirable if the companies could continue such experiment as they have made with this class of car. The Congress would be very glad to see such ordinances as apply to this class of car simplified so as to encourage their use."

ELECTRIC TRACTION

MR. AUVERT read a resumé of the report on "Electric Traction," which he had prepared for the second and fifth sections, in connection with Mr. Mazen. The writers had not thought it necessary to cover the subject in exactly the same way as outlined in the original title, and so had modified it. While the steam locomotive is capable of operating at a variable speed, electric locomotives, as at present built, can operate economically at only certain predetermined speeds. On secondary railways a constant speed for all trains could be employed without great inconvenience, but it is not the same on lines of heavy traffic. With the Sprague system all the cars of a train are motor cars, controlled from one point. This offers great advantages for lines with heavy grades, and also for rapid transit city lines, where the question of acceleration is an important one. The greater number of installations made up to this time have used direct current. Alternating currents at high potential are better adapted for lines of long distance, as the voltage can be reduced by various stationary transformers. Alternating current has been directly employed for car propulsion in Italy, and possesses important advantages. In summing up, the writer said that the installations already made show that electric traction is well adapted for secondary lines, but its advantages for lines of heavy traffic have not yet been demonstrated.

MR. MAZEN then presented an abstract of a paper written by Col. N. H. Heft for the Congress, and published in the STREET RAILWAY JOURNAL for Aug. 25 and Sept. 8 (International Edition for September). This paper described the employment of electric cars upon three feeder sections of the New York, New Haven & Hartford Railroad Company, as well as the application of electric traction to street railways. Mr. Heft thought that electric traction could be used to advantage by large railway companies.

MR. MAZEN expressed about the same opinion on this subject as Mr. Auvert.

THE PRESIDENT of the second section proposed the adoption of the following resolution based on papers read, viz.: "On secondary railways electric traction can be used to advantage, but for the operation of heavy trunk lines, except under special circumstances, the employment of electricity is not now considered desirable, at least the operation of locomotives drawing heavy trains." This proposal met with certain opposition.

MR. GERARD thought that the second part of the resolution should be divided and a distinction made between heavy trains and short and light trains. He thought that, so far as the latter was concerned, the advantages of electricity had been shown. On the other hand, he saw great advantages in the drawing of high-speed trains weighing from 250 tons to 300 tons by electric locomotives.

MR. RIGONI cited certain good results obtained in Switzerland by the direct use of polyphase currents.

Mr. Auvert pointed out several difficulties met in the employment of such, and among others that of regulating the speed of the motors. This included the inability to catch up with schedule time in case a train should be late.

Mr. Rigoni did not attach great importance to these difficulties.

A long discussion then followed, in which Messrs. Rigoni and Gérard, Mazen, Baudry and Cairo discussed the subject of current collectors and methods of conducting current to the car.

Mr. Rigoni praised the employment of overhead wires, where polyphase currents at high tension were used, but the other speakers thought, from the results secured in practice, that the third rail was preferable when the speed exceeded a certain limit.

Mr. Von Leber thought that considerable difficulty would be found in the employment of high-tension currents directly, and that this had been the result of the experiments in Italy.

Mr. Rigoni replied that in Switzerland, after a thorough set of experiments, that no such difficulties had appeared.

Mr. Cairo added that the same experience had been found in Italy. He gave a number of details as to the precautions adopted in the employment of high-tension curcuits.

This point was also followed by long discussion.

Mr. Solacroup remarked that in practice it was important to take the financial side of the question into consideration. He would like to see the technical side of the subject of the application of electricity to heavy electric railroading separated from a study of the economical side, for he thought that the real drawbacks to the employment of electricity in this work were almost entirely financial, but this statement is denied by a number of the members, and it would, therefore, seem very difficult to arrive at a satisfactory conclusion at present on the subject with so few data at hand as to the cost of operation. Another important element to which sufficient weight had not been attached, in his opinion, was the importance of traffic on the line under consideration.

Messrs. Clerault and Von Leber said that it would be premature to state that the problem of the application of electric traction to railway work had been solved even for secondary lines.

Mr. Campiglio thought that the use of electric trains on railway systems would introduce new questions of operation, on account of their lightness and greater frequency.

Mr. Baudry insisted on the importance of the tests which had already been made with polyphase currents, and on the service which it had so well rendered.

As a result of this discussion, the two sections finally passed the following resolution; "The Congress considers that actual progress has been made in the application of electric traction to certain railway lines operating under special conditions. This progress has been both technical and economical. The information at hand is not sufficient to determine yet whether this application is advantageous under all conditions of railway service, especially where heavy trains are run at high speeds over long distances."

M. R. Maltbie, editor of *Municipal Affairs,* has replied to the circular letter recently sent out by the Chicago Street Railway Commission with reference to suggestions as to the best method of procuring a suitable rapid transit service. Mr. Maltbie suggests the building of subways, and that the municipality at least should own the tracks, leaving the questions of control and operation in the hands of private companies.

Deterioration of the Peoria Standpipe

BY A. B. HERRICK

In a paper entitled "Electrolysis of Underground Metal Structures," read by D. H. Maury before the American Waterworks Association at Richmond, Va., in May, 1900, an attempt was made to show that the collapse of the standpipe at Peoria, Ill., was due to electrolysis, caused by electric railway return currents. This paper was later introduced as evidence in the test case for damages for the destruction of this standpipe, between the Peoria Water Company and the Central Railway Company, of Peoria.

An abstract of the portion of this paper referring to the standpipe, as it appeared in the *Engineering News,* is reprinted below:

On March 30, 1894, the water company's steel standpipe on the West Bluff burst, killing one person and injuring fifteen others, one of whom died later from his injuries. Upon examining the wreck of the standpipe, the writer at once noticed a peculiar pitting of the inside of the vertical sheets, and the appearance of these pits was so different from that caused by any ordinary oxidation that he was soon almost positive that they were due to electrolytic action. A similar standpipe on the East Bluff was drained, and was found to be similarly pitted. The whole inner surface of the vertical shell appeared to be thickly covered with blisters resembling in outward appearance the tubercles sometimes found inside of old cast-iron mains. This blistered covering, which was almost as thin as paper, was composed entirely of oxide of iron, and on brushing it away with the finger tips, the black paint with which the standpipe had been originally coated would be found beneath it. The black paint was oftentimes almost unbroken, or, at least, very slightly cracked. When the paint was brushed off, the pit would be disclosed, considerably smaller in area than the surface covered by the blister. The surface of the metal in the pit was perfectly bright and clean, and its fiber was clearly discernible. Many of these pits were more than ⅛-in. in depth. They were slightly more numerous in the West Bluff pipe than in the East Bluff standpipe, and were in both generally larger and deeper on the lower courses of the vertical shell.

FIG. 1.—VIEW OF WRECKED STANDPIPE AT PEORIA, ILL., SHOWING PITTING ON UPTURNED PIECE, DUE TO ELECTROLYSIS

(The two largest blotches are streaks of mud.)

Fig. 1 is a photograph of the wrecked standpipe, the upturned corner of the torn sheet near the center of the picture showing the pitted appearance of the surface, the blisters having been, of course, shaken off by the fall of the metal, and the metal itself having become somewhat oxidized before the photograph was taken. Fig. 2 is from a photograph of a small sample of steel from the standpipe, and shows the pitting in the sheets around the edges of the rivet heads.

It seemed advisable to secure a thorough expert examination with a view to determining the cause, nature and extent of the observed pittings on the standpipes, and injuries to the piping system. Stone & Webster, of Boston, were selected to make this examination. The work, in which the writer, from time to time, assisted, covered seven weeks on the ground, and the reports submitted by Stone & Webster fully confirmed the suspicions that the pitting was caused by electrolysis, and established the fact that the entire piping system of the water company

would be endangered by a continuance of the existing electrical conditions. The West Bluff standpipe was distant about 60 ft. from the street railway line on Bourland Street. The East Bluff standpipe was about 700 ft. distant from the railway line on Knoxville Avenue. Both standpipes were more than a mile from the power station, and were negative to the rails. The electrical examination relative to the standpipes was conducted mainly at the East Bluff standpipe, which was still in service. A flow of a part of the current from the railway line was clearly traced through the earth to the anchor bolts which held the standpipe to its foundation, as shown in Fig. 3, up these bolts and into the steel of the shell, and through the shell and from its inner surface to the projecting section of the 16-in. flanged cast-iron pipe which served as both inlet and outlet, and which connected the standpipe to the water mains. The current was then traced along this pipe and along the mains to the power station. The deflections of the voltmeter needle were clearly traced to the railway current, being especially influenced by the one or two cars on the line beyond the standpipe on Knoxville Avenue, and when the cars stopped running at night, the movement of the needle ceased. Where the current left the inner surface of the shell to pass through the water to the inlet pipe it made the pits already described.

Fig. 4 is from a photograph showing the interior surfaces of three sections of this inlet pipe, marked A, B, and C, respectively, the positions occupied by these sections originally being shown by the letters A, B, and C in Fig. 3. An examination of the photograph shows the strongly marked and numerous pits which were found inside the sections A and B, while the inner surface of the section C was found to be practically as smooth and perfect as though new. When the condition of the inside of these three sections of pipe was first noted, it seemed hard to understand why A and B should be pitted, while C was unaffected. A closer examination, however, showed that in the flanged joints between the bottom sheet of the standpipe and A and B, respectively, corrugated copper gaskets were used, while the pipe B was separated from the pipe C by a thick rubber gasket; and that under the nuts and heads of the bolts holding the flanges together there were grummets or wrappings of cotton wick soaked in tallow. The result of the arrangement was, that the current which entered A,

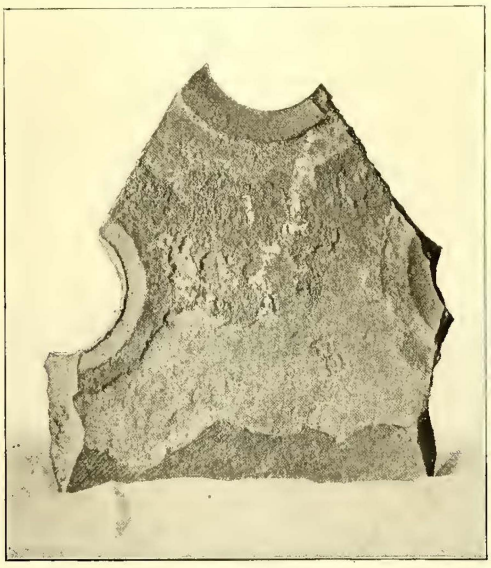


FIG. 2.—VIEW OF FRAGMENT OF PEORIA STAND-PIPE, SHOWING PITTING AROUND EDGES OF RIVET HEADS

after passing through the water from the inner side of the shell of the standpipe, and which was trying to return along the inlet pipe and water mains to the power station, encountered, at the joint between B and C, the rubber gaskets and grummets. The effect of the gasket and grummets was to practically insulate the section C from the section A and B, and as none of these pipes were in contact with the ground, the current was compelled to leave the pipes A and B and travel through the water or along the slimy coating of oxide on the inside of the pipes around the joint between B and C, in order to continue on its journey. As the current was not leaving C, this pipe was not injured, but the current, in leaving the inner surfaces of A and B did pit them, as shown in the photograph.

These standpipes and the inlet pipes were negative to the rails, and are striking examples of electrolytic pitting under such conditions.

The coroner's jury reported that, after having made a careful examination, both mechanically and chemically, of this standpipe, the failure *"was occasioned by the use of inferior material in construction."* William D. Pence in a report published in his book on Standpipe Accidents and Failures regarding the metal used in this standpipe, stated:

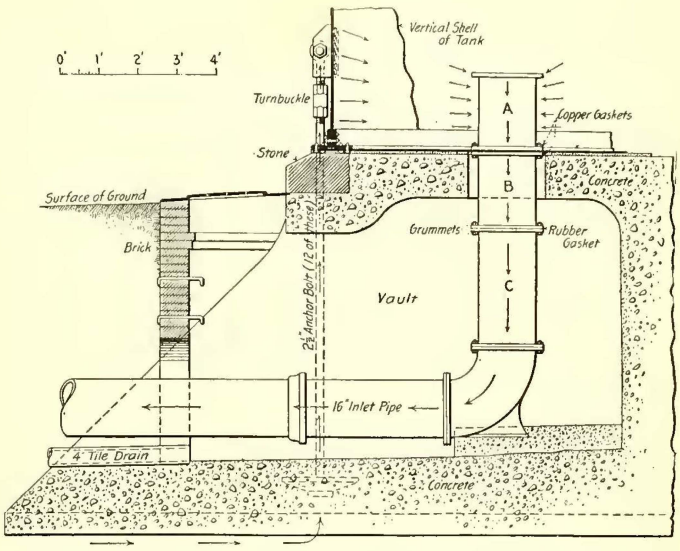


FIG. 3.—MAURY'S DIAGRAM, SHOWING FLOW OF RETURN CURRENT

"No physical test of this piece (referring to sample of this standpipe plate) was made, because it broke off short in the attempt to cut out a sample piece." In regard to the initial rupture, Prof. Pence says that this took place at or near the point on the north side of the standpipe where calking was in progress, and occurred at the time, or a moment before the standpipe collapsed.

It is evident from the above that these authorities do not consider that the failure of the standpipe could be attributed in any way to electrolysis. But let us consider further. The pittings found on the interior of the shell, it is assumed by Mr. Maury, were caused by the action of the current from the ground return of the railway company.

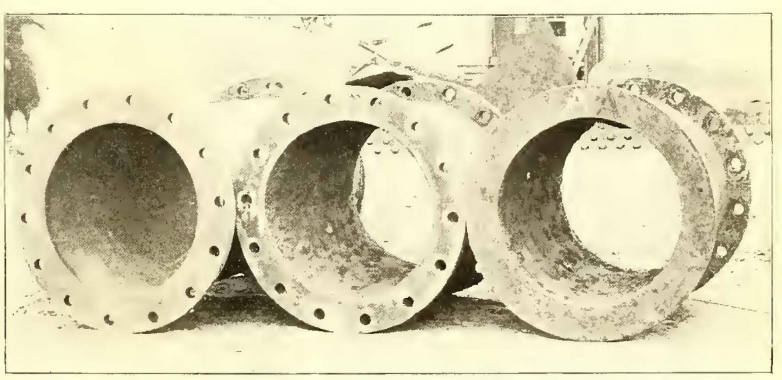


FIG. 4.—INTERIOR VIEW OF LENGTHS OF INLET TO STAND-PIPE, SHOWING PITTINGS IN A AND B, AND EFFECT OF INSULATION OF C

Mr. Maury shows, in Fig. 3, the course this current would take in order to produce the pitting on the interior of the shell and outlet pipe of this standpipe. Pitting of this character is well known. Technical journals, such as the *Engineering News,* are full of records of cast iron, wrought iron and steel being pitted, and the descriptions of the blisters or tubercles are identical with Mr. Maury's description of what he found on the interior shell of the standpipe.

This action is very extensive in some cases, and I will cite an instance, which D. J. Lewis related before the Society of Mechanical Engineers at their meeting in Cincinnati in regard to the interior of a penstock, examined in 1893. This penstock was used by the Merrimac Water Company, and became pitted before any electric railways were located near it. He states that "the interior was covered with barnacles as large as 2 ins. in height, and 1½

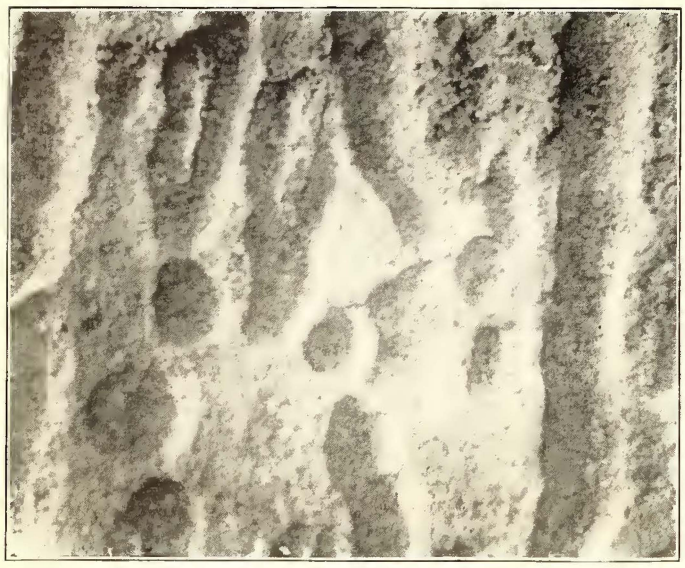
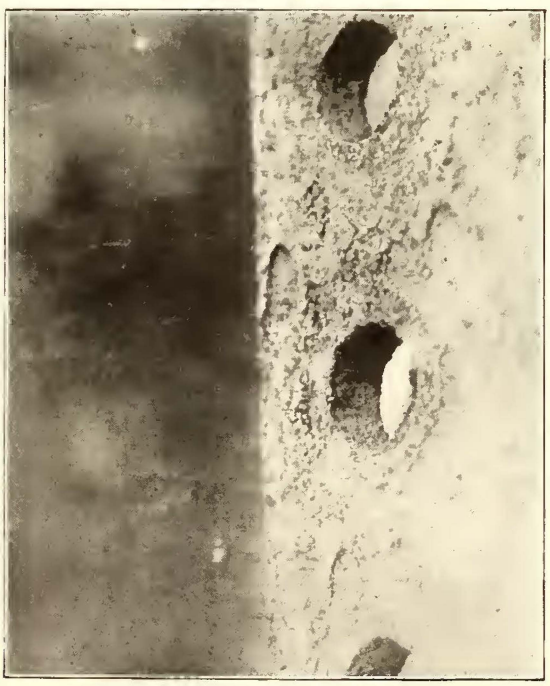
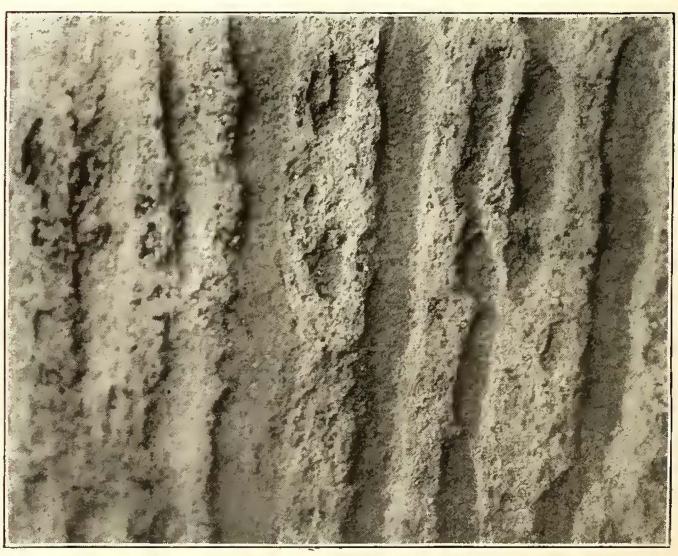


FIG. 5.—REPRODUCTION OF PITTINGS FROM STAND-PIPE IN RARITAN NOT DUE TO ELECTRIC RAILWAY

ins. in diameter, and on their removal the metal was found badly pitted, as deep as 3-16 in. in places."

Figs. 5, 6 and 7 show the pitting of a standpipe located at Raritan, N. J., between the canal and the river, there being no electric railways within many miles. This standpipe was taken down on account of the severe pitting action of water on the internal surface, which certainly shows a great deal worse condition than that exhibited by Mr. Maury in Fig. 2.





FIGS. 6 AND 7.—REPRODUCTIONS OF PITTING AT RARITAN, N. J., NOT DUE TO ELECTRIC RAILWAY

Fig. 7 shows a very remarkable grooving produced in this standpipe plate, as these pits seem to be from one edge of the plate to the other in nearly parallel lines.

In Fig. 8 will be found a larger diagram, showing the relative locations in Peoria of the railway, the water main and the equalizer leading to the standpipe; the arrows show the relative flow of current from the railway system to the water pipe. It will be noticed that, in the distribution of current in the railway, the current leaves the rails and passes 80 ft. to the standpipe; on reaching the latter it has to pass underneath the concrete foundations into the anchor bolts, D. In doing this it has to pass by the 16-in. main, which carries this current back into the piping system again. How this current flows against itself to and from the standpipe cannot be explained by any known laws of distribution of current over potential surfaces.

Again, in order to sustain this theory of electrolysis, the current has to leave the pitted sides of the standpipe and reach the flange A in order to affect the internal sheets of the standpipe as claimed; it has also to pass through the water circuit instead of the metallic circuit formed by the iron bottom of the standpipe to which flange A is connected. The measured resistance of the metallic circuit, which shunts the water circuit, shows the relations of these two circuits to be over 890,000 to 1. In other words, the natural laws of electricity have to be distorted to account for the depreciation of this standpipe from electrolysis.

The pitting of A and B, in Fig. 4, and not C, can be readily accounted for by the fact that A and B, being part of the standpipe structure, were not of the same composition as pipe C, and were made by the standpipe manufacturers. This iron runs high in phosphorus and carbon, and it is well known that this composition is much more readily corroded by water than cast iron.

It can be seen from the photographs, Fig. 4, that the top flange of A and the surface around the bolt holes are pitted. If the current did flow from the sides of the shell to A, these surfaces should not have been pitted, according to Mr. Maury's statement.

The measurement of potential made on the standpipe shows, as might be expected, high resistance between the stay bolts imbedded in concrete foundation and the ground. Each of these bolts was measured with a potential of 500 volts to discover if by any conceivable means current, to produce the pitting complained of, could have been introduced into this standpipe, but if it had, it would not have taken the path indicated in Fig. 3, due to its preference to a metallic low-resistance path over a high-resistance water path.

It was further found, in connection with the electrolysis

power station, that the Peoria Water Company had established a metallic connection between the water pipe system and the rail returns by locating its gate boxes directly against and electrically connected to the rails, thus forcing current into the water pipe system. The position of the rails in the streets is fixed by ordinance; the gate box location is at the option of the water company.

It behooves the water companies, then, to use reasonable care in the construction of their water pipe systems, so as not to introduce directly into their systems the current of which they complain. I am familiar with a number of cases where, due to improper construction, they have voluntarily connected the water mains so as to form, by the water mains, an auxiliary return to the rail return.

In regard to the electrical measurements on this standpipe, it should be stated that the soil surrounding the standpipe and on the bluff is clay of fairly high resistance. Any two iron grounding rods stuck in the soil several yards apart, at this location, will show a difference in potential. A much more marked difference will be found when one rod is stuck in the ground and the other connected to the water pipe, for then the water pipe acts as a pressure wire over a larger potential area. Tests made by Mr. Maury by measuring the potential between the standpipe bolt and the 16-in. water main were not tests duplicating the conditions that existed before the collapse of the standpipe.

If an officer of the water company wished to find the flow of water in a pipe, and sent out a man to determine it, and if the latter should report that there was 80 lbs. pressure, it would not be rash to come to the conclusion that the man was ignorant. Yet in the question of electrolysis potential differences are given as a criterion of the electrolytic conditions existing, whereas the only thing that has any bearing on the subject is the current flow.

As the effects of oxidation from the natural action of the soil and its constituents, and those caused by oxidation from decomposition by electrolytic action are identical to visual and mechanical examination, and whereas a special chemical examination will disclose whether the residue was produced by electrolysis or ordinary corrosion, in equity, it should not be assumed that all rust or pitting (where the pipe is positive to the rail) is caused by electrolysis; for this is throwing, by an unwarranted assumption, on the railway companies the burden of maintaining the water pipe systems, which are positive to and paralleling their tracks, against natural depreciation.

The investigations carried on by water companies are in some cases placed in charge of electrolytic enthusiasts, who will unfold tales of horrors that are going to happen by the wholesale destruction of the water mains due to the silent but inevitable action of the diverted railway return current. This has happened periodically for the past seven years, but the fear of danger has now nearly passed, except when expressed in scare lines in the public press, for nothing serious has yet happened that could be attributed, even by the water companies involved, to electrolysis.

Where the railway and water companies can mutually co-

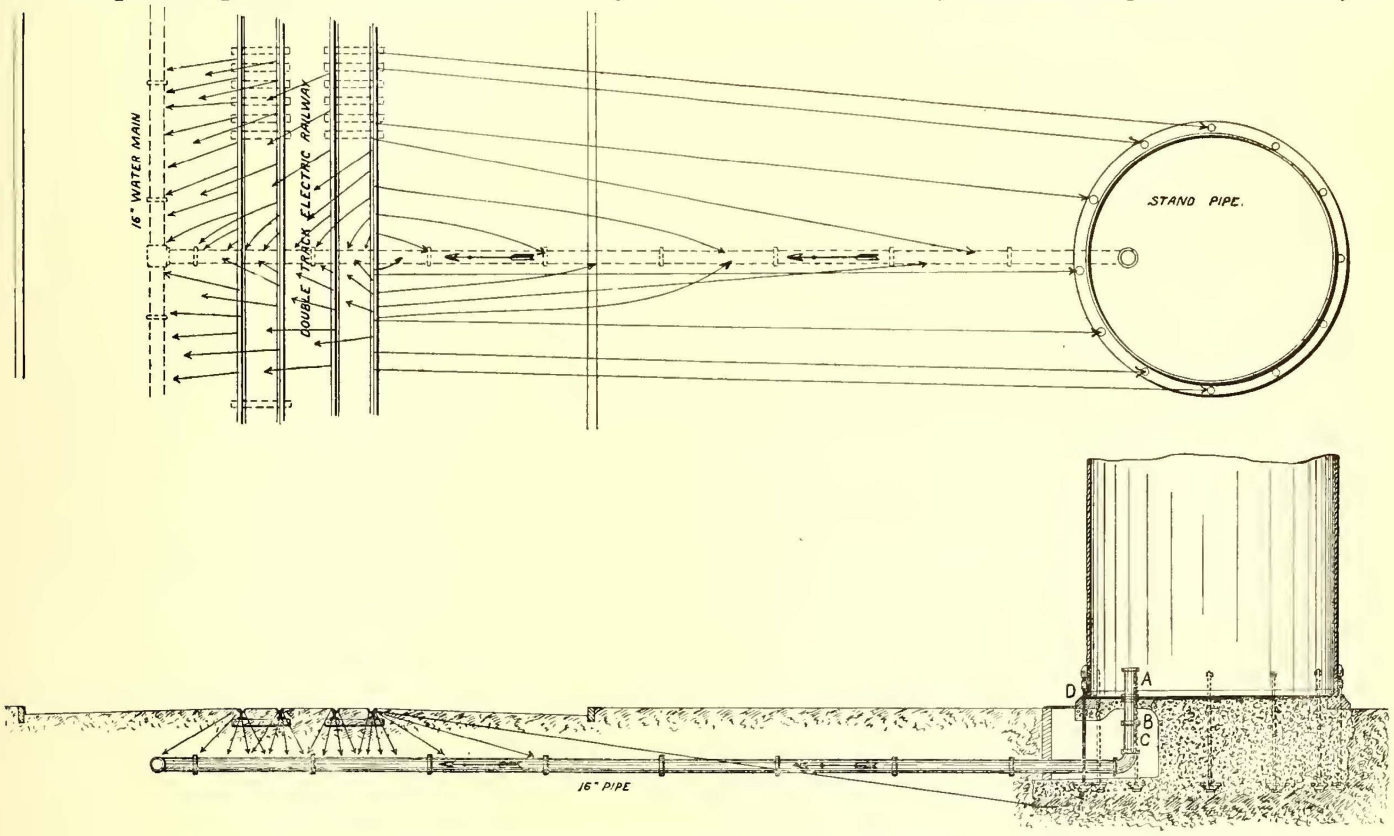


FIG. 8.—CORRECT DIAGRAM OF CIRCUITS AT PEORIA

operate in carrying out such changes in the existing systems, and where they adopt such methods as are well known and have been in operation for years, the problem is a simple one. But where relief at law is the resort chosen by the water company, it is necessary (even in this case) that justice may be done by the processes of law, for guilt cannot be assumed until proven. This legal axiom should be followed in scientific investigations to insure the disclosure of the true causes for any particular phenomenon observed; such examinations mislead the observer if undertaken only to prove a presupposed case.

Mr. Maury's solution for electrolytic difficulties is for the railway companies to erect a double trolley system. In support of this he cites the well known Cincinnati construction, and also says:

> In Washington, D. C., all roads within the city limits are required by law to have a complete insulated underground metallic return for their current, and by recent acts of Congress, passed on account of electrolytic injury caused by the single trolley system, the overhead double trolley is required in all other new or amended charters within the District of Columbia.

The real conditions in Washington are shown by a letter,

published in *The Electrical World and Engineer* for Oct. 20, from Walter C. Allen, District electrical engineer. The last two paragraphs of this letter are abstracted herewith:

Owing to the efforts of the District authorities to require all lines within the District to be double trolley, and to the fact that their efforts will undoubtedly result in securing legislation to that end, the company voluntarily rebuilt the line on the double trolley system. It is, however, not operated as such, but is operated as a single trolley line with a ground or rail return, which accounts for the statement in this article that the rails have been bonded at the joints.

Of the nine railway companies controlled by the Washington Traction & Electric Company in the District of Columbia, only one of them is required by law to operate with the double trolley system. In rebuilding the lines over which they secured control, however, they have equipped four of them with the double trolley system, among which is the one mentioned in this article.

It is evident from the above that the railway companies do not wish to use the double trolley unless forced to do so by law.

CORRESPONDENCE

Tractive Resistance on Street Railways

British Electric Traction Company,
Norfolk Street, London, Oct. 15, 1900.

Editors Street Railway Journal:

In a recent editorial you discuss tractive resistance of street railway cars, and state truly that the amount of knowledge on this subject is singularly small.

It should not be difficult for engineers to get together a considerable amount of experience, or rather of the results of experience, if they would only make an occasional test of a car under varying conditions as to load and weather. The probability is that they would be surprised to find how small was the resistance due to the motor. It is desirable that this should be known, however, and it may easily be obtained for the more important case of the motors being driven by the car rather than when driving the car, for in the former instance the wheel is driving the pinion, and the friction is probably a maximum. The resistance of the motor or motors can be arrived at by difference. The car may be allowed to drift down hill under the influence of gravity only, and in full working order. The motors may then be disconnected, and the car again allowed to drift and the resistance calculated from the difference in the times. For this purpose a gentle declivity of as uniform a grade as possible should be selected of about 1 in. in 90, to 1 in. in 100, or about 50 ft. to 60 ft. per mile. The grade should not be so steep as to necessitate the use of the brake. A distance of about 400 yds., more or less, may be selected, the length being to a considerable extent determined by the choice of the grades, for a grade flat enough not to accelerate the car too much will permit of a longer drift without excessive speed being attained.

Very good results may be secured with no further marks of distance than are afforded by the poles of the overhead system, but as these are not usually spaced at identical distances, and are perhaps too widely spaced also, it will be found an improvement to use wide lathes, painted white, and these should be observed by an observer through a vertical opening, which can be made by means of a slit in a paper pasted over the car window. Time may be recorded from a clear center seconds watch, hung so as to be visible to the observer, so that he may read the time as the post passes the eye. The equal spacing of the poles simplifies the drawing of curves of performance, and also the calculations.

A convenient recording instrument would be a well-regulated clockwork-driven strip of paper, on which the observer would press a mere dot as each pole was passed. Recording clocks, as often used with their paper movement controlled by a fan at the end of the wheel train of the clock, are not reliable. The control must be given by a balance wheel, and with an accurately driven paper band the time can be measured off after the test. Fan-regulated movements are useless for timing; they are not merely inaccurate, but give inconsistent results when wound more or less fully up or down.

Speed records may be taken by a tachometer, if required. This driven off, the axle of the car will give results that can be read fairly well, and are fairly consistent with other observations, but speed can always be calculated from the time records and post intervals probably as accurately as it can be read from a dial.

When more extended tests are to be made the current used by a car when running with current may be measured from a recording ammeter on the usual traveling band of paper. Instruments devised for this purpose by Mr. Sudworth have a band that travels at the rate of 3 ins. per minute, and the average current used on any run can be found by setting the points of an Amstler planimeter to the length of the diagram and finding the mean height in the usual way. If a diagram extends beyond the range of the planimeter it can be divided exactly in halves or thirds, and each measured separately, and averaged with the other or others. The exact voltage may be similarly recorded by another similar instrument.

If a car be released from rest at the top of the chosen gradient, and allowed to descend freely under the influence of gravity, it will gradually accelerate its speed, and will pass the posts in decreasing intervals of time. The results can easily be plotted in curves by setting vertical ordinates to any convenient scale on a horizontal line, and drawing horizontal abscissæ from a vertical scale of time to each post. The intersections of these lines with the post lines are points in the curve.

It is necessary to have an accurate measure of the levels of the rails at each post, in order that the gravity calculations may be made. It is a well known fact in mechanics that a body falling freely a distance of 16.1 ft. will do this in one second, and will attain a final velocity of 32.2 ft. per second. The effect of gravity is thus described as an acceleration of 32.2 ft. per second in one second. For this it is necessary that the body should fall along a radius of earth, *i e.*, vertically. But no matter what may be the the path of descent of a body, it will still acquire the velocity of 32.2 ft. per second if it descends 16.1 ft., but the time required will be longer. If an absolutely frictionless mass be allowed to descend a grade having a total fall of 16.1 ft., it will acquire the velocity of 32.2 ft. per second, whether the grade be 96.6 ft. long or 966 ft., but in the one case the time of descent will be performed in six seconds, and in the other case in sixty seconds, the ratio of time being inversely as the tangent of the inclination.

In order to obtain a datum for comparison we may assume first a frictionless car, and find the velocity it should obtain. The formula for accelerating is

$$V = \sqrt{2 g H}, \text{ or } 8.025 \sqrt{H}$$

where $g = 32.2$, and H = total declivity. In a given case where the total fall was 9 ft. in 900, the acquired velocity per second would thus be $8.025 \sqrt{9}$, or 24.075 ft. We may neglect the decimal for present simplicity, and call $g = 32$. Then the acquired velocity will be 24 ft. per second. The car having started from zero, the mean velocity is 12 ft. per second, and the time required to pass over a distance of 900 ft. is 75 seconds. Had the fall been vertical the time would have been .75 second. The slope being one in one hundred, the time is multiplied one hundred fold. In fact a grade may be regarded as a parallel with the Attwood machine

for exhibiting gravity effects. Gravity is thus reduced in its effect to the one hundreth of its normal intensity, or 0.32. If gravity is reduced to this fraction it naturally follows that to produce the effect of gravity on a level would demand 22.4 lbs. of tractive effort per ton (2240 lbs.). A 7-ton car would thus demand a tractive effort of 156.8 lbs. to produce the effect of a grade of 1 per cent.

Let the case be now taken of a car that descends the same grade in 150 seconds. Here the mean speed is 6 ft. per second, and the maximum is 12 ft. The effect of gravity is such that V. is now 12 ft., and the velocity equation becomes $12 = x\sqrt{9}$. Therefore $x = 4 = \sqrt{2g}$, and the effect of gravity is thus only 8. In other words, as gravity still exerts its customary acceleration of 32, there must be some force now acting to oppose gravity. The magnitude of the opposing force is obviously the difference between 32 and the new gravity, or $32 - 8 = 24$. As the grade is still 1:100, the value of the retarding force is 0.24. Then $.24 \times \frac{1}{g} \times 2240 = 16.8$ lbs. per ton.

This is the resistance of the car axles, its motors, the rails and the atmosphere, and closely corresponds with a recent test made by the writer on a grade of 1 in 95.5, which showed 16.88 lbs. per ton on a clean rail at a mean velocity of 6.28 ft. per second over a distance of 835 ft., or about 120 lbs. for a 7-ton car. As this resistance was exerted over a space of 900 ft., we have a total resistance in foot-pounds of $900 \times 120 = 108{,}000$, spread over two and one-half minutes, or 43,200 foot-pounds, or at the rate of about 1 1-3-hp per minute for the given velocity. The usual statement of resistance in pounds per ton may, however, better be kept to, and we may state that a double motor car of four wheels will have a resistance of about 17 lbs. per ton, at a mean speed of 6 miles per hour. We may know from this that car resistance must have provided for it, say, 20 lbs. per ton, and that all tractive force beyond this may be assumed to be available for acceleration or hill climbing.

In an ordinary, well-maintained, oil-lubricated car of the type named, run on a clean rail of grooved type, it appears from other tests that of the total resistance to traction about half is due to the four axle bearings and the remainder to the machinery, rails, etc., but further experiment is needed to confirm this *opinion,* which, if correct, points to the importance of care in the maintenance of these bearings that are apt to be more neglected than perhaps the motor bearings or suspension brasses.

WILLIAM H. BOOTH, M. Am. Soc. C. E.

Kinks of the North Jersey Street Railway Company

On this page are illustrated some ingenious devices in use in the shops and on the road of the North Jersey Street Railway Company. The first cut shows a useful device which has been in service for some time at the Newark repair shops. This is a trolley-pole straightener, and gives very satisfactory results. Considerable power can be exerted by the screw, and bad twists can be removed without greatly injuring the tubing. The cut gives a good idea of the general appearance. The pole is straightened by placing it on the hooks, with the convex side toward the screw, and tightening until the bend is taken out. The whole apparatus is about 2 ft. long, and can be used without removing the trolley pole from the car.

In the next engraving is illustrated a handy appliance for adjusting the sprocket chains of sweepers. It consists of a turn-buckle with a hook at each end, the length when screwed out being about 3 ft. When in use, the ends are hooked into the links, and, with a few turns, the chain is drawn tight. The operation of fastening or unfastening the connecting links is facilitated by the shape of the hooks, as the curves allow easy access to the chain.

The difficulty of replacing portions of the rattan in snow-

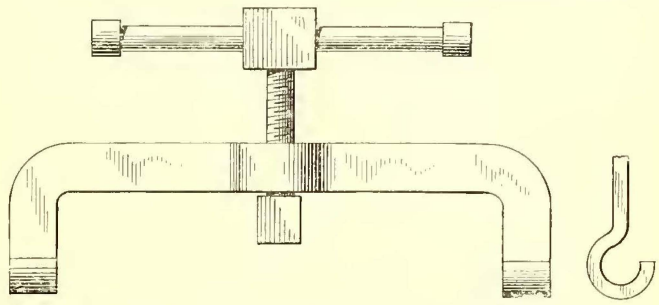


FIG. 1.—TROLLEY POLE STRAIGHTENER

sweeper brooms and the liability to uneven wear, which necessitates such changes, has led to the invention of a sectional broom for use on this road. The accompanying engraving shows the broom, which has been patented by H.

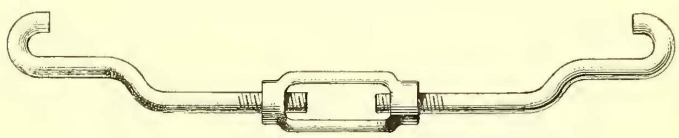


FIG. 2.—ADJUSTABLE LINK FOR SWEEPERS

H. Adams, master mechanic of the company, with two of the sections removed. As can be seen from the detail drawings of the device, each independent section consists of a row of bunches of rattan bent around a board and

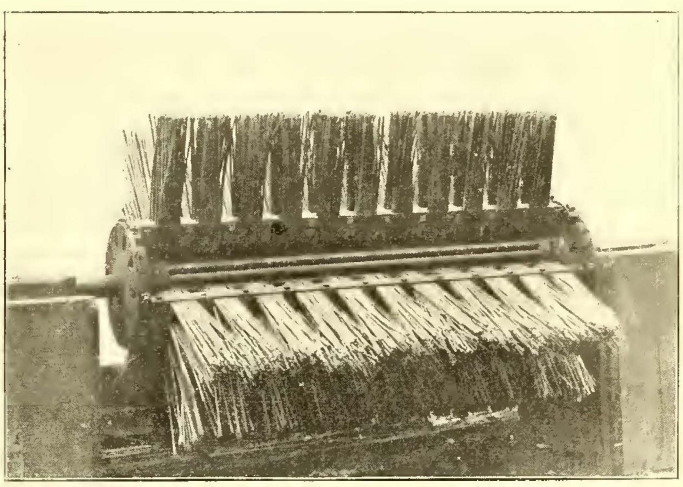


FIG. 3.—NEW TYPE OF BROOM

held in place by iron strips bolted along the edge. Blocks are placed between the bunches so that a large amount of rattan is saved without affecting the efficiency of the broom. When a section is in position it is secured

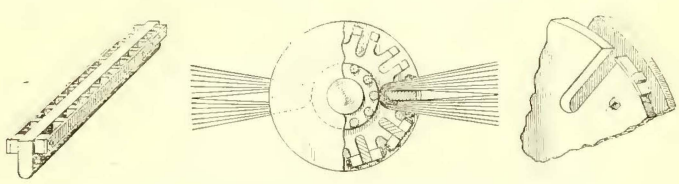


FIG. 4.—METHOD OF FASTENING THE RATTAN

by clamping strips similar to the one shown in the last figure, and the bunches of rattan are held firmly by the backing or retaining bars, which are fastened permanently to the spider heads. A section may be removed while the broom is in position, and the bunches replaced by new ones without loosening any other bolts.

STREET RAILWAY JOURNAL

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The first official trip of an electric train with the new equipment on the Manhattan Elevated Railway, of New York, occurred Nov. 22, and marked an important epoch in the history of the company, as well as in that of the transportation system of New York City. To those who have ridden on the electric elevated railways in Chicago the trip was of no great novelty, although the operation of the cars was excellent, and reflected great credit on the engineers in charge. To the New York public, however, the new train was a revelation of what electric power in elevated railway service can do, and the quickness of acceleration, the absence of jolting in starting and stopping, and the cleanness of the equipment and operation excited widespread and most favorable comment. The engineers expect to have the entire Second Avenue line in operation by the end of this year, and probably by April will have engines turning in its new power station at Seventy-Fourth Street and East River.

* * *

New York during the next year will present a scene of the greatest activity in electrical construction, particularly in station work. The Metropolitan Street Railway Company will be engaged upon completing the 216th Street station, formerly belonging to the Third Avenue Railroad Company. This station was originally planned for 96,000 hp, and was described in the STREET RAILWAY JOURNAL for January, 1900. Under the present plans it will be completed to one-quarter its originally planned size, and will supplement the output of the Ninety-Sixth Street station of the Metropolitan Company. The latter station, although practically completed so far as operation is concerned, will necessarily be the scene of considerable activity during the next year, with the perfection of details which the necessity for current has prevented the company from making up to the present time. The new station of the Manhattan Elevated Railway, with its 11,000-hp units, is now progressing rapidly at East Seventy-Fourth Street, and the extent of the work there will necessarily prevent its entire completion by December, 1901. As indicated in the plans which have been published, this station will be about as large as the two generating stations combined of the Metropolitan Street Railway Company at Ninety-Sixth Street and 216th Street. In addition, the New York Light, Heat & Power Company is about to build a still larger station on East Thirty-Eighth Street, the plans calling for a capacity not far from 150,000 hp. These projects are entirely outside the requirements of the new Rapid Transit Railway, whose underground work is now being actively carried on in a dozen different sections of the city. No announcement has yet been made of the power plans of this system, but while the franchise of the company allows any kind of power except that which produces combustion in the tunnel, it is safe to say that electricity will be used, and that the consumption of power on its line will be at least equal to either of the other two railway systems of the city, surface and elevated. Altogether, New York City seems to be in an excellent way toward being provided with ample power facilities sufficient for the needs of the city during the next several decades.

About once a month we notice in the daily papers a revival of the electrolysis scare in some city or another of this country. The announcement is usually made in the large headlines that the entire sub-surface system of gas and water pipes is being slowly but surely destroyed by the return current of some electric railway, and householders are warned that they are in danger from gas explosions in the street, caused by escaping gas, or that the local fire department may be deprived of its supply of water at a critical moment if the electric railway is not enjoined against using a grounded return. The public is usually duly terrified by these announcements, and the excitement lasts until some other subject comes up to distract its attention, and the whole subject is then forgotten. Occasionally, however, the alleged injury is made the basis of a damage suit, brought by the water or gas company against the railway company. The most famous of these suits was that brought by the Peoria Water Company against the Central Railway Company, of Peoria, the complainants alleging, among other injuries received, the destruction of its standpipe through electrolytic action of the return current of the railway company. This claim is most effectually discussed by Mr. Herrick in an article in this issue, in which he not only shows that the alleged trouble could not have been caused by the railway return circuit, but also proves most clearly that damage of a precisely similar character, or greater, has occurred in standpipes many miles distant from any electric railway. It might be interesting to cite here the actual causes which have been brought against railway companies for alleged damage by electrolysis through the return current. One of these was at Spokane, Wash., where the judge decided that all danger of this kind could be avoided by the use of a particular kind of bond, which the railway company agreed to adopt, and the case was then dropped. A second is the Peoria case, which is still under adjudication. The city railway companies of Dayton have also been sued, and the case is still in the courts.

It would be an interesting question as to how to trace any alleged damage in the case of several operating companies in the same city. If damage is found, or if the water company thinks that it has found evidence of electrolysis, it would be a serious problem to proportion such damage between two or three railway companies which traverse the territory in which the pipes exist. It is not enough to prove that the injury was caused by a return circuit, but the particular amount of damage which each company caused would have to be shown—to collect damages. This argument would not apply to a company operating all the lines in a city, but might be effective where two or more systems occupy the same territory. The water companies, however, are working together in this matter to a considerable extent, while as yet the railway companies have taken no united action on the subject. While we do not believe that the result of this litigation will be in any way different from that of the early telephone litigation with electric railways, in which the effort was made by the telephone companies to compel the railway companies to give up the ground return in favor of a complete metallic circuit, there is no doubt that greater public education on the subject is required.

The proceedings of the International Street Railway Congress, which are published in extended form in this issue, will be found of great interest to readers on both sides of the Atlantic. The Congress, which was held in Paris during the Exposition, was made coincident with the regular biennial meeting of the International Street Railway Association, which comprises the principal street railway companies of Europe outside of England, and its proceedings have always commanded great respect. The list of subjects selected for discussion was quite comprehensive, and included subjects of motive power, power distribution, track construction, rolling stock, equipment and operating details. The custom of the association, by which the author of a paper submits with his paper certain conclusions derived from it for endorsement by the association, was productive of considerable discussion, and was an excellent means of eliciting the combined opinion of the members of the association on the topics under consideration. Two of the most interesting features of the meeting were the condemnation, by practically all the delegates who spoke, of the storage-battery system of traction and the insistence, where the advantages of "electric traction" were referred to in the other papers, that the overhead system was the one understood and intended. In this respect, street railway practice abroad has shown a very marked change in sentiment. During the early days of electric traction, while the overhead system was being installed and developed in America, the energies of European engineers were being devoted principally to the endeavor to produce storage-battery cars which would operate. The overhead system was regarded as a barbarism, and money was unreservedly spent in the purchase of new types of batteries and forms of plates. Many American managers were confronted by the local authorities in their different cities with the inquiry as to why storage-battery cars could be made to give good service abroad and were not considered commercially practical in this country. It seemed as if "climatic conditions" could be the only reason possible. But the truth had finally to come out, and it would seem as if the vast expense to which many of the European companies have been put in the attempt to operate storage-battery cars had, if anything, served to intensify their opposition to any compromise on the subject. It is doubtful whether in the meeting of any American street railway association such sweeping condemnations would have been uttered. The other subjects discussed and the expressed sentiment of the association upon them were, briefly, that the use of transfers could not be separated from a great many disagreeable features; that electric lines should, if possible, be built standard gage; that the cast-welded joint had been demonstrated to be a valuable improvement for street railway tracks; that heaters were an undesirable portion of the equipment of a car; that a standard rating for tramway motors is desirable; that too little attention has been given to the subject of brakes, that this is a very important feature of street railway operation, and that it could well be studied by street railway managers to advantage. These conclusions, with the exception of that on heaters, might very well have been adopted by any representative American street railway association without exciting much comment.

* * *

It seems, however, that within a week after the close of the Street Railway Association, the International Railroad Congress, comprising representatives of the principal steam railroads of the world, discussed electric traction to a considerable extent, and, surprising as it may seem, considerable attention was paid to accumulator traction. Whatever the advantages that accumulator traction may possess, many would naturally suppose that they would not be particularly evident on a line operating over its own right of way, and where high speed is usually desired. Nevertheless, it is interesting to note that the Steam Railroad Congress treated accumulators with much greater respect than the managers of the European street railway companies, whose scant courtesy to this method of traction characterized their Congress. It is undoubtedly true that on long lines of very light traffic, where single motor cars are run only every hour or so, and where consequently the transmission is over a long distance, while the load is light and fluctuating, the ordinary direct-current system of distribution does not show up so advantageously as under other conditions. We doubt, however, whether many steam or electric railway engineers in this country would advocate storage-battery cars for a condition of this kind. If electricity had to be depended upon, we believe that either high-voltage transmission with rotary sub-stations and storage-battery boosters would be preferable, or an attempt would be made to develop a market for electrical power at other points along the line to equalize the load.

* * *

It appears somewhat strange that the modern electric heater should not have followed other American improvements on the European electric tramway systems. Municipal authorities abroad have paid the greatest attention to the brake question, and are more rigorous in their requirements for brakes than are those in this country. They are also very strict in regard to the drop of voltage on the return circuit, and have compelled the companies to introduce many refinements in this particular which are not considered necessary here. The heating of cars, however, has not been considered of as much importance. The reason can not be due to climatic conditions, because in

many of the cities of France and Germany the winters are often as severe as they are in our Eastern and Middle States. The reason is undoubtedly due to the fact that no satisfactory system of heating has ever been applied to European steam railroad coaches, and that the public consequently has not been educated up (or down) to being warm while traveling. Europeans traveling in this country often complain about the degree of heat in our steam cars, and claim that it is productive of colds, caused by passing from the heated car to the outside air. We believe that while American cars, both steam and electric, are more overheated than underheated, there is a considerable field in Europe for the modern electric heater.

We have met recently frequent inquiries concerning the results that should be reached in electric railway practice while using various coals and mixtures of coals. To answer them in particular is an almost impossible task, but at the risk of boring a few of our technical friends, we desire to call the attention of our readers in general to some considerations touching the use and efficiency of fuel. While the world's coal supply is by no means in imminent danger of early or even remote exhaustion, it certainly is a fact that the actual condition of our coal supply, with respect to production, is such that there is serious danger of steady appreciation in price. To a considerable extent the fuel supply is now controlled by a few groups of producers, who are by no means disposed to enter into cut-throat competition, to put the case mildly, and it behooves large coal users to take account of the situation with an eye to remedial measures. From the general use of high-grade steam coal we are passing to the employment of mixtures that ten years ago would hardly have been considered salable. It is the economic value of these which constitutes the standing puzzle of to-day in steam production. To begin with, one can determine with a high degree of precision the total output of a station in kw-hours, and the indicated horse-power necessary to produce it at the engine under working conditions. Tracing power production back a step further one can readily find the weight of dry steam required, again, under working conditions, to give one indicated hp-hour. We fear from experience that in many stations the analysis of the matter is not carried even to this point, but it ought to be. At this stage of the proceedings the economy of engine and dynamo becomes evident, and the next step is to analyze the conditions of steam production. Here the real difficulty begins. By measuring the water by meter, and the coal by weight, one can get at the coal required to evaporate a given amount of water under working conditions, but this is only half the story, and the smaller half at that. The next obvious step is to find the evaporation at various stages of the station load, in other words, to separate boiler efficiency from engine and dynamo efficiency. If one merely ascertains the coal consumption per kw-hour, he does not find out whether his boilers are doing their work properly or not. But figuring out the work of evaporation done, it is at once apparent whether the boilers are being pushed too hard at full load, whether they waste fuel at low loads, and whether on the whole they are doing reasonable duty.

The proper duty of a boiler, however, depends mainly upon two things; first, the quality of the fuel, and, second, the manner in which it is burned. In relative importance this order should be reversed. Boilers are rated for their efficiency on carefully fired coal of the best quality, such as Pocahontas, and the best boilers will evaporate, under the standard conditions, from 9 lbs. to nearly 13 lbs. of water, according to the care with which they are fired. Right here is a variation of 25 per cent to 30 per cent in the net return from the coal. If the engine and dynamo builders were responsible for such uncertainty in efficiency, they would find it desirable to hastily leave in disguise for Tangiers. Even with the best coal burned in furnaces, known by long experience to be adapted to it, there is, thus, a great variation, due to the skill of the fireman. Certain boilers require a special knack in firing to get the best results. One familiar type, for example, works beautifully, and produces an astonishing amount of steam with a thin and very even fire over the whole grate surface, but let the first once get irregular and lumpy, and the fireman will nearly break his back to get half the output. With relatively poor fuel, difference in firing is even more serious.

As to thermal value, the finest American coals give a total of about 15,000 B. T. U. per pound, more generally a little over 14,000 B. T. U., while a low grade of slack may give less than 11,000 B. T. U. But in point of fact the actual difference in thermal power between first-class steam coal and the scrubbiest mixtures of pea, dust and slack, is far less than one would naturally suppose, and much less, too, than the differences found in the evaporative power of the best coal under different conditions of firing. In other words, poor coal, well fired, will do as well as the highest grade of coal badly fired. Moreover, as a rule, the meanest mixtures of cheap coal are capable of good economic results, if properly burned. But calorimeter tests alone are not a safe guide, since they show merely the total calorific power, and tests under the boilers may be very deceptive, as merely proving that the furnaces and the habits of the fireman suit one kind of fuel better than another.

The problem actually before steam users to-day is to find out how to burn low grades of coal efficiently. A calorimeter test shows what the fuel might do in evaporation, and the next step is to see what it can be made to do. We have, therefore, traced economical power production back to the furnace and the fireman. The conditions of economy in dynamos, engines and even boilers, are fairly well known, but the practice of past years has tended to evolve furnaces suited to standard steam coals, and methods of firing fitted to these furnaces. To meet the new conditions which have grown up in recent years, there is needed a large amount of careful study of the furnaces and methods of combustion suited to relatively cheap fuels, mixtures of bituminous and anthracite pea, dust, slack and culm, to low-grade coals, and to coke, which must not be forgotten in reckoning with the fuel question.

In the final results of power at the switchboard it matters little where waste occurs along the complex course between the coal bin and the bus-bars, so long as it exists. But for some strange moral reason the station manager attaches, generally, great importance to differences of a few per cent in the efficiencies of his dynamos and engines, while a loss of 10 per cent or 15 per cent, due to improper furnaces, unskilful firing, gets lost in the shuffle. How the electricians would bestir themselves if there were a good fighting chance to raise dynamo efficiencies by 10 per cent! Yet, right before us is a task of equal economic importance to every steam-driven station, and one worthy of the most persistent efforts.

Notes and Comments on the Street Railway Accountants' Convention, II and Conclusion

BY A. O. KITTREDGE, F. I. A., C. P. A.

The question of where taxes shall be placed, whether this item is to be regarded as an operating expense or to be treated as a deduction (?) from "net" earnings, will not down. A cloud no bigger than a man's hand has appeared upon the horizon, and while, according to the report of the committee on a standard system of accounting, it may be safely disregarded, for it does not think it will be much of a shower in any event, yet there are others who look at that little cloud as something of far greater importance and likely in the course of time to prove an uprooter of certain old ideas. The committee's report alludes particularly to the transactions of the convention of the National Electric Light Association, held in May last. A paper was read on that occasion on uniform accounting, which in a sense criticised the Street Railway Accountants' Association for treating taxes as a deduction from income, taking the position that taxes by right should be considered a part of operating expenses. Not only did the author of the paper take this position, but the association formally indorsed that conclusion. The paper in question not only classified taxes as an operating expense, but brought into the same category interest on current liabilities, allowances for depreciation, and certain other reserves. The reason stated, as the chairman of the committee on standard system of accounting reported to the convention, was that these accounts ought to be included among operating expenses, instead of deductions from income, in order that the true cost of production could be determined.

* * * *

The gentlemen of the committee on standard system, it seems to me, were disposed to handle this matter somewhat gingerly, for they put forward the statement that they do not care to provoke any further discussion of the subject. In effect, the committee washed its hands of the whole matter after submitting the facts of the case for the information of the association. It very cleverly dodges the responsibility of a further consideration of the general question by asserting that it did not believe that the Accountants' Association would be wise in criticising the position taken by the other association on questions of accounting.

* * * *

I take it that this cloud no bigger than a man's hand is likely to grow until it overspreads the street railway accounting sky to such an extent that no one can avoid its shadow or fail to be aware of its presence, even though his eyes are shut. Accounting principles are eternal, inflexible and all pervading. Any violation of them and any deviation from the course that their correct interpretation would point out will have to be atoned for or adjusted sooner or later. Interstate commerce commissions, State Railroad Commissioners and other bodies more or less legal in their organization and duties, may prescribe and dictate as to classification; they may formulate reports and hold companies to them, but if their demands are wrong in principle, sooner or later they will be changed, for in the end right will prevail.

* * * *

The Street Railway Accountants' Association at various times during its existence has stumbled on several points. For example, it has not always clearly seen the difference between the capital invested in a street railway represented by bonds and that represented by stock. It has at different times called all of it capital. This view may be correct from the investor's point of view, but it is wrong from the companies' standpoint. Just at present, apparently, the association cannot see the identity in effect of those expenses which are under the control of the management and those which are established by law, like taxes. It pretends to see a difference in these two classes of expenses which warrants a difference in treatment. When the question of depreciation of plant or the establishment of a reserve to provide for replacement of plant came up some time since, various members of the association exclaimed hastily: "We are not ready for that yet." Perhaps they will be ready for it and still other advanced features in the near future.

* * * *

The difficulty of the present situation is that the gentleman who read the paper before the National Electric Light Association sees the case clearly and correctly. On the other hand, the street railway accountants are apparently groping in the dark. But ultimately, as said before, right will prevail. Sooner or later the street railways of the country will have offered them, at the hands of this organization or by some other authentic source of supply, a system of accounts that is logically correct and theoretically perfect. They have not, however, reached that point yet so far as the association is concerned. The system that will be presented when the correct idea is reached will undoubtedly employ the present classification of expenses, but it will arrange in the general scheme a balance sheet and profit and loss statement upon a plan strictly conforming to accounting principles.

* * * *

The address before the convention by John I. Beggs, on "What the General Manager Wants to Know from the Accounting Department," was both interesting and instructive. Mr. Beggs lays down as a broad rule that the manager stands for the board of directors, and that the board of directors stands for the stockholders and that the stockholders are the capitalists who are investing in the enterprise. Therefore, what the manager wants to know proceeds from his conception of the stockholders' interests. No one can gainsay this standard or object to it is a foundation principle. From this point of view he argues first for honesty, integrity and reliability upon the part of the persons employed, both principals and subordinates, and finally leads up to such a statement of the condition of the company's affairs as would be just not only to the stockholders, but also to the bondholders, and to the municipality as well from which the franchise is derived. The yardstick or unit of measurement thus presented by Mr. Beggs is one that the association could well apply to the system of accounts which it will ultimately work out. Whatever fully and completely satisfies these conditions will meet all requirements, and ought to be satisfactory to every one. Those accountants in the general field who most nearly accomplish in their work a presentation of what the business man wants to know, arranged as the business man wants to know it, most nearly meet actual requirements and give the greatest satisfaction to their clients. The conditions in street railway accounting do not differ from those in ordinary business.

* * * *

The discussion on the unit of comparison, as well also as Mr. Mackay's paper on the subject, was important. I was particularly impressed with the statement of Secretary Brockway that in New Orleans several different lines produce results that seem to warrant the use of several different units of comparison. It would seem that the experience of the street railway accountants in this matter is not essentially different from that of accountants in the

general field, having to do with miscellaneous industries. The effort to establish a unit for street railway purposes resembles in some respects the search for a unit in manufacturing enterprises, although the use of the unit sought in the latter case is somewhat different from that of a railway enterprise. In manufacturing, some basis must be established upon which to spread the general manufacturing expenses so as to let each item of product stand its own proper pro rata. The expenses to be spread in a manufacturing enterprise correspond in a sense to the general expenses of a street railway operation. In manufacturing they include rent of factory (in case it is a rented property), insurance, taxes, superintendence and foremanship, reserves for repairs and depreciation, heat, light and power, and other items of the same general sort. The unit that works most satisfactorily in one case is not the best in another.

* * * *

In a machine shop the man-hour unit is sometimes preferred. In a foundry it would be pounds of castings. In a cotton mill, producing muslins, for example, it would be square yards. In a blast furnace it would be tons of metal. In a rolling mill it would be pounds or tons of sheets or bars or beams, as the case might be. Comparatively few manufacturing enterprises, however, are single propositions. There is very often a considerable aggregation of small industries combined in one company. There are concerns which operate both a foundry and a machine shop, and still others which, in addition to these two divisions, have a woodworking plant. Now, it is obvious that pounds of castings would not be the proper unit to employ either in the machine shop or in the wood shop, and that the man-hour basis would not be satisfactory in the foundry, no matter how advantageous it might be in the other divisions. The result is that accountants use different units in different establishments, and different units for different divisions of the same establishment.

* * * *

Mr. Vreeland very aptly illustrates the difficulty of the situation so far as street railway men are concerned, by what he said concerning the complex conditions under which different portions of the railway system under his direction in New York are operated. With cable roads, different sections of which operate at different rates of speed, with under trolleys and over trolleys, with compressed air cars, and last, but not least, with numerous horse cars still in use, a single unit, that would be of advantage, seems doubtful, if not absolutely impossible, save only as it is employed in each division separately, and in each case carefully supported by specifications of conditions. Comparisons of results between different divisions could only be made in the light of the statements of condition. The association did wisely, it seems to me, to reach the conclusion that it did in this matter, as set forth in the report—namely, that it "recommends the use of the car-hour as a standard unit of comparison, with the understanding that it is to be put to a practical test with each company represented in the association, either in connection with the car-mile or not, as they may see fit, and that the committee report back at the 1901 convention."

* * * *

One difference betweeen the units employed by manufacturing companies in the distribution of expenses and the unit which the street railway companies are seeking should be noted in this connection. In manufacturing, it is a question of the distribution of general expenses, as already pointed out. In street railway work it is a basis of representing the relative cost of expenses and also the relative income derived from the line. The tests which will be made of the car-hour in the next year will be both interesting and valuable. The discussion at the present convention served to bring to the attention of every one who will undertake to test the relationship of several different standards to the question at issue, and also very clearly indicated the points at which comparisons could be made. All who experiment and go up to the next convention with their results will be the bearers of some very valuable information.

* * * *

It would seem from following all that has been presented on the subject, that the ultimate use to which the standard unit is to be put, after it has been discovered and agreed upon, is comparisons of one company's results with those of another, or the results of one division of a company's business with others. The comparison will naturally have to be made on a double basis, first, with respect to expense, and, second, with respect to income. It was pointed out in the discussion that some divisions are operated with a high expense relatively, yet are profitable because the income is proportionately high. From this it appears that to make the assertion that a road is operated at 22 per cent or at 50 per cent, or with some other result, amounts to nothing, save only as it is explained. It is only the net results in the way of profits that answers the question that is up for settlement. Even though the expenses of one line be five times as much as those of some other line, yet if the income is proportionately greater, the stockholder is quite as well satisfied as though the same net results had been obtained upon a lower schedule of both expenses and earnings. A practical scheme for discovering and stating what are the net results from a line is really the only plan that will be satisfactory to the accountant and to the stockholder.

* * * *

At the Niagara convention of the Street Railway Accountants' Association the mention of material and supplies accounts developed the fact that only one or two of the delegates present had in practical use in their accounting systems anything of the sort. In the interval since that date much progress has been made in this regard. Far more companies to-day are giving attention to the accounts necessary to take care of materials and supplies than were doing so at that time. Accordingly, Mr. Barnaby's paper was much more apropos at this date than it would have been at an earlier convention. The problem that Mr. Barnaby discussed is one that is encountered in various enterprises besides street railways. It is one which underlies the proper conduct of steam railways, and is one also which is ever up for consideration in manufacturing establishments of all kinds. There are two general plans in use: One is to dump all the materials and supplies bought into the operating or manufacturing accounts at the time that they are purchased, and the other is to keep separate accounts of materials and supplies, charging into operation or manufacturing, as the case may be, only those items that are actually consumed.

* * * *

Very slight consideration of the question shows that the latter plan is the correct one, but there is involved in it, first, the need of a well-devised system for the purpose, and second, a certain amount of clerical work for maintaining it. A proper view of this question is to be obtained only in the light of a broad generalization upon accounting principles. The value of the quantity of materials or supplies on hand at any time is essentially an asset. That which is consumed in the operation of the road is an expense. That which remains on hand is something that would go into the balance sheet statement among the resources, while

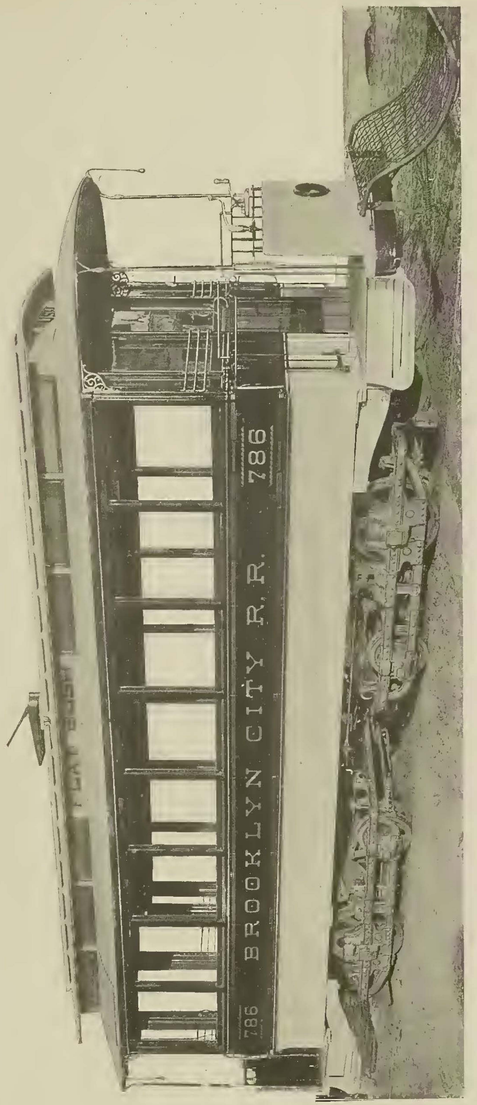


FIG. 595.—BROOKLYN STANDARD CLOSED CAR

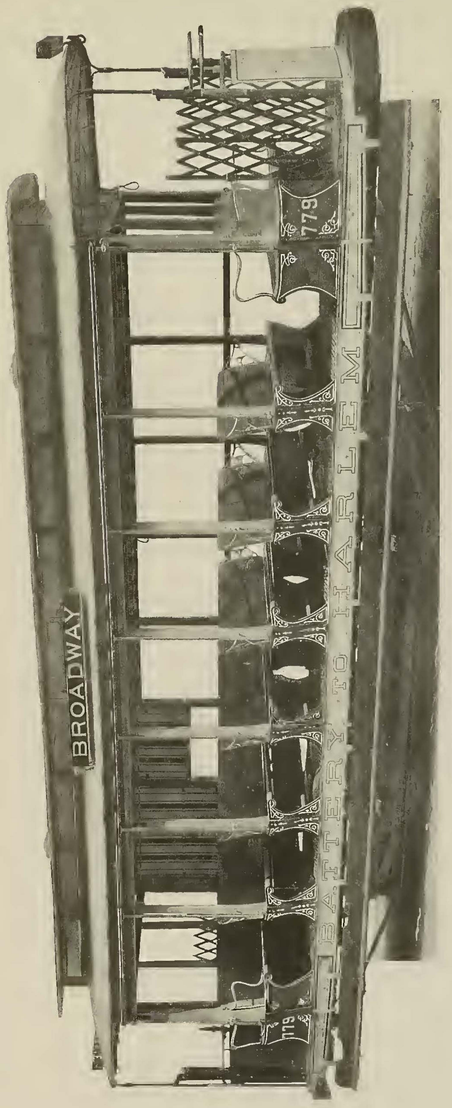


FIG. 596.—METROPOLITAN STREET RAILWAY (NEW YORK) STANDARD OPEN CAR

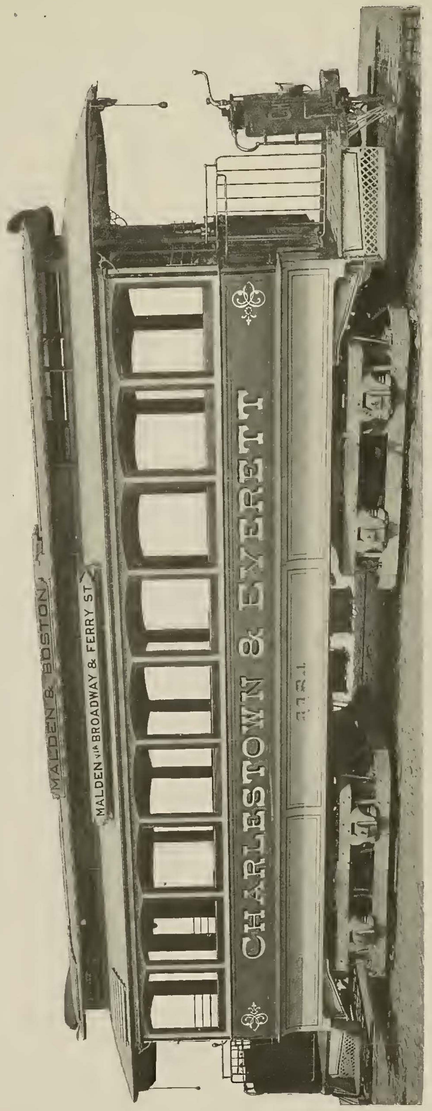


FIG. 597.—BOSTON STANDARD CLOSED CAR

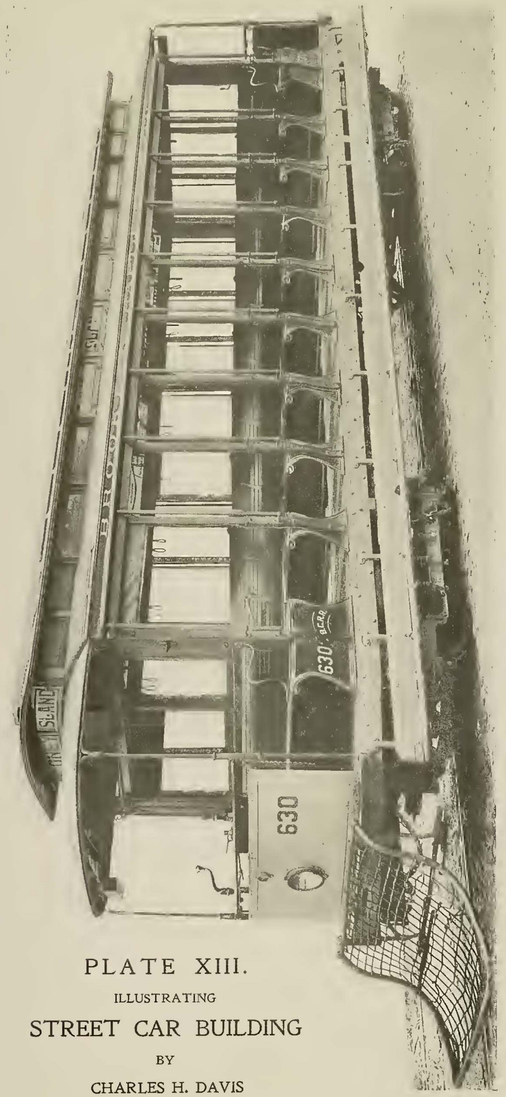


FIG. 598.)—BROOKLYN STANDARD OPEN CAR

PLATE XIII.

ILLUSTRATING

STREET CAR BUILDING

BY

CHARLES H. DAVIS

FIG. 599. CHEAP METHOD OF JOINING END AND SIDE SILLS

FIG. 600. LAP JOINT, MORTISED AND TENONED, OF END AND SIDE SILLS

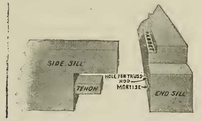


FIG. 601. DETAILS OF LAP JOINT SIMILAR TO FIG. 600

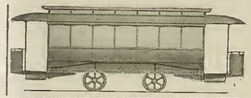


FIG. 602. LOW TRUSS-ROD METHOD OF STRENGTHENING BOTTOMS TO PREVENT SAGGING OF ENDS

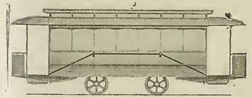


FIG. 603. HIGH TRUSS-ROD METHOD OF STRENGTHENING BOTTOMS TO PREVENT SAGGING OF ENDS

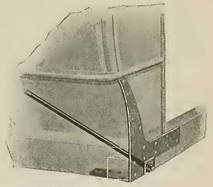


FIG. 604. DETAILS OF CORNER, SHOWING SILLS, TRUSS ROD AND CORNER PLATE

FIG. 605. DETAILS OF TIE RODS FOR CROSS SILLS

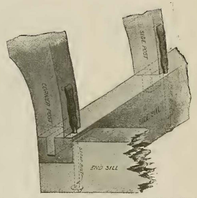


FIG. 606. DETAILS OF POSTS SETTING INTO SILLS

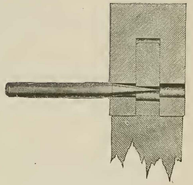


FIG. 607. DRAW-PINNING A MORTISED AND TENONED JOINT

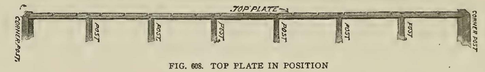


FIG. 608. TOP PLATE IN POSITION

FIG. 609. TOP BELT SCREWED ON TO POSTS AND TOP PLATE

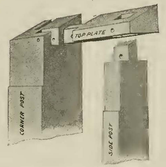


FIG. 610. DETAILS OF POSTS SETTING INTO TOP PLATE

FIG. 611. DETAILS OF END HEAD PIECE FRAMED FOR AN "ACCELERATION" (DOOR)

FIG. 612. DETAILS OF HEAD PIECE AND POST JOINT

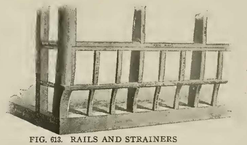


FIG. 613. RAILS AND STRAINERS

FIG. 616. DETAILS OF CARLINE, TOP PLATE AND SIDE POST

FIG. 614. DETAILS OF JOINT BETWEEN RAIL AND SIDE POSTS

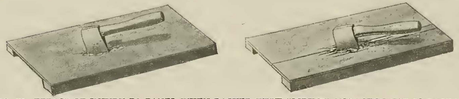


FIG. 615. EFFECT OF INJURY TO PANEL WHEN BACKED WITH "SCRIMS" AND WHEN NOT SO BACKED

FIG. 617. TROLLEY-BRIDGE

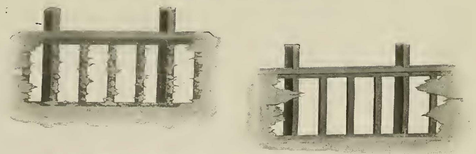


FIG. 618. EFFECT OF GLUE AND LACK OF SAME ON SIDE PANELS WHEN REMOVED

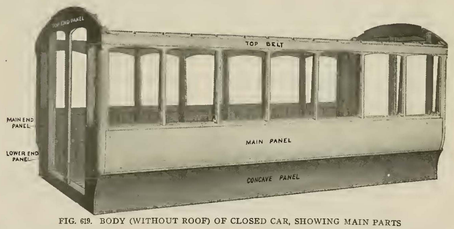


FIG. 619. BODY (WITHOUT ROOF) OF CLOSED CAR, SHOWING MAIN PARTS

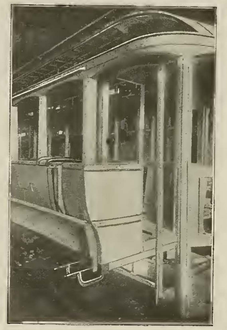


FIG. 623. METHOD OF PUTTING PANELS IN PLACE

FIG. 624. VESTIBULE (IN THE WHITE)

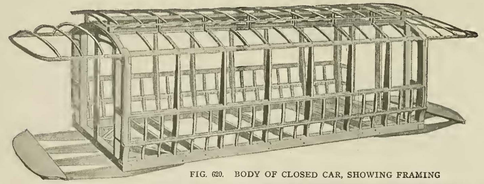


FIG. 620. BODY OF CLOSED CAR, SHOWING FRAMING

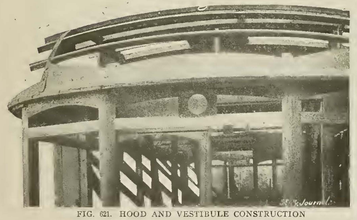


FIG. 621. HOOD AND VESTIBULE CONSTRUCTION

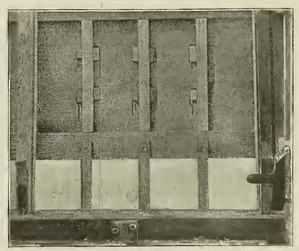


FIG. 622. INSIDE OF PANEL (BOSTON CAR, 1886)

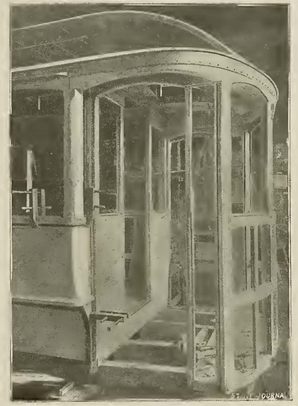


FIG. 625. FRAMING OF VESTIBULE

PLATE XIV.

(Figs. 599 to 625)

Varying Practice

....IN....

Street Car Building

ILLUSTRATING

STREET CAR BUILDING

(Stephenson Practice)

....BY....

CHARLES HENRY DAVIS, C. E.

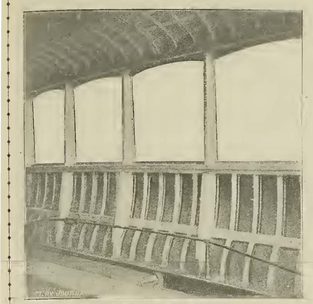


FIG. 626. INSIDE OF PANELS

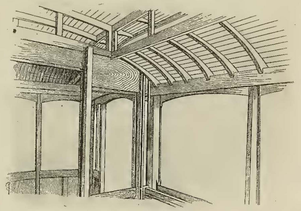


FIG. 627. INSIDE OF END

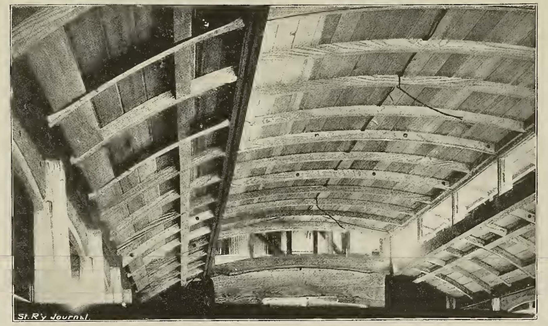


FIG. 631. INSIDE FRAMING OF ROOF. (J. G. BRILL CO., 1895)

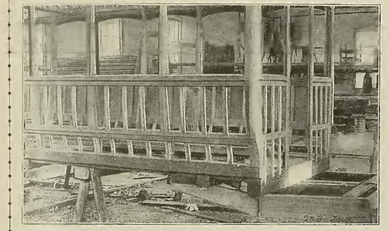


FIG. 628. FRAMING OF SIDE AND END. (BOSTON CAR, 1896)

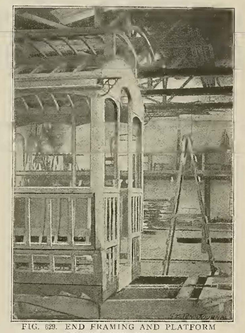


FIG. 629. END FRAMING AND PLATFORM (BOSTON CAR, 1896)

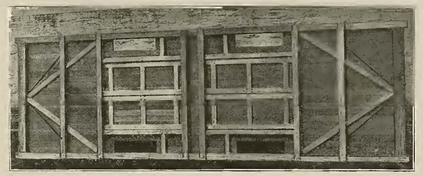


FIG. 633. FLOOR FRAMING. (UNDER SIDE, 1895)

FIG. 640. CORNER (IN THE WHITE)

FIG. 630. INSIDE FRAMING. (BOSTON CAR, 1896)

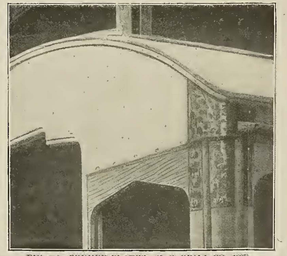


FIG. 632. CORNER PLATES. (J. G. BRILL CO., 1895)

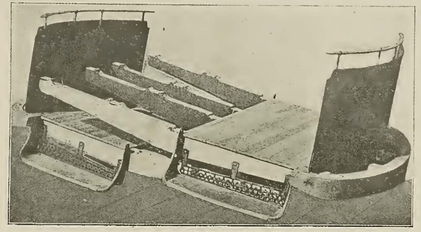


FIG. 634. CAR PLATFORMS (1896)

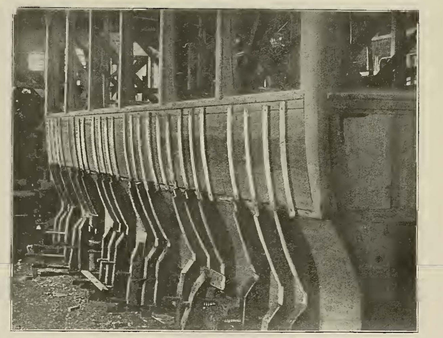


FIG. 637. METHOD OF PUTTING PANELS IN PLACE (1895)

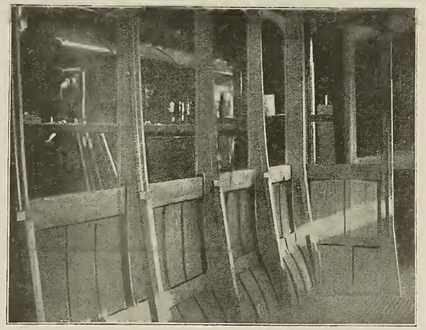


FIG. 638. INSIDE FRAMING

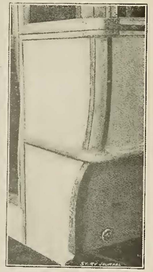


FIG. 639. CORNER PLATES

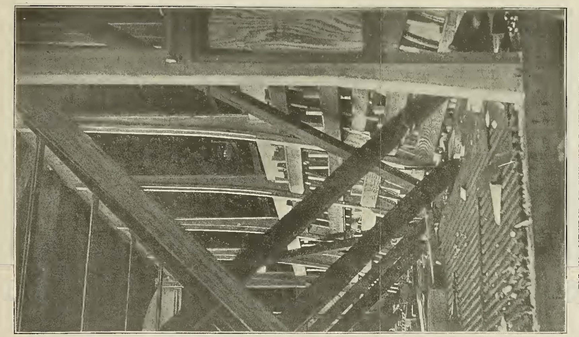


FIG. 636. METHOD OF PUTTING PANELS IN PLACE (USING WEDGING STRAINERS AGAINST PANELS)

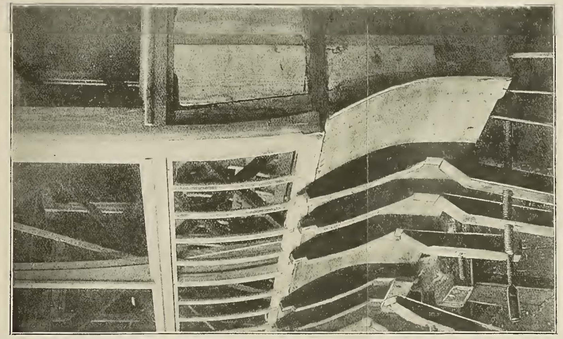


FIG. 635. METHOD OF PUTTING PANELS IN PLACE (1899)

PLATE XV. (FIGURES 626 TO 640)

VARYING PRACTICE IN STREET CAR BUILDING

ILLUSTRATING STREET CAR BUILDING (STEPHENSON PRACTICE)

....BY....

CHARLES HENRY DAVIS, C. E.

that which has been consumed is something that would appear, not in the balance sheet, but in the profit and loss statement, being, as before stated, one of the expenses. The question then is simply a method of taking out of the asset accounts from day to day, week to week, or month to month, according to the time schedule of the accounting system, that which is used. The asset account is to be credited with what is withdrawn, and the expense account is to be debited with the same amount.

* * * *

Here again, as in other cases, the association is lacking, at this time at least, in a skeleton of accounting principles to which it can subscribe, and a reference to which from time to time would show in what section or division of the balance sheet or profit and loss statement a given item belongs. The result of the discussion of Mr. Barnaby's paper was the appointment of a committee to prepare "a uniform set of blanks on stores, from the purchase to the inventory." It would be interesting to watch the work of this committee. To my mind the blanks proposed for standardization will vary materially at the hands of the different members of the committee, depending very much upon the theory underlying their use that each of the several members prefers. It is possible that some very interesting discussions will take place among the members of the committee before it really gets down to work as to the particular theory that shall prevail.

Franchise Tax Decision

On Nov. 14 the Appellate Division of the Supreme Court decided that a corporation affected by the franchise tax law may have the courts review its assessment as fixed by the State Tax Commission, notwithstanding the fact that such corporation does not file with that Commission a report regarding its condition, as required by law. The law provides that all corporations coming under the special franchise act shall file their first reports with the board before Nov. 1, 1899. The New York & Queens County Railway Company failed to file its report until April last, and then subsequently instituted proceedings to review the valuation placed on its property by the State Board. The Attorney-General, on behalf of the State Tax Commission, applied to Justice Herrick for a revocation of the writ upon this ground, and Justice Herrick decided against the company. The Attorney-General will, however, abide by the decision of the Appellate Division.

Chicago was visited by a fierce snow storm on Nov. 16, which seriously interrupted street and elevated railway traffic, and was responsible for two collisions, due to slippery rails.

Street Car Building

(Stephenson Practice)

BY CHARLES HENRY DAVIS, C. E

X.—Assembling—(Continued)

In the October issue of the STREET RAILWAY JOURNAL we finished the detailed description of the building of our two standard cars, namely, the Boston (closed) and the Brooklyn (open). Plate XIII. gives views of the four standard cars discussed, showing them completed and equipped as ready to operate:

Fig. 595.—*Brooklyn Closed Standard Car.*

Fig. 596.—*Metropolitan* (New York) *Open Standard* (single truck) *Car.*

Fig. 597.—*Boston Closed Standard Car.*

TABLE NO. 41.—DETAILS OF THE NUMBER OF PIECES IN STANDARD BOSTON CLOSED AND BROOKLYN OPEN CARS

GENERAL DIVISIONS OF CAR	STANDARD BOSTON CLOSED CAR						STANDARD BROOKLYN OPEN CAR					
	Number of Distinctive Pieces	Number of Pieces	Number of Bolts	Number of Screws (Approx.)	Number of Nails	Total of Columns (3)+(4)+(5)+(6)	Number of Distinctive Pieces	Number of Pieces	Number of Bolts	Number of Screws (Approx.)	Number of Nails	Total of Columns (9)+(10)+(11)+(12)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Bottoms	32	187	190	706	?	1,083+	27	96	158	584	?	838+
Sides and ends	71	746	4	2,150	?	2,900+	38	286	92	942	?	1,320+
Roofs and bonnets	62	622	216	1,622	?	2,460+	40	446	84	732	?	1,262+
Platforms	67	235	244	372	?	851+	60	189	310	322	?	821+
Cabinet work, trimmings, etc	144	1,335	None	3,700	?	5,038+	99	1,182	12	1,668	?	2,862+
Totals	376	3,128	654	8,550	?	12,332+	264	2,199	656	4,248	?	7,103+

Fig. 598.—*Brooklyn Open Standard Car.*

Table No. 41 groups the number of pieces of the Boston (closed) and Brooklyn (open), showing that the former has 112 more distinctive parts than the latter (equal to 42 per cent more), while the total number of pieces is 5229 + greater in the Boston (closed) than in the Brooklyn (open), which is equal to 73 per cent more. While the Boston (closed) has an excessive number of parts as compared with the best modern practice in closed cars, as exemplified in the Metropolitan (New York) standard double-truck car, for example, it nevertheless gives a fair idea of the relative greater complexity of a closed car over an open one.

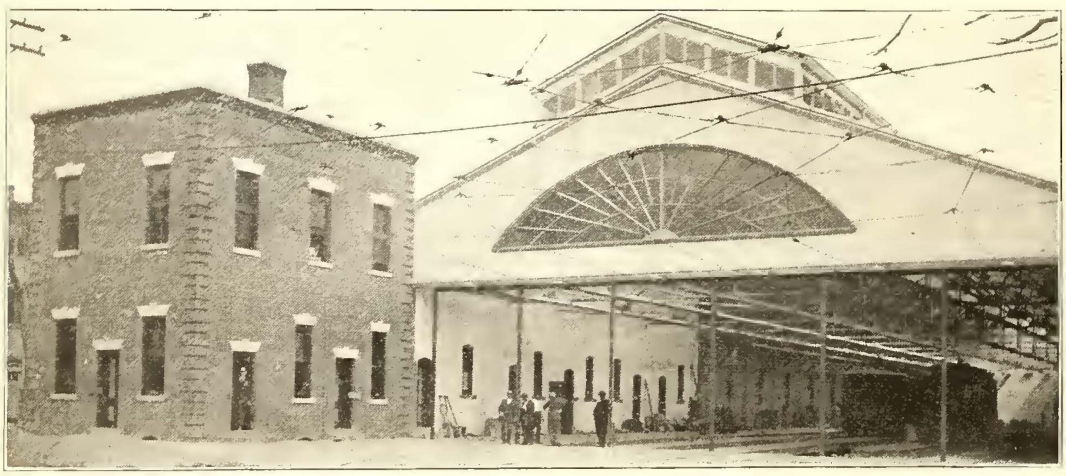
Plates XIV. and XV. give some details of methods of construction (Figs. 599 to 620, inclusive, having been taken from "Carbuyer's Helper," issued by the Brownell Car Company, of St. Louis, while Figs. 621 to 641, inclusive, have been taken from various articles appearing from time to time in the STREET RAILWAY JOURNAL), as used in car building in various shops of the United States.

Allentown Company Absorbs New Lines

The Lehigh Valley Traction Company, of Allentown, Pa., has just completed negotiations for the purchase of the Allentown and Slatington Electric Railway and the Slate Belt Electric Railway. The Allentown & Slatington Electric Railway is 21 miles long, extending through the heart of Lehigh County, and the Slate Belt Electric Railway is 17 miles long, extending from Nazareth to Bangor, the slate belt region. It is proposed to run cars over the entire line, with Allentown as the center. The Lehigh Valley Traction Company's system now embraces 110 miles, and the purpose is to further extend the lines from Slatington to Mauch Chunk, a distance of 12 miles.

A New Car House at Newark, N. J.

The North Jersey Street Railway Company has lately completed the car house illustrated on this page. The new building is situated at the corner of Frelinghuysen Avenue and Miller Street, the front being on Miller Street. The rear part of the site was formerly occupied by the old car house, which fact necessitated the employment of no little ingenuity in the building of the new structure, as the use of the old one had to be continued as long as possible during the construction. The front half was first completed and was immediately put in service for storing the cars while the old house was being removed and the rear portion built. This extended the work over a somewhat longer period than it would otherwise have taken, but had the advantage of not interfering materially with the service.

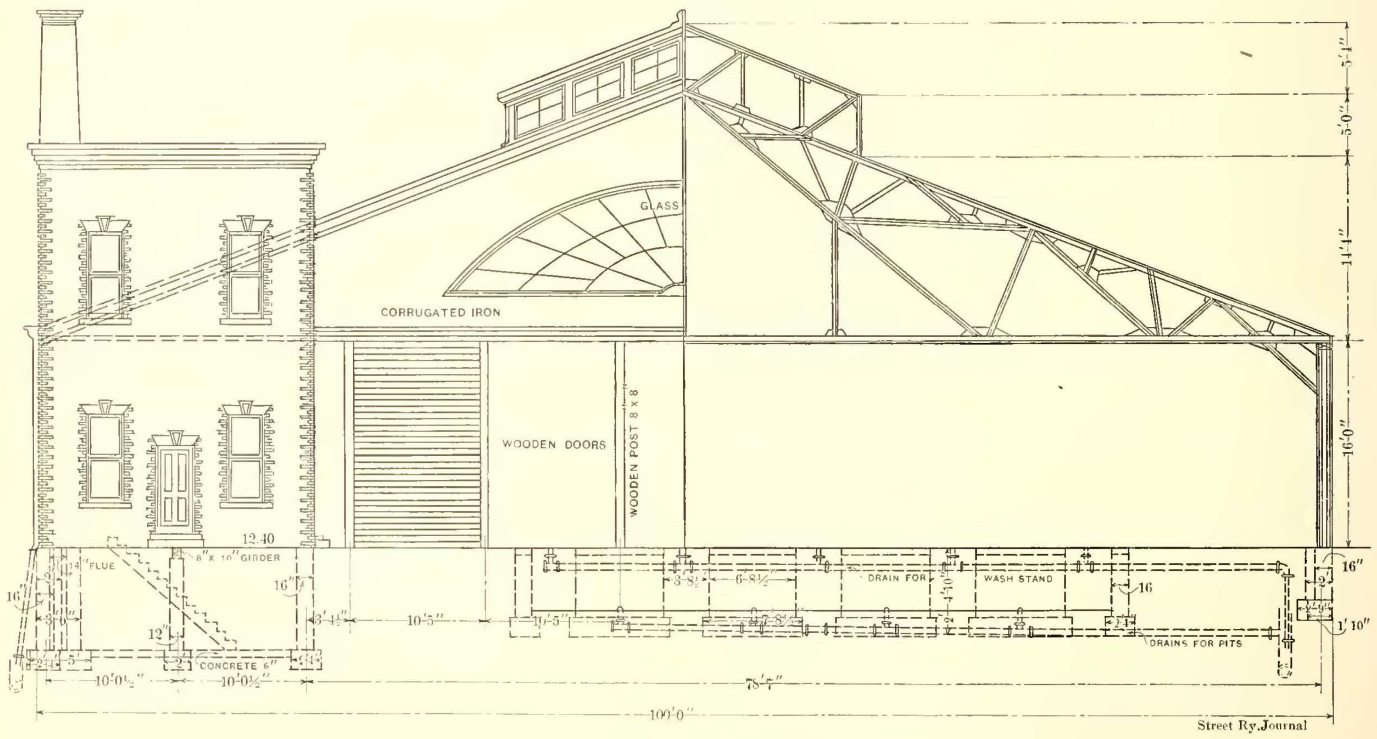


VIEW OF CAR HOUSE ENTRANCE

The two photographs reproduced herewith show the general exterior and interior appearance of the building, while the plan gives a good idea of the arrangement of tracks, pits, washstands, etc., as well as showing the disposal of the space allotted to the use of conductors and motormen. A study of this plan cannot fail to bring the fact prominently to view that the most careful thought has been given to all of the details and that the arrangement facilitates as much as possible the handling of cars.

The two-story office building at the corner extends upward above the main roof, and serves in a large measure to relieve the barn-like effect which appears in most structures of this kind. Together with the main walls, it is built of brick, the window-sills and other trimmings being of Indiana limestone. The roof is made of steel, covered with corrugated galvanized iron, which is guaranteed to last for ten years. The front gable is also covered with corrugated galvanized iron. The method of construction is shown in the cut of the front elevation. The fanlight is glazed with $\frac{1}{4}$-in. rough glass fastened in the framing made by the galvanized iron radiating bars of which it is constructed, and has a galvanized iron molded margin. Rough plate glass $\frac{3}{8}$ in. thick is used on the skylight. The vertical ventilating sashes are made of galvanized iron and $\frac{3}{8}$-in. glass, and are pivoted in the center, being operated by a crank and worm gear. The inside of the car house is painted white.

The floor is made of cement. Gratings are provided near the door on five of the tracks to make a washstand for cars. In the pits behind these gratings is installed a motor-driven Clayton air compressor, which furnishes a supply of air under a pressure of about 60 lbs., to be used in dusting the cars and blowing out the motors and controllers. This method of cleansing the equipment is found to be both expeditious and effective. In the pits are also the steam radiating pipes which will warm the building in winter. There are twenty coils, having a total radiating surface of 2300 sq. ft., and their presence will render the operations in the pits more pleasant during the cold weather than it



FRONT ELEVATION OF ENTRANCE

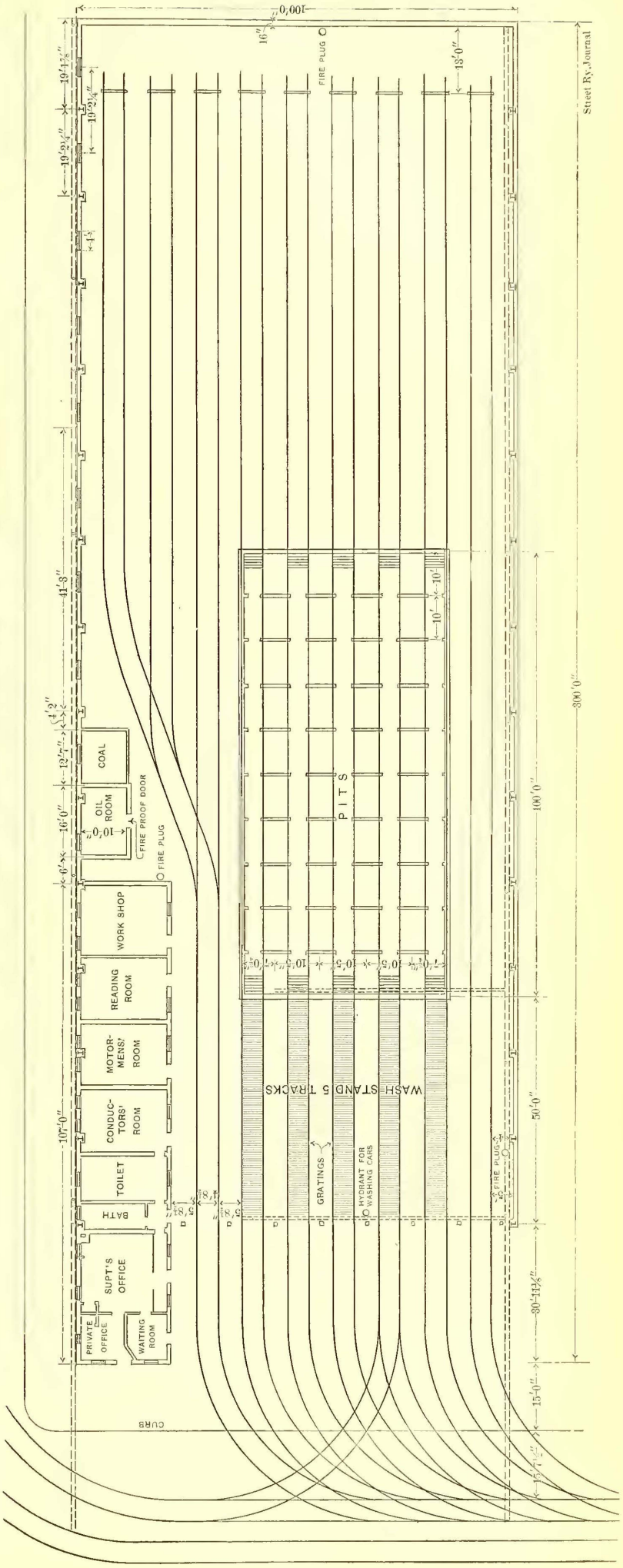
could otherwise be. The boilers which supply the steam for heating purposes are placed in the cellar of the office building. The plant consists of two Bundy boilers, installed in a room by themselves. The door of this room is held open by a fusible plug, which automatically causes it to close in case of fire. The heating is done by radiators in the offices, and the above mentioned coils in the car pits. There are also coils in the oil room, etc. The system has been designed so as to keep the temperature of the rooms, halls, etc., at 70 degs. F. when the outside temperature is at zero.

The comfort of the motormen and conductors has received careful attention. In the cellar lockers are provided, made of "expanded" metal, a kind of iron netting stamped out of a single sheet. Each man has a locker to himself, and, while insuring perfect ventilation, the netting permits inspection of the interior to be made without the necessity of opening the lockers. As shown by the plan,

INTERIOR OF CAR HOUSE

there are separate rooms for the motormen and conductors and a joint reading room. The walls of these rooms are provided with bulletin boards and blackboards, where time-tables, notices, etc., can be posted. The sanitary arrangements are all of the best, the men being allowed the use of the bath room upon application. Provision has been made on the second floor for the accommodation of the officers in charge of the car house, so that they can find comfortable quarters within the building itself. The front room is fitted up as a bedroom for their use. The lighting is done by incandescent lamps placed five in series between the trolley wire and ground, the building being also piped for gas, to be used in case of emergency.

The doors are made of horizontal wooden slats, rolling up on cylinders at their top. When open they permit the free use of all the tracks, and are entirely out of the way. On the inside and outside the trolley wire terminates at the doorway in an inverted, fan-shaped trough of copper, which assures the easy running of the cars through the doorway without fear of the trolley flying off. The oil room is provided with an automatic fire door similar to that used at the boiler room. The window is made of fireproof wired



glass. Fire plugs are provided around the building, in addition to the arrangements for washing the cars.

The car house was designed by A. W. Pratt, track master of the North Jersey Street Railway Company, and was erected under his personal supervision. It was through his courtesy that the photographs and drawings which illustrate this article were obtained, together with most of the accompanying data.

Electric Railway Possibilities in Sicily

BY CESARE PIO

The frequent changes in government, which the island of Sicily has endured for many years, operated for a long time to keep the grade of civilization of Sicilians very low, and, as a consequence, the industrial and financial conditions for many years have been far behind those of the Italian continent. The transportation facilities have felt the influence of this low grade of civilization, and while in Italy the steam railroads had a rapid growth all over the continent, in Sicily there has been, until during the last few years, a great need of steam railroads, as well as ordinary roads. Sicily should be the most prosperous country in Europe, on account of the great variety of its agricultural and horticultural products, as well as of the great number of sulphur mining centers; but on account of the great difficulties of communication and travel, the financial conditions of the island, as has been said, are very poor, indeed. The writer, who has traveled all through the island, can state that riding on the provincial and municipal roads is a most uncomfortable experience, and takes, besides, a very long time for any short trip, as the means of locomotion are still most primeval. The public horse carriages are of very poor construction, and the transportation of freight is carried on by means of primitive, two-wheel carts, supported on large wheels, which are often artistically painted. This kind of dray cannot carry in any case more than a short ton, so that the transportation of freight costs about 80 centimes (16 cents) per ton-mile. The railways are very few in number; they are mostly along the shores, and are owned by the Società Italiana per le Strade Ferrate della Sicilia, which does not give a good service.

As for the street railways in the main cities of the island, it may be said that, in spite of the size of these cities and the generally prosperous conditions of the population, no tramway of any description has been built up to now, so that electric traction is now being applied to some of the Sicilian towns without involving the transformation of horse lines into electric, as has happened in the most of the Italian cities on the continent. The existing transportation facilities in the streets of Sicilian towns are public carriages, which charge from 50 centimes to 100 centimes (10 cents to 20 cents) for a short ride within the city. For going outside the city a special contract must be made with the driver, and as the rule it is quite expensive to go beyond the city limits. Taken altogether, the outlook for electric traction enterprises is exceedingly good in Sicily. This has been recognized by a number of foreign electrical manufacturing companies, who have opened offices and agencies in the island for construction work in electric railway enterprises.

The Schuckert Electric Company, of Nuremburg, was the first to establish an important office in Palermo. In that city the same company installed a complete plant for lighting and electric traction. Later the Allgemeine Elektricitäts-Gesellschaft, of Berlin, opened in Palermo an agency for the same purpose. The Heilos E. A. G., from Cöln (Ehrenfeld), Germany, established in Catania, about the end of last year, a construction office for installing a 2000-hp central station for traction purposes. The same company was granted a franchise for sixty years for the operation of a street railway system in the city and vicinity of Catania. In Trapani, on the west shore of the island, a French company was granted, six months ago, a franchise for an interurban railway, running from Trapani to Monte S. Giuliano and to Paparella. In Syracuse on the east coast, franchises for a street railway were also granted about two months ago. In Messina the steam road running from the harbor to Faro (lighthouse), and for about 7 miles on the beautiful shore of the Stretto of Messina, will be soon transformed to an electric road by a Belgium company. Many other cities are in need of a good electric railway system, and there is no doubt that all these lines will prove profitable investments.

Among the roads that the writer believes will pay fairly well is the Giardini-Taormina Railway, situated between Catania and Messina, on the east coast. The number of visitors coming to inspect the interesting relics and ruins of the old Greek colony situated there is enormous. The climate of Taormina is healthful, and many foreigners spend the winter there for the benefit of their health. At present the steam railroad trains stop at Giardini, a small village situated at the foot of Taormina Mountains. There are 3 miles to traverse before the traveler can reach Taormina City, which is situated about 750 ft. above the sea level. At present the only conveyances for this distance are the ordinary Sicilian horse carriages, which are very slow and very far from comfortable. Besides, the fares are very high, and there is no doubt that an electric line running from Giardini up to Taormina, and thence through all of that delightful locality, would pay fairly well.

The State Railroad Commission has just had presented to it an extended scheme for electric traction, which will no doubt increase, when operated, the prosperity of the island. This project calls for the construction of a large

electric railway, 200 miles long, and connecting the east, north and south coasts of Sicily. The map herewith, for which the writer is indebted to the secretary of the State Railroad Commission, shows, in dotted lines, the projected electric railway. The full lines indicate the present standard gage (1.44 m) steam railroad. The line drawn with dashes, running around Mt. Etna, from Catania to Giarre, is a narrow gage steam road, which has been in operation for only a few years, and is owned by an English company. This railroad connects all the farming districts around Etna, Paternò, Biancavilla, Aderno, Bronte and Randazzo, with the harbors of Catania and Giarre. The proposed electric line connects the two shores and harbors with the center of Sicily, which is now isolated.

The government will probably give this railway a subsidy of $1,500 per mile. Water power will be utilized at two points, one of which can furnish 4000 hp, and the other 8000 hp. The generating apparatus will be direct-connected to the turbines, and will consist of two 300-kw alternating-current machines, generating three-phase current at 400 volts, 25 cycles. This will be stepped up to 12,000 volts. The high-potential current will be sent to two sub-stations, situated at Valguarnera and Cesarò. In each of the two sub-stations there will be a single bank of three step-down transformers, provided with a special high-potential switchboard, and two rotary converters, giving direct current at 550 volts, which will feed the trolley line.

The Circumenea Railroad Company is very much interested in this project, and will probably change its 70 miles of steam roads to electric. Indications also point to the possible consolidation later of the Catania Street Railway Company with the operating company of the large electric railway system described above.

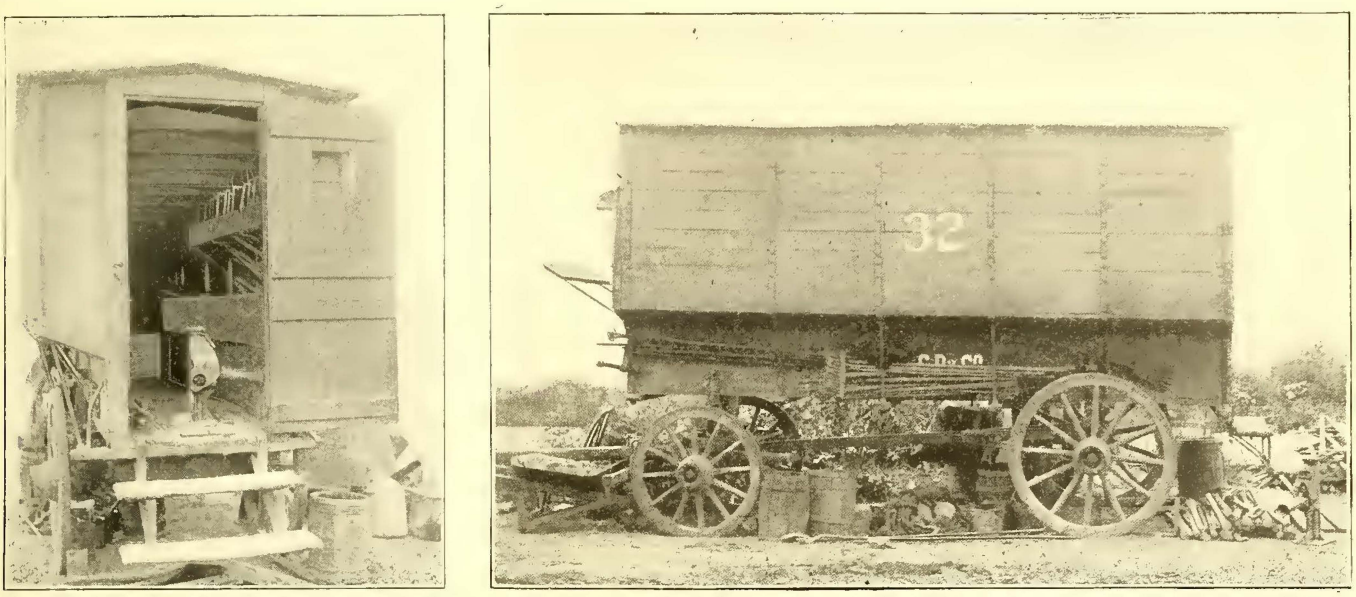
The report of the Secretary of State for Ohio regarding the new incorporations, etc., for the year ending Nov. 1, shows that the value of electrical properties in the State has increased beyond all precedent. The number of new street railway companies and consolidations numbered thirty-five; the capital involved was $10,352,000, and the increased capitalization $8,160,000. Fourteen electric light and power companies were consolidated; the capital involved was $930,500, and the increased capitalization $254,000. Sixty-nine telegraph and telephone companies were consolidated; the capital involved was $1,388,999, and the increased capitalization $4,442,000.

Track Tool Wagon

The accompanying illustrations are views of a very strong and convenient wagon for storing and transporting track tools and supplies during construction and repair work. The wagons are of a type that are employed on the lines of the Chicago City Railway and were designed and built in the company's repair shops. Quite a number have been employed by this company for some years.

The frame work and sheathing are of heavy oak timbers and plank, rendering the wagon strong and safe so that it can be left on the work at night without fear that it will be broken into and tools removed.

As will be noted, the entrance is from the back end, and this entrance is closed by a strong door which can be locked. The interior walls of the body are provided with shelves and bins for the storing of bolts, spikes and other small parts as well as the shovels, picks, jacks and lamps which are used by the workmen. Provision is made on the roof for carrying the poles of the electric drop lights which are employed on night work, and which have been previously described in these columns. The braces which support the flaring portion of the body on each side also provide a place for carrying the brooms, track brushes and tamping irons. The dimensions are about the same as ordinary van wagons and the vehicle is not so heavy but that it can be hauled about and shifted by an ordinary team of horses. Some of these wagons were rebuilt from old grain wagons, while others were built from new designs as above noted.



END AND SIDE VIEWS OF TRACK TOOL WAGON

Commutator and Bearing Wear at Council Bluffs

The Omaha & Council Bluffs Railway & Bridge Company, operating the electric line between Council Bluffs and Omaha, has met with some motor maintenance difficulties which have been successfully overcome, and the results will be of interest to other roads having similar troubles, though the points are not entirely new. Three years ago the company bought some G. E. 57 motors to run under its long interurban cars. These motors gave much trouble from commutator wear, the sparking being excessive, and it being necessary sometimes to turn down a commutator as much as $\frac{3}{8}$ ins. After a time it was found this was due entirely to too hard mica between the commutator segments. It is now the practice to groove out the mica between the

segments to a distance of 1-32 in. or 1-64 in. below the surface of the commutator. The commutators now run without any attention whatever except a turning down every three months, when an armature is out to have bearings renewed. The cost of such turning down in this shop is given by Master Mechanic Tarkington as 50 cents to 60 cents. No treatment is given the brushes, they are simply renewed as fast as they wear out. These motors average 140 miles a day, and the original commutators are still on the road. The grooving out of the mica is done by putting the armature in a lathe, fastening it so that it cannot turn, and putting the grooving tool in the tool post of the lathe, so that when the tool post is worked back and forth parallel with the axle by hand the mica can be grooved out from between the segments. This affords a cheap and rapid method of doing this work. When the motor is run the grooves do not clog with carbon from the brushes, as would be supposed, and the effect of the grooves seems to be nothing but beneficial.

In renewing armature bearings it has been found that better results are secured by boring out the freshly babbitted shells in a lathe to fit accurately the armature journal they go on, rather than by casting the shell around a standard mandrel, which may not be the exact size of the armature journal owing to wear on the journal. The shells are poured over a core, and then bored out in a lathe. A special chuck, which is clamped over the whole length of the shell, and which requires no special centering, is used for holding the shell while it is being bored out. As a small amount of play in an armature, when new, reduces the clearance so materially (in practice it will sometimes reduce it one-half), and as this reduction of clearance so reduces the length of time an armature can safely be run as to call for more frequent renewals, Mr. Tarkington considers that the extra work of boring out shells is fully paid for in assurance of longer life and safety from armatures hitting pole pieces.

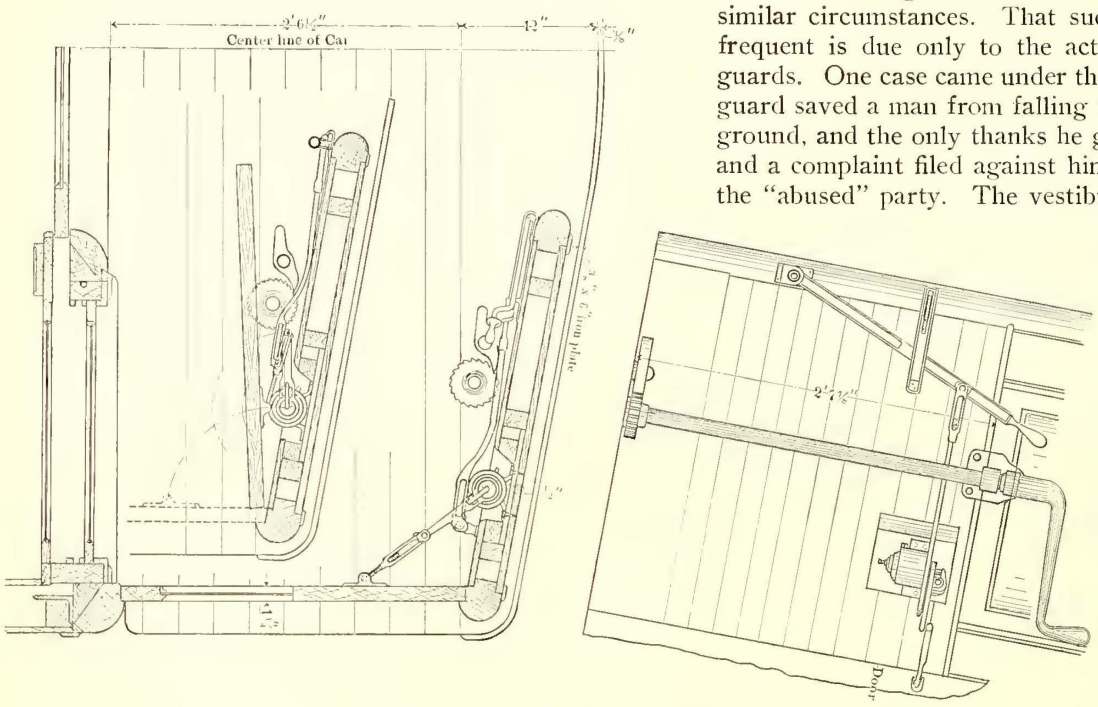


FIG. 1.—NEW TYPE OF GATE

The Cincinnati Street Railway Company has been granted a franchise for the extension of its Warsaw Avenue line to connect with its Elberon Avenue line at the latter's terminus at St. Joseph's Cemetery, thus forming a belt line.

New Type of Gate for the Northwestern Elevated, Chicago

In the equipment of the Northwestern Elevated Railroad, of Chicago, a departure from the usual type of elevated railway gate was made on some of the cars. The change appears to be for the better, as far as the danger of accidents is concerned. The gate, instead of being an iron framework, about 3½ ft. high, is a wooden vestibule door, with plate glass window, reaching clear to the hood of the car, and making the cars practically vestibuled. Each year there

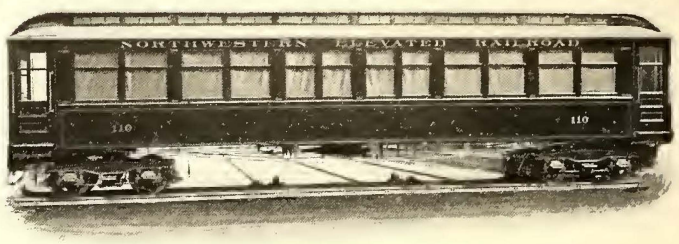


FIG. 2.—CAR OF NORTHWESTERN ELEVATED RAILWAY

are usually a number of accidents on an elevated road, due to efforts of passengers to board the train after it has started and the gates have been closed, or to get off under similar circumstances. That such accidents are not more frequent is due only to the activity and strength of the guards. One case came under the writer's notice where the guard saved a man from falling from the train clear to the ground, and the only thanks he got was a torrent of abuse and a complaint filed against him at the general offices by the "abused" party. The vestibule-door form of gate entirely put an end to accidents of this kind, and also to the exceedingly annoying complaints and quarrels with people who think they should be allowed to jump over the usual type of gate. When the gate is shut that settles the question beyond any dispute or foolish attempt. These doors are 2 ft. 6½ ins. wide, and swing back against the front wall of the vestibule. The mechanism for swinging the door open or shut is very simple, and is shown in the accompanying illustration, Fig. 1. As will be seen, a straight hand lever is used instead of a crank. Fig. 2 shows one of the cars as it appears with the doors closed. The cars are Pullman make.

A New Ohio Road

The contracts for constructing the Dayton, Tippecanoe & Troy Interurban Railway have been awarded, and the line is now under construction. The line will extend from Dayton to Piqua, and among the towns through which it will pass are Troy, Piqua, Tippecanoe, West Carrollton, Phoneton, Brant, New Carlisle, Trademore, Vandalia, Fishburg, Hooksville and Dayton. The power house, car house, shops, etc., are to be located at Tippecanoe. The Westinghouse Company has been awarded the contract for the electrical equipment of the line. The Carnegie Steel Company secured the contract for the rails, and the New Castle Bridge Company was the successful bidder for the bridge work.

Suggestions on How to Make Non-Paying Roads Pay—I.

BY H. S. COOPER

After from five years to ten years of strenuous effort and unlimited expenditure, it seems pitiful that nine-tenths of the urban street railways of the United States do not pay dividends, and over three-fifths of them, excluding a few in the larger cities, are not actually earning their fixed charges and depreciation. Their bond and stockholders are in the condition of the farmer who had hold of the mad bull's tail in the pasture, "It's the devil to hold on, but it's hell to let go!" That cry, "Give! Give!" rings continually in their ears, and good money is thrown after bad in the hope that "something will turn up" to better matters, to change the outgo to income.

With many of these the hope is hopeless, for facts and conditions are against their being a success in their location; their only resource is the receiver or the second-hand dealer and a credit entry to profit and loss, and the sooner such entry is made the better it will be for the owners.

There are others which are not legitimate commercial enterprises; conceived in promotion and born in stock jobbery, they have subserved their ends when the last certificate or bond is unloaded, and the sheriff and the junk man, acting as minister and undertaker, are the logical outcome. Others of this class are those built solely or principally to back up some land scheme, to connect somebody's "addition" to the city, to make good one claim of the real estate agent, "Within two minutes' walk of the street cars." These sometimes contain elements of success, but are not of themselves legitimate operating enterprises, as they depend on fortuitous circumstances for their success, and are mostly a species of lottery.

There are, however, many roads that were built in good faith, and are trying to be operated as legitimate business enterprises, where, by a change of policy, management, route or schedule the scale could be tipped the other way; where economies could be practiced that would—without lessening net earnings or increasing operating expenses or depreciation—transfer a balance to the other side of the ledger; where an expenditure in certain directions would result in a decrease of operating expenses or an increase of receipts much greater than the expenditure, and there are others where all or a large part of the above might have to be applied.

No hard-and-fast rule or rules can be made for the successful and remunerative operation of all street railways, no matter how similar many of them may seem. No two properties are so exactly alike in their condition and conditions that exactly similar treatment will bring similar results. Local conditions and characteristics vary so infinitely that an exact and careful study of each case, on the ground, *must* be had before a correct diagnosis can be made and a complete remedy prescribed, for the successful rehabilitation of such properties is not a matter of rule or theory, but a practical application of the knowledge and experience obtained under all possible varying conditions.

In these articles it is proposed to give as suggestions those things which have been found of practical value in obtaining better results from many non-paying properties—properties of all conditions and classes, and situated in towns and cities of all kinds and locations. It is not thought to make these articles a "Stock-and-bondholder's-Vademecum," or an "Every-street-railway-owner-his-own-reorganizer." The only thorough and complete plan for the betterment of any street railway property must be made by a competent and experienced man, after having thoroughly, conscientiously and understandingly gone into all the conditions which affect that property.

One of the first and most important factors in the success or non-success of any road, is the *personal element*—the employees; and chief among them is the manager or superintendent, the operating head—whatever his title may be. Of him there should be but one, and he should be as good a one as it is possible to afford.

One of the most successful of employers was once asked the secret of his success in always being able to surround himself with efficient, trustworthy and permanent subordinates, and his answer was: "I get good men, tell them what I want, let them alone, watch the results, and if they are good, I keep the men!" And that about tells the whole story in five short and pithy chapters. Let us elaborate them a little.

Chapter I. "Get good men." Now, good men in any business cost more than poor ones, and in the street railway business this is especially the case, as the necessary qualifications of the operating head of a small or medium-sized road are more numerous and complex than in any other business. While it is not needful that he be an E. E. or an M. E., it is needful that he have a fair theoretical and practical knowledge of both those branches, or, human nature being human nature in street railways, as elsewhere, his subordinates and others may take advantage of his ignorance, to the detriment and expense of the company. While it is not necessary that he be a practical line man, track man, winder, painter, carpenter, machinist or blacksmith, he should have had enough practical experience of all these branches to enable him to judge the results of the expenditure of labor and material in them. He must be a thorough disciplinarian, and must still be able to win and retain the liking and respect of all his subordinates. He must be accountant enough to obtain from any and all sources such data as he needs, and, where it is necessary, to originate the forms and methods necessary to do it; and he must be able to collect, collate, integrate and understandingly apply such data when obtained. He must have a pleasing address, imperturbable good nature, endless tact, an abundant knowledge of human nature, and must be "as wise as a serpent and as harmless as a dove," for he has municipalities and municipal officers, politicians, lawyers, doctors, editors, reporters, ministers, professors, his executive committee and local owners, all sorts and kinds of kickers, cranks, fools and knaves, and last—but not least—the ladies to deal with, to convince, to foil, to please, to pacify, to placate! He must be pliable where it is necessary, and no principle is involved, and he must be firm as a rock when right or duty requires it. He must have no "string to him," but must be free from any affiliations or influences that will lessen or limit his usefulness to his employer, the company. Finally, he must be honest, truthful, sober, industrious, untiring, cool-headed and a pusher—both of himself and others!

With such a list of necessary qualifications, the lack of any one of which may make the difference between success and failure for himself and his company, is it any wonder that, at the salaries generally paid by small and medium-sized roads, their operating heads are not what they ought to be? Leaving out the technical knowledge, a man who has the other qualifications above enumerated will make a success of any business under possible circumstances, and if such a man—with the additional technical knowledge—is compelled to take the position of operating head of the ordinary small or medium-sized street railway, at the salary and under the conditions usually attendant, is it any wonder if he uses such a position merely as a stepping-stone to something better?

Not that all high-priced men are good, or all low-priced

men are poor, but, as a rule, brains, combined with energy, honesty and good judgment, have a fairly steady comparative market value, and, other things being equal, a man who will work in a certain position for $1,000 per year will not be as valuable a man in that position as one who will not undertake it at less than $2,000; and the chances are, in a complex business like the management of a street railway, that the higher priced man can show previous better results than the other, and that he will save or earn for his employer much more than the excess paid him.

Another mistake, in line with the employment of a cheap head, is that of employing a cheap "practical" operating superintendent to "look after" that portion of the operating, and then think that the road may be successfully "run"—as a side issue—by some doctor, lawyer, banker, college professor, or any other "butcher, baker or candle-stick maker" who may be a local owner or the relative, friend, favorite or representative of an owner. Because he has made a success of a totally different business—and very often because he has made a failure of one—because he is known and liked by every one in the town, because he has a pull in this, that or the other direction, and very often simply because he is an owner or a representative of one, he is put on to "manage" the road. Without an ounce of training in one of the most complicated of businesses, with all his ideas, feelings and prejudices fresh from the passenger side of the business, hampered by his ignorance of the mechanical and practical side of the operating, and made mischievously suspicious by that ignorance, handicapped by his previous business and social relations with the patrons of the road, is it any wonder that under such a management (?) the road gathers debts and depreciation, that it has either a quick fever or a slow decline, that it jumps into the arms of a receiver or leads an anæmic existence that is liable to terminate from the slightest cause?

It is true that there are a number of successful roads that are apparently managed by doctors, bankers, etc., but in many cases of this kind another power will be found behind the throne, a subordinate or subordinates, "railway men" by training, who alone are responsible for the success, but whose work is successfully covered and appropriated by the big man. The exceptions to these cases are the exceptions that prove the former rule. If the street railway business were not a business by itself, as much so as banking, law, medicine, teaching or selling or buying goods, then it might be possible for Tom, Dick or Harry to successfully "run it" without previous experience, but it is a business *sui generis,* and, therefore, needs as head a man who not only has an aptitude for it, but also a thorough training and a previous successful experience in it.

Therefore, if your road is not paying, or is not properly paying, if it is "going down hill," and the cause is not plainly visible, look to your operating head, or the place where it ought to be. If you have two or three or a dozen, cut them all off but one, and have that a good one; if you have none, get one; if you have only half a one, get a whole one; if you have a poor one, get a good one—you must have a head, and he must be a "good man!"

"But we cannot afford such a man."

"How do you know, have you ever tried one?"

"No, but we are just paying expenses now, and if we go paying a big salary, we won't be able to pay expenses at all!"

"Now, look here! Suppose you pay a competent man a thousand dollars a year more than your present mismanagement costs you, and he *saves* you a thousand dollars a year (that is only $2.75 per day!) in one direction, and makes you another thousand (which is also $2.75 per day!) in another, will it not have paid you?"

"Yes—but there is not any chance to do that here. We know this road and the people better than any stranger, and there is not another cent to be made or saved out of it."

"Well, if that is the case, then your road has absolutely no reason for existing, and the sooner you pull it up by the roots and sell it to the junk man the better you will be off. But in all probability it is not the case. Do you mean to say that you are so thoroughly acquainted—not only with your road and people, but with all that is known of the possibilities and resources of street railroading—as to affirm that nothing can be done by anyone to decrease your expenses or increase your earnings?"

"Oh, well, we wouldn't go so far as to say that."

"All right. Now, your road is not paying dividends, is it?"

"No."

"All you can do to scrape up enough to pay bond interest, isn't it?"

"Just about."

"And how about depreciation?"

"Oh, we keep the repairs up, all right."

"Great Scott! *That's* operating expenses! What I asked about was de-pre-ci-a-tion! How old is the road?"

"Five years."

"And the track?"

"The same."

"And the cars, and equipments, and the line, and the buildings, and the generating machinery?"

"About the same, but in the last two years we've put in a lot of new ties and poles, and bought some nice second-hand cars, and fixed the trolley wire the whole length of the road!"

"Are you insured against accidents?"

"No, it costs us too much to do that. Besides, we run so carefully that we never have any accidents to amount to anything."

"H'm! Any paving or repaving to be done soon along your line?"

"Well, there's some talk of it, but we can arrange *that*—we stand in all right with the city!"

"All right! Now—on your own showing—you are barely earning your operating expenses and fixed charges. Your property is worth less than half what it was in the beginning, and is cutting out 10 cents more on the dollar of its value every year, and in five years more it won't have any value at all, except as junk, and in three years more you won't be able to run at all. You are liable at any minute to have an accident that will put you into the hands of the sheriff or the receiver, some turn of politics or public opinion may swamp you with a paving bill, and yet you neglect the only chance that is left. You have shown that you have pretty nearly every disease that street railways are heir to, and yet you won't call in a specialist, pay him a reasonable fee for a reasonable time, and get positive results—one way or the other."

Now, this is not an isolated or an exaggerated case; within sixty days four similar situations have been brought to the notice of the writer.

Chapter II. "Tell him what you want." Have a plain and full understanding as to his duties, his authority, his responsibilities, his limitations. Be frank with him as to the exact condition of the property in every respect. Explain to him fully the policy, aims and desires of the owners. Give him full and unprejudiced information as to any points that may be of use to him in his position. Make him second only to the board of directors, or their empowered representative, in all matters pertaining to the policy of the company or any matter that affects the property, its charter, its franchises or its standing in law, and in all matters of operating make him the superior of that

board or representative. If he is not worthy of this confidence and this trust he is not the man you want!

Chapter III. "Let him alone." Don't meddle with him because his methods are not yours. Keep your hands off him, and keep other's hands off him. Protect his authority both from yourself and from others, no matter how great the temptation. Always refer to him all matters that come under his authority. Never criticise him adversely to, or before, others, outside of the owners. If you have suggestions to make, be sure first that they are good, feasible and seasonable, and if so, go to him and give them to him quietly as suggestions. If you receive complaints or criticisms that are serious, and cannot be referred to him, be fair and just, lay them before him, giving him your authority, and hearing his side of the matter fully. Don't worry yourself or him in regard to his methods as long as they are clean. No two people do the same thing the same way. What you are after is results, leave the methods to him, as long as they are only a "matter of opinion."

Chapter IV. "Watch the results." Look for them only within a reasonable time, taking into full consideration what is against them and the obtaining of them. Don't look for instantaneous results nor that all shall come together; "make haste slowly" is the motto of a new executive, and the easy handling of a new broom raises least dust.

Watch the operation; see if the employees are more alert and attentive to duty, if the cars are cleaner and run more closely to schedule, if there are less breakdowns, detentions and delays, if the public, as a whole, is being better served and satisfied. Watch the property; see if it appreciates, if the cars are less noisy, if the track is less bumpy, if the overhead work looks less like a Monday morning clothesline, if the power station and car house are neater, cleaner and more orderly, if everything shows signs of "walking up" instead of "running down." Watch the accounts; see if the income is greater or less than last year, at the same time taking into consideration all attendant circumstances and conditions, see if the operating expenses are greater or less than last year, and in what department and why, note the proportionate increase or decrease of your accounts payable, bills payable and bank accounts, analyze and integrate all the returns carefully, giving full consideration to all affecting conditions. Note especially your material or supply accounts and the condition and value of the stock room supplies.

All the above items, if intelligently read and considered, will give you the material results, and if, within a reasonable time, they do not average favorably, then it is your right to lay the matter before the new man, and ask his explanation. Put it to him in a quiet, business way, hear fully what he has to say, insist on a careful explanation of all points not plain to you, judge his explanation on straight business principles the same as you would in your own business, giving him credit for results to be attained as shown by his previous experiences. No honest and competent man will object to such an inquiry so conducted, after he has had a reasonable time in which to show his ability and the results from it. What drives him half crazy and takes the heart out of him is the petty, personal and unreasonable complaints and criticisms, the usurping of and meddling with his authority, and the half-hearted semi-cooperation of his officers and owners.

Chapter V. "If the results are good, keep him." Don't be in a hurry to change him, even if the results are not up to your expectations, so long as they are better than they were before he came. Give him an unreasonable length of time to come up to your expectations, as they probably were unreasonable. Besides that, in such cases as yours, the results are generally in the form of an arithmetical progression, with a very small first term. It always takes some time for a new man to get his bearings, and his best work will not come until he has all matters and people at his finger's ends. Besides that, a new man is expensive at first, no matter how economical he may be. He is getting his bearings at the company's expense, and the full round of the year with the different conditions of each season must roll by before his local education is complete. He will, of necessity, have his own particular methods, which will necessitate an investment on the part of the company that would be lost under the different methods of a succeeding—even if better—man. Therefore, it is wiser and generally better economy on the part of the owner if the results obtained by a new man are good, and better, as time passes, to keep him until they are fully satisfied that they should do better. If, however, the new man gives first-class results, do everything possible and reasonable to retain him. Don't think that the salary check pays everything, let him feel with words and acts that his efforts in your behalf are appreciated. Commend where commendation can possibly be given, don't think that merited praise will cause the "big head"; that is an exploded theory. Willing, cheerful effort reaches twice as far as that done perfunctorily, and nothing tends to it more than a knowledge of its appreciation. Do not stop at words, let your appreciation show itself in a material form, an extra vacation with a little extra check to enable it to be fully enjoyed, a slight and unasked increase in salary, a present at Christmas or New Year's, or at the end of the fiscal year, will generally bring usurious interest. Remember, also, that such a man has aspirations for the future; that, as a rule, he will grow faster than the property, and that a sense of ownership or partnership is the highest and most continuous spur to effort; therefore—when you are assured that he is the man that you want, and before his salary reaches the limit—you can commercially afford to give him a personal interest in the property, some stock or some scrip, or the opportunity to purchase some at low prices and easy terms, a percentage on the net returns or the dividends, something that will give him a participation in the results obtained by his own efforts, and that will increase with the results. It will be a good investment, it makes and keeps a satisfied man!

In regard to the other employees, your share in their improvement will be more administrative than executive, for if the new man is the "good man," their efficiency will be mainly in his hands. You can, however, co-operate with him in all efforts for their benefit; in fact you must do so unless you wish to make them partisans for him instead of allegiants to the company. Remember that injustice is felt and resented sooner and deeper than illiberality by the rank and file of the employees, and whether it is directed toward them or to a liked and honored official; and that very often a small concession, intervention, commendation or reward on the part of the company is a strong incentive to loyalty and a discouragement to partisanship and dissatisfaction. *(To be continued.)*

Opening of the Albany & Hudson

The line of the Albany & Hudson Railway & Power Company was officially opened on Thursday, Nov. 22. A special train left New York in the morning with a large contingent of capitalists and railway and supply men, which took the party to Hudson. An inspection of the entire road was then made, the guests being carried to Rensselaer by the company's large and elegant cars at express speed, and returning at a more leisurely rate, when opportunities were afforded to visit the sub-stations, car houses and the main combination hydraulic and steam power plant at Stuyvesant Falls.

LEGAL NOTES AND COMMENTS*

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

CHARTERS, ORDINANCES, FRANCHISES, ETC.

CALIFORNIA.—Tracks—Intersection—Use by Two Companies. In 1897 defendant constructed and has since maintained a street railway in a city, under a franchise from it. Civ. Code, sec. 499, provides that "two lines of street railway operated under different managements may be permitted to use the same street, each paying an equal portion for the construction of the tracks and appurtenances used by such railways jointly." Held, that plaintiff, having a like franchise from defendant, is entitled to intersect defendant's tracks and operate cars thereon jointly with defendant, upon payment to the latter of one-half of the value of the tracks and appurtenances at the time plaintiff is permitted to make use of them.—(Hook vs. Los Angeles Ry. Co., 61 Pac. Rep., 912.)

CALIFORNIA. — Construction—Contracts—Consideration—Estoppel—Discharge—Notice.

1. Plaintiff owned and operated a street railway on M Street, and defendant obtained a franchise for a street railway on T Street, which did not cross M Street directly, but entered it from the east, and followed it for a short distance, and branched off to the west. Defendant agreed, in writing, that, if plaintiff would grant the right to use its track on M Street from the entering to the departure of T Street, defendant would reconstruct that part of plaintiff's line and equip it for use as an electric line. Four months later they executed a supplemental agreement, which provided that, in the event plaintiff elected to spread its tracks to a greater distance than 8½ ft. from center to center, defendant would pay all costs incident to such change. Held, that the supplemental agreement was void for want of consideration, since it was not an alteration of the original contract, but in addition to it of a new and onerous burden on defendant.

2. Where, after plaintiff and defendant had executed a written agreement, they entered into a second one, which was designated as supplemental to and explanatory of the first, the fact that it was so designated did not estop defendant from showing that the supplemental agreement was not a part of the original, and that it was without consideration.

3. Where, after plaintiff and defendant had executed a written agreement, they entered into a second, which was designated as supplemental to and explanatory of the first, the fact that defendant notified plaintiff that he would not be bound by the supplemental agreement did not discharge him from his obligation under it, since the party in fault cannot discharge a contract by repudiating it.—(Main St. & A. P. R. Co. vs. Los Angeles Traction Co., 61 Pac. Rep., 937.)

GEORGIA.—City Improvements—Paving—Liability of Street Railway.

1. The act of Oct. 10, 1891 (Acts 1890-91, vol. 2, p. 457), is the only source from which the Mayor and General Council of Atlanta can, in a case like the present one, derive power to charge a street railway company with a portion of the original cost of paving when it lays its tracks upon a street which has already been thus improved.

2. Under this act it is incumbent upon the Mayor and General Council, before granting a street railway company permission to lay its tracks on a paved street, to fix the amount of compensation which will be required of it; and, when no amount has been thus fixed, no demand can be made against the company after the tracks have been laid, either in behalf of the city or of abutting property owners, for the cost of pavement.

3. Where the Mayor and General Council granted such a railway company permission to lay its tracks on a paved street, expressly stipulating that no charge for paving should be made against the company, the General Council could not thereafter, under the provisions of the act above cited, enforce, by execution or otherwise, a claim against the company for any portion of the original cost of laying the paving in that street.—(Atlanta Consol. St. Ry. Co. vs. City of Atlanta, 36 S. E. Rep., 667.)

GEORGIA.—Crossing Other Roads—Additional Servitude—Condemnation Proceedings.

1. Even if the provisions of Civ. Code, sec. 2219, are applicable to the crossing by a street railway of any other railroad, the phrase, "heretofore or hereafter chartered by the Legislature of this State," embraces a street railway company whose charter, though granted by the Secretary of State, has been confirmed and made valid by an act of the General Assembly. A company having such a charter may properly be termed one "chartered by the Legislature."

2. No new burden or servitude is imposed upon a public street or highway by constructing and operating therein a street railway for the transportation of passengers, the cars of which are propelled by electric power.

3. That a street railway company has, under its charter, authority to use steam as well as electricity as a motive power, is a matter of no consequence in testing its right in a given instance to cross a railway on a street under a municipal grant restricting the company to the use of electric power, and where it is not seeking to employ steam power.

4. A railroad corporation which is permitted to construct its tracks across an existing city street or public road does so subject to the condition that it must submit to the increased inconvenience to it which may result from the growth and development of the city or country, and the consequent increase of travel in the usual methods along such street or road.

5. A company owning and operating a street railway of the character above indicated may, under the permission of the proper municipal or county authorities, construct its lines across the track of a steam railroad company, and use the same, without instituting condemnation proceedings, or being required to pay damages.—(Southern Ry. Co. vs. Atlanta Ry. & Power Co., 36 S. E. Rep., 873.)

NEW YORK.—Use—Liens—Two Fares—Right of Lessee—Additional Fare.

1. Railroad Law, sec. 101, declares that no corporation constructing a railroad under that act, or under laws 1884, c. 252, shall charge more than 5 cents for one continuous ride from one point on the road, or from a point on any road, line, or branch, operated by it and under its control, to another, or to a point on any connecting line within the limits of any village, the act not to apply to any road constructed and in operation prior to 1884. Held, that where defendants, owners of an electric line, leased a line run by steam, which had been in operation since 1879, and connected the two, and operated both as electric lines, they had a right to charge a 5-cent fare on each line for a continuous trip over both, since the act restricting the fare to 5 cents has no application to street railways constructed and in operation prior to 1884, or to any road operated by steam.

2. Under laws 1892, c. 676, authorizing any railroad corporation to contract with any other such corporation for the use of their respective roads, where defendants, owners of an electric line, leased a line run by steam, which was constructed and in operation prior to 1884, and connected the two, and operated both as electric lines, defendants, under their lease, acquired the power to charge a 5-cent fare on the leased line, in addition to a fare on its own line, for a continuous trip over both lines, notwithstanding railroad law, sec. 101, limiting charge to 5 cents for continuous ride over company's entire system, since, if the defendant had operated the leased road independent of its own, it could have charged a fare on the leased line.—(Barnett vs. Brooklyn Heights R. Co., 65 N. Y. Suppl., 1068.)

NEW YORK.—Fares—Amount Chargeable—Parties—Private Citizen—Right to Represent Public.

1. Laws 1884, c. 252, sec. 13, as amended by laws 1897, c. 688, sec. 101, provides that no corporation constructing and operating a railroad under such act shall charge any more than 5 cents fare on any line owned or operated by it within the limits of any incorporated city. Held, that a street railway company organized under such act could not charge more than a 5-cent fare within the city limits, whether it operated its own lines, or leased other lines, whose owners had a right to charge a higher rate.

2. A private citizen may not maintain an action to enjoin a street car company from charging an excessive fare, since he suffers no injury not in common with the whole people; the remedy being by Code Civ. Proc. sec. 1798, in an action by the Attorney-General

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

to vacate its charter.—(McNulty vs. Brooklyn Heights R. Co., 66 N. Y. Suppl., 57.)

NEW YORK.—Railway on Street—License from City—Abutting Owner—Possession—When Adverse.

1. Defendant and its predecessors in interest for a long time had occupied with tracks the city street on which plaintiff's lot was situated, plaintiff owning the fee to the middle of the street. No compensation was ever made to plaintiff for the use of the street, nor was the right to such use ever acquired from plaintiff. Defendant's entry on the street was under a license from the city, and there was no evidence that any claim was ever made of any rights in the street, except under such license. Held, that such occupation was not adverse to the plaintiff.

2. Possession of the street having been under the license, and not adverse to plaintiff in its inception, in absence of proof there was no presumption, after twenty years, that the character of the possession was changed.—(Monohan vs. N. Y. Cent. & H. R. R. Co.; Thoman vs. same, 66 N. Y. Suppl., 37.)

LIABILITY FOR NEGLIGENCE

KANSAS.—Attorney and Client—Contract with Collection Company—Notice of Attorney's Lien—Settlement with Client. Where B. made an agreement with a collection company to prosecute her claim against defendant, and plaintiffs were the attorneys for such collection company, and there was a contract directly between B. and plaintiffs, subsequent to B.'s arrangement with the collection company, by which plaintiffs should act as her attorneys, and, in spite of notice by plaintiffs to defendant that they claimed an attorney's lien, defendant settled with B., a finding that plaintiffs were not attorneys for B., and not entitled to recover, is not justified.—(Anderson vs. Metropolitan St. Ry. Co., 61 Pac. Rep., 982.)

LOUISIANA.—Injury to Pedestrian.

1. Where the evidence discloses that the electric street car which struck plaintiff was running at a moderate and safe rate of speed, was under the control of the motoneer, that he was sounding his warning gong, that he stopped the car in a brief space of time and distance, and, from the circumstances attending the accident, it is evident she ran into the car without paying any heed whatsoever to its approach, she cannot recover.

2. It is the duty of a person approaching a railway track to pause and look and listen, and govern himself with prudence, according as the situation demands.—(Canedo vs. New Orleans & C. R. Co., 28 So. Rep., 287.)

MARYLAND.—Negligence—Evidence—Instructions to Jury—Depositions.

1. A city, having in use a derrick on the same street as defendant's car line, had a cable attached to the derrick, and extending across defendant's track to the engine by which the derrick was operated. When the cable was tightly stretched, it was at an elevation above the car track sufficient to allow the cars to pass under it, and the city had a flagman to give warning when it was dangerous to pass under the cable, and to signal defendant's motorman when it was safe to go forward; but in passing under the cable the conductor lowered the trolley pole, so as to prevent the pole from coming in contact with the cable. Under these circumstances, one of the defendant's cars being signaled by the city's flagman to proceed, the motorman obeyed the signal, and the base of the trolley pole caught the cable, and dragged the derrick over, causing it to fall upon plaintiff's intestate, and killing him. Held, that it was the duty of the city to keep the cable stretched so defendant's cars could pass under it, and, if the accident occurred by reason of the cable being slack when it ought to have been taut, or because of the city's flagman signaling the motorman to proceed when there was danger, the negligence was that of the city, and not that of the railway company.

2. It not being claimed that the conductor's omission to lower the trolley pole was the cause of the accident, the fact that the conductor was in the forward part of the car, collecting fares, when the accident occurred, instead of being on the rear platform, to lower the trolley pole as the car passed under the cable, was not negligence for which plaintiff would recover of the railway company.

3. An instruction requested by defendant, that the railway company was not responsible for the negligence of the city's flagman, was properly refused because of the assumption that the flagman was the employee of the city instead of leaving the jury to find that fact.

4. Under Code, art. 35, sec. 19, providing that either party may, upon notice to the opposite party, take the deposition of any witness, to be used on the trial "in case only of the death of such witness, or on proof to the satisfaction of the court, of the inability of the party to procure the attendance of such witness at the time of trial," where, after a deposition so taken, the witness appears in court and testifies orally, his deposition cannot be read on a second trial of the cause, although the witness is not then in attendance.—(Baltimore Consol. Ry. Co. vs. State to Use of O'Dea et al., 46 Atl. Rep., 1000.)

NEW HAMPSHIRE.—Carriers—Injuries—Stopping Place—Selection—Liability—Alighting from Car—Duty to Look—Knowledge of Conductor—Negligence—Instructions.

1. Where plaintiff, a passenger on defendant's car, requested the conductor to stop at the first entrance to a cemetery, where she was in the habit of alighting, and where the highway was level with the roadbed, which he failed to do, but stopped a short distance beyond, opposite a hole, into which plaintiff fell in alighting and was injured, the objection that there was no evidence to support a verdict that defendant was guilty of negligence was not well taken.

2. Where the conductor of a street car failed to stop at the place plaintiff requested, but stopped a short distance beyond, where the track ran close to the edge of the highway, and plaintiff, in alighting with a number of bundles and wraps, fell into a hole and was injured, the fact that she did not look at the ground before alighting was not sufficient to charge her with contributory negligence.

3. An instruction that a passenger on a street car has no right to expect that the street where she alights shall be in a safe condition, and that if plaintiff alighted without looking to see where she was stepping, and was injured thereby, she was guilty of such negligence as would prevent her recovery, was properly refused.

4. Where a conductor of a street car ran beyond the regular stopping place, and stopped opposite a hole in the highway, into which plaintiff fell in alighting and was injured, an instruction that the defendant had a right to presume that plaintiff, in alighting from a car in broad daylight, would notice any defect in a street, which was open to ordinary view, at the place where she stepped from the car, was properly refused.

5. Where a conductor of a street car neglected to stop at the regular place, and stopped a short distance beyond, opposite a hole in the highway, into which plaintiff fell in alighting and was injured, an instruction that, if the conductor had no special information as to the condition of the place which the plaintiff did not have the means of seeing or obtaining for herself, he was under no obligation to give her any information in regard to it, was properly refused.

6. An instruction that if the plaintiff, in alighting from a street car in broad daylight, in full possession of her sense of sight, did so without looking to the ground, or using any means of seeing where she was stepping or the distance to the ground, she was guilty of such negligence that she cannot recover for an injury sustained in alighting, was properly refused.

7. Where a conductor of a street car neglected to stop at the regular place, as requested by plaintiff, but stopped some distance beyond, opposite a hole in the highway, into which plaintiff fell and was injured, an instruction that the plaintiff, being incumbered with bunches of flowers and her wraps, was under greater obligations to look where she was about to step than she would have been if she had the free use of her person, was properly refused.

8. An instruction that it was plaintiff's duty to use great care in alighting from a street car, and if there was any defect at the place of alighting which might contribute to her injury, and by looking she could have discovered such defect, but neglected to do so, and the neglect to look contributed to the accident, she could not recover, was properly refused.—(Bass vs. Concord St. Ry., 46 Atl. Rep., 1056.)

NEW YORK.—Negligence—Employees—Incompetency—Fellow Servants—Assumption of Risk—Duty of Conductor—Proof—Objection on Appeal.

1. Plaintiff, a street car driver, in crossing an excavation was obliged to unhitch his team, and leave the car, under the control of the conductor, to come down the grade of its own weight, past the excavation; and, in getting the team around the excavation,

plaintiff stumbled and fell across the track, and the conductor, who had just been hired, and had received no instructions as to the use of the brake, turned it the wrong way, whereby the car ran over plaintiff and injured him. Held, that defendant company was guilty of negligence in not instructing the conductor in the use of the brake.

2. The fact that the contractor making the excavation provided men to push the cars going up grade past the excavation had no tendency to show that it was not the duty of the conductor to take charge of the car while coming down grade.

3. The objection that there was no proof that it was the duty of the conductor to take charge of the car as it passed over the excavation cannot be raised for the first time on appeal.—(Sullivan vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 842.)

NEW YORK.—Contributory Negligence—Injury to Team—Electric Car. Where the driver of the injured team looked down the track as far as he could see (the view being somewhat obstructed), and defendant's car was not in sight till too late to avoid collision, and came very fast, without any signal (the motorman not being at his brake, or where he could control his car), the evidence does not establish contributory negligence of the driver, as matter of law.—(Vitelli vs. Nassau Elec. R. Co., 65 N. Y. Suppl., 1027.)

NEW YORK.—Personal Injury—Conflicting Testimony—Inadequate Damages. Where plaintiff, a boy of seven years, was struck by defendant's street car, and his physicians testified that he was losing his mind because of an injury at the base of his brain, while defendant's physician was confident that no such symptoms were present, judgment for $1,000 in favor of plaintiff will not be set aside as inadequate.—(Simonsen vs. Brooklyn Heights R. Co., 65 N. Y. Suppl., 1077.)

NEW YORK.—Expert Witness—Competency—Striking Out Testimony. In an action against defendant for negligently running into and injuring plaintiff's coach, a witness was allowed to answer the question: "What would you say to be the difference between the value of that coach at the time you saw it there that day and after it left your shop—after it had been repaired?" On cross-examination he testified that he had no remembrance of the condition of the coach before the accident. Held, error to refuse to strike out his testimony as to value, since by his own evidence he was incompetent to tell how much the coach had been injured.—(Eureka Stable Co. vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 509.)

NEW YORK.—Release—Fraud—Effect. A release for injuries sustained by reason of the negligence of defendant, the execution whereof was procured by deceit and fraud, and by inducing the plaintiff, who was illiterate, to believe that he was merely signing a receipt for a gratuity, will not bar an action for such injuries.—(Markowitz vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 784.)

NEW YORK.—Personal Injury—Excessive Damages—Instructions—Exception—Evidence—Withdrawal from Jury—Evidence—Written Statement of Conductor—Admission.

1. Where plaintiff, a boy of eleven years, was injured by a street car, from which he suffered two amputations, and the loss of one limb above the knee, a verdict for $22,500 was not excessive.

2. Where plaintiff was injured by being struck by the fender of a passing street car, which projected over the sidewalk, and the court instructed the jury that it was not negligence for the fender to extend over the curbstone, and cautioned them not to award exemplary damages, and no exceptions were taken to the charge, the objection on appeal that the trial court, in his charge, so unduly minimized the evidence of defendant as to practically withdraw it from the jury, was not well taken.

3. Where a discharged conductor, who had charge of the car when plaintiff was injured, referred on cross-examination to a written statement made by him soon after the accident, and there was no claim that in any way contradicted his direct testimony, it was not error to refuse to admit the statement in evidence.—(Williamson vs. Brooklyn Heights R. Co., 65 N. Y. Suppl., 1054.)

NEW YORK.—Personal Injuries—Negligence—Contributory Negligence—Evidence.

1. Where plaintiff's intestate, a boy between ten and eleven years old, attempted to cross the track 50 ft. in front of defendant's car, and, having stumbled and fallen, was run over by one of defendant's cars, and it appeared that the car was running up grade at the rate of 6 miles per hour, and could have been stopped within 2 ft. to 4 ft., defendant was guilty of negligence, without reference to the question of intestate's contributory negligence.

2. Evidence that plaintiff's intestate had been in the habit of stealing rides on defendant's cars was not admissible in an action against a street railroad company for his death, where it did not tend to prove contributory negligence on the occasion of the injury for which damages were sought.—(Totarella vs. New York & Q. C. Ry. Co., 65 N. Y. Suppl., 1044.)

NEW YORK.—Carriers—Street Car Passengers—Extending Arm—Contributory Negligence—Evidence—Sufficiency—Finding.

1. That a street car passenger, sitting beside an open window reading, with his arm resting on the sill, extended his arm not more than 3 ins. outside the car, did not constitute contributory negligence as a matter of law, precluding recovery for an injury to such arm caused by another car passing on a switch.

2. Where the evidence showed that, at the time of an injury to the arm of a street car passenger by another car passing on a switch, he was sitting beside an open window, reading, with his elbow resting on the sill, without reason to suppose that the cars would be run so close to each other, and the only circumstance showing want of care on his part was that his elbow might have extended not more than 3 ins. beyond the sill, such evidence was sufficient to justify a finding that such passenger was using reasonable care at the time of the accident.—(Tucker vs. Buffalo Ry. Co., 65 N. Y. Suppl., 989.)

TENNESSEE.—Accident at Crossing—Personal Injuries—Action—Trial—Instructions—Evidence—Sufficiency.

1. Plaintiff was injured while crossing defendant's tracks. The evidence was that defendant's track crossed the road on which plaintiff was driving at right angles, the track descending a heavy grade; that defendant's car came down the grade on the night of the injury at the rate of 6 or 8 miles per hour, the motorman ringing the gong for the crossing; that when within 50 ft. of the crossing the motorman loosened the brake and increased the car's speed; that when within 12 ft. he saw plaintiff driving toward the track, and immediately sounded the gong rapidly; that, plaintiff paying no attention to the gong, he reversed the car when within 6 ft. of the crossing, and made every effort to stop it; that the car was lighted inside, and carried a sufficient headlight; and that a person seated on an ordinary wagon, such as plaintiff was driving, could see a car coming on defendant's track for a distance of 750 ft. Held sufficient to sustain a verdict for defendant.

2. In an action for injuries sustained by plaintiff while crossing defendant's track, an instruction: "If no one was in the range of the motorman's vision, or if no one was near enough to * * * the crossing to make the danger of collision probable, he had the right to * * * assume that, if anyone was approaching the crossing, they would have their vehicle under proper control, and would exercise ordinary care to avoid a collision; and no mistake that the motorman made in regard to these two rightful assumptions * * * could be charged to him as negligence,"—was erroneous, since it ignored the question of the speed at which the car was running.

3. Where plaintiff lived 25 miles from town, had crossed the tracks at the point where the accident occurred only four or five times, and was not familiar with their location, it was error to instruct that he could not recover if he failed to look and listen before attempting to cross; for such failure did not constitute negligence *per se*.—(Wilson vs. Memphis St. Ry. Co., 58 S. W. Rep., 334.)

NEW YORK.—Passenger—Injuries—Witness—Cross-Examination—Impeachment—Evidence—Admissions After Accident—Presumption as to Negligence—Burden of Proof.

1. Where, in an action against a street railway company for injuries, defendant calls the conductor of the car on which plaintiff was a passenger, and on cross-examination he denies making an admission to plaintiff after the accident that the car was in bad condition, such matter not having been reverted to in chief, plaintiff's own testimony that he did make such an admission is inadmissible, since a foundation for impeaching the conductor could not be made on a cross-examination concerning matters not testified to in chief.

2. In an action against a street railway company for injuries, evidence of the street-car conductor's admission to plaintiff after

the accident that the car was in bad condition, and that he had so notified his superiors, is inadmissible, since his admissions so made could not bind the company.

3. In an action against a street railway company for injuries to a passenger arising from one car escaping from the control of its driver, sliding down an incline, and colliding with another car at the bottom, it is error to instruct that the burden is on defendant to prove such facts as will demonstrate its freedom from negligence; since, while the presumption arising from such an accident is that the company was negligent, this presumption is merely an aid to plaintiff in sustaining the burden of proof, which remains on him throughout the case.—(Kay vs. Metropolitan St. Ry. Co., 57 N. E. Rep., 751.)

NEW YORK.—Settlement by Client—Attorney's Lien—Rights of Opposite Party. Where an insolvent plaintiff, without the knowledge of his attorney, settled an action for personal injuries after issue joined, and executed a general release of his claim, defendant was entitled to plead such release in a supplemental answer, over the objection of such attorney, though the latter had given notice of an attorney's lien.—(Zaitz vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 396.)

NEW YORK.—Domestic Corporations—Action—Proof—Matters of Record—Appeal and Error. Plaintiff sued defendant, a corporation, in the municipal court of New York City, and recovered judgment, though failing to show the jurisdiction of that court by proving that defendant was a domestic corporation with its principal place of business in New York City. Held, that since these facts are matter of record, and cannot be answered or disputed, she can sustain her judgment by proving them in the Appellate Court.—(Barnett vs. Metropolitan St. Ry. Co., 65 N. Y. Suppl., 509.)

NEW YORK.—Station—Banana Peeling—Negligence. The fact that a banana peeling was on a stairway leading to a street railway station, on which a passenger stepped, causing him to fall, would not support a verdict against the railway company for injuries, in the absence of a showing of negligence in permitting it to remain there.—(Benson vs. Manhattan Ry. Co., 65 N. Y. Suppl., 271.)

NEW YORK.—Negligence—Elements of Damage—Miscarriage.

1. While plaintiff could not recover for loss of offspring due to a miscarriage caused by the accident in question, yet evidence was admissible to show that her sufferings were increased thereby, notwithstanding her complaint contained no mention of such miscarriage.

2. Same—Verdict—Damages. Where plaintiff was badly bruised on the leg, knee, thigh and hip, and a portion of her extensor muscle was torn from the kneepan, which necessitated the use of a crutch, and was, in the opinion of experts, permanent, a verdict of $3500 was not so large as to warrant its being set aside on the ground that the jury had considered a fact as an element of damage which it was instructed to disregard.—(Witrak vs. Nassau Electric R. Co., 65 N. Y. Suppl., 257.)

A New Text Book on "Electric Law"*

Opinions will always differ as to the value of the modern law text book, whether it is written as an argumentative treatise or in the form of a digest of selected cases arranged in a more or less logical order. But there certainly seems to be a place for a work that seeks to gather between a single pair of covers the law, as expressed in the constitutions, statutes and decisions of the various States, applicable to the various questions which most frequently present themselves to corporations engaged in some specific branch of industry.

It may be an illogical division of the law to attempt thus to combine in one work scraps of constitutional law, discussions of equitable remedies in suits for injunctions and like relief, a presentation of the law of negligence as applied to telegraph companies and the carriers of passengers upon street railways, incorporation, taxation, condemnation and similar subjects, which form the bulk of the litigation and legal questions in which companies using electricity on a large scale are interested. Indeed, one can say, without much fear of contradiction, that the very term "Electric Law," which is the title the Messrs. Joyce have chosen for the latest text-book along these lines, is one which defies logical definition. We do not remember any analogous subdivision of the law—the terms "Steam Law" and "Gas Law" have as yet no place on the shelves of the library or among the subdivisions of the digest.

All this, however, does not militate against the practical usefulness to the officers and heads of departments in telegraph, telephone, lighting and street railway corporations, which use electricity, of a work of a thousand pages, which collates and epitomizes the law to be consulted in answering very many of the questions which arise in the legal complications of the company's business.

In such a work proportion is of the utmost importance. What to omit must be one of the most serious and difficult questions to be determined by the authors. How much space to devote to any subject, which is included in the scheme of the book, is one of equal importance. So difficult are these questions of solution that anyone must despair of producing a work which will solve them all to the complete satisfaction of anyone, including the author himself.

The book now under discussion is not the first upon the subject. In addition to the six volumes of cases collected by Mr. Morrill, under the title of "American Electrical Cases," and covering the period from 1873 to 1897, Mr. Barnard published a monograph on the "Electrical Law" of New York in 1895, and Mr. Croswell, in the same year, published his "Treatise on the Law Relating to Electricity."

Thus the authors of the present volume had the advantage over their predecessors in the opportunity of reviewing recent decisions covering a period of several years, which were not available to their predecessors in the field; while, at least, one of the latter had the advantage of the experience gained in the law department of one of the largest electrical companies in the country.

One peculiarity common to all the text-books referred to, as well as to Mr. Morrill's collection of cases, is the absence of any discussion of the complex, scientific and technical questions of electrical patent law, and it is obvious that that subject could neither be conveniently included within the limits of such a work, nor could it serve any useful purpose therein, except for a very limited portion of its readers.

The Messrs. Joyce have avowedly attempted to write a work which shall be useful, both as one which discusses fundamental principles and one which collects, cites and classifies the numerous decisions which are growing each year in number and variety, and as a result of this double purpose, the work has a two-fold character, which detracts from it as a work of art, but perhaps adds to its value as a practical working tool.

Among the subjects which are treated, more or less exhaustively, are interstate commerce; many phases of negligence law; the application of the Federal Constitution and legislative enactments imposing penalties, the rights of abutting owners, especially in their contests with telephone, telegraph and electric lighting companies. A number of chapters are given to a review of conflicting decisions upon various novel questions in the several States, the chapters being frequently divided into sections, and each section devoted to the legislation and decisions in a different State.

The manifest advantages and usefulness of the volume must appear from this brief review of the scope of the work.

The book, in common with most of our modern text-books, lacks literary style, and, unlike many of them, needs the pruning knife and condensation, rather than expansion, both of the matter and of the manner. The work shows signs of some haste in preparing it for the press, for in some parts of the work repetition is a frequent offense, and especially when the authors undertake to reason for themselves in those parts of the work where they discuss principles, instead of citing and quoting authorities. Section 826 is a flagrant example of this, where the authors criticise the Texas decision of 1881, which holds that damages for mental suffering alone, distinct and separate from physical injury, can be recovered. We read: "Courts should prefer to travel *super antiquas vias*. Precedents must be followed. The rule *stare decisis* is the only safe rule." We cannot see why any one of these sentences does not express the full thought of the authors, nor why any one of the following six or seven sentences in the same section does not fully express the next step in the argument.

The day seems to have passed when we are to receive from the law writers works of literary ability as well as of legal acumen—the days of Blackstone, of Kent, of Story and of Wharton. But perhaps the modern text-book is called upon to fulfil a different mission, and the one under discussion certainly is a practical work of great value on the library shelves of the telegraph, telephone, the electric railway and electric lighting corporations of the United States.

* A treatise on electric law, covering the law governing all electric corporations, uses and appliances, also all relative public and private rights. By Joseph A. Joyce and Howard C. Joyce. Bank's Law Publishing Company, New York, 1900. Pp. 1133; $6.50.

Double-Truck Cars*

How to Construct and Equip Them to Obtain Maximum Efficiency, with Minimum Cost of Maintenance

BY N. H. HEFT

To prepare a paper which would be of any value to the members of this association, it was necessary to learn the conditions governing the operation of double-truck cars on different systems. The conditions under which cars are operated vary to such an extent that it is impossible to construct and equip a car that can be operated with equal economy on each system.

To keep within the time allowed by the committee, and the more readily to convey to the members the writer's opinion as to the most desirable double-truck car, the subject matter will be taken up under the following divisions:

1. Trucks.
2. Electric Motors.
3. Double-Truck Car Body and Equipment.

TRUCKS

The double truck for use on street railways has not received the attention it merits. These trucks have been constructed along the lines of the single truck, and to meet the varied views of railway managements. One has only to observe the different styles of trucks now in use to find how at variance have been their views.

The fifty-five years' experience of the steam railroads in the development of the double truck now used by them should be a warrant to the street railway managements in adopting only trucks that conform to the lines used by these roads. The diameter of wheels, with the tread and depth of flange should be changed only where conditions prevent using the Master Car Builders' standard.

In Figs. 1, 2, 3 are shown a double-truck design, along steam railroad lines, to meet the varied condition of street railway service. In the design of this truck it has been the aim of the designer to include all known good features of the present street railway truck, and to add improvements of value. This truck is constructed with a minimum number of parts consistent with safety, strength, accessibility, lightness and cost of maintenance.

In giving a brief description of the truck shown, it will not be necessary to mention the wheels, further than to say that they are cast chilled, 33 ins. in diameter, with a 3-in. wheel tread, 1-in. flange, formed to fit the modern rail, shown in Fig. 1, weight 380 lbs.

The axles are of forged steel, high in carbon, with a 2-in. hole bored through the entire length. The key seat at gear wheel fit is cut above the line of motor bearings and journals, as shown in Fig. 1, in order not to weaken the axle.

The oil boxes are constructed so that the journal brasses may be readily removed, with dust guard placed in position, from the under side of box. An extra guard is placed from the same side, and where it will retain the oil at the highest point.

The journal brasses and boxes are finished in such a manner as to obtain the full journal bearing under all conditions.

The side frames are made from two ⅜-in. steel plates, thus allowing the main equalizer to be supported between the two frames on long spiral springs. With this arrangement the bar can be removed for repairs without in any way taking the truck apart. This form of frame allows the greatest accessibility to all parts, and the use of the extended equalizer bars, shown on Fig. 1, gives extended spring movement, with a perfect side movement on curves and at low places in the track, minimizing the blow to the car body, rail-joints and special work, and reducing the cost of maintenance of track and equipment. The side frame is so strongly constructed at points where the transom joins the frame that it is not necessary to continue the frame around the end to connect with the other side of frame to keep the truck in alignment. This also allows the placing of the truck near the end of the car body without coming in contact with the steps.

The brake is placed on the inside of wheel, without using a brake beam. This position insures the most positive action, with either hand or power, and independent braking on each wheel. The wheel base, 5 ft. 6 ins., allows the motors to be suspended between axles and transoms.

MOTORS

The writer, having had experience with heavy and light motors, mounted with two motors on one truck, the other truck being an idle or trail truck, as well as with one motor on each truck, has found that, while greater efficiency is shown with the latter method, the two motors mounted on one truck show a saving in labor, first cost of the trail truck, with less cost for maintenance.

Maximum efficiency, with minimum cost of maintenance, with both heavy and light motors, has been obtained by mounting two motors on each truck, making a four-motor equipment. With this form of equipment, higher speed and quicker acceleration are obtained with less power consumption, both in the average and total for the whole trip.

After an experience extending from the time that the first railway motor was constructed, the writer knows of no mechanical apparatus in which the development has been so rapid, and the point of perfection so nearly attained. Yet the future promises even greater development, both in the direct and alternating-current motors. With the great corps of engineers employed by our large manufacturing concerns, working with the men who are operating these motors, and constantly suggesting and demanding improvements, the ideal commercial car equipment will be developed.

The writer desires to call the attention of electrical and mechanical engineers to improving ventilation, increased copper, insulation, bearings, hollow armature shaft, decreased armature speed and gearless motors.

The controllers have not, as far as space and weight are concerned, kept pace with the motors. This part of the apparatus should receive the attention of the best talent of our manufacturing companies. The four-motor controllers, in their present form, are large, cumbersome affairs, placed in that portion of the car body which it is inconvenient and expensive to support. A more satisfactory controller can be produced by using a small pilot controller placed on the platform, with some developed form of main controller underneath the car body.

DOUBLE-TRUCK CARS AND EQUIPMENT

From information furnished by operating department and personal observation, the writer is led to believe the following dimensions the most desirable:

Length over all, 40 ft. to 50 ft.

Width over all, 7 ft. 6 ins. to 8 ft. 8 ins.

With the increasing demand from the traveling public for the extension of present systems to suburban districts, with a more frequent service and increased speed, also the construction of long interurban lines, the present managements, to meet this demand, are turning to the double-truck car constructed along the lines of the steam railroad coach.

In Figs. 1 to 5 will be found a double-truck car, which the writer believes will become justly popular. This car combines the largest number of good features, and is so constructed as to admit of placing the electrical equipment where it is accessible and less liable to come into contact with the truck or brake equipment.

The car body can be carried at the lowest point, and trucks placed near the end of body. This car gives the maximum efficiency, durability, speed, safety and seating capacity, attractiveness and ease and comfort to passengers, coupled with the minimum cost of construction and maintenance, and less dead weight per passenger, based on seating capacity.

The total weight is made up as follows:

Trucks, 3970 lbs. each.

Four motors, 2385 lbs. each.

Car body and equipment, 12,300 lbs.

Making a total weight of 29,780 lbs.

This amount, divided by sixty-three passengers, gives a dead weight of 473 lbs. per passenger. The cars of to-day show a dead weight, based on the seating capacity, of from 750 lbs. to 1100 lbs.

While the writer does not claim that the truck and car body described are perfect, yet he believes they are along lines that will become attractive to managers when taking up the cost of operation. Decreased cost of operation can only be obtained by purchasing equipments that are designed to perform a specific duty where all weights and speeds are known.

The Belfast (Ireland) Tramways Company has just completed very considerable extensions to its tramway system, and will from now on operate an increase of about 2000 car miles a day. About a year ago the corporation of the city made overtures to buy out the company, but satisfactory terms could not be arrived at, and the negotiations fell through. The company will not spend the money necessary to equip the system electrically, having only ten years in which to operate them, and as the corporation cannot arrange terms of purchase, it looks very much as if Belfast would be without electric traction for many years to come.

Dick, Kerr & Company have been awarded the contract by the Corporation of Durban, South Africa, for the complete equipment of its new electric tramway power station plant; all the generators, engines and other equipment of the plant will be of English manufacture.

* Paper read at the Kansas City convention of the American Street Railway Association, Oct. 18, 1900. The views accompanying this paper are not yet ready for publication by the author.

Elevated Railway Cars for Brooklyn

Elevated railway cars have developed in lines entirely different from those found on any steam, cable or electric surface roads. They are unlike steam cars in many particulars, though having a general resemblance to them. Though little like street railway cars in appearance, they have borrowed many of their important features. Lightness is an essential for cars which are to run on elevated structures, because the roadbed is in the nature of a bridge with a limited carrying capacity. For this reason the car framing must be designed with special reference to strength and the workmanship must be that of the street car rather than that usually employed in steam car shops.

The new cars purchased by the Brooklyn Heights road for the Brooklyn Rapid Transit elevated trains are examples of the latest development in elevated railway car operated by electricity. In Fig. 1 an exterior view of one of these cars is shown, and in Fig. 2 the interior. The latter is especially interesting from the fact that the seat arrangement is entirely novel.

These cars were designed and built by the J. G. Brill Company, of Philadelphia. They are 39 ft. 6 ins. long, and but 8 ft. 7 ins. wide. In this dimension the builders were controlled by the limits of the road, which is 8 ft. 9½ ins., the cars being in this case only 2½ ins. inside the clearance. The cars have platforms at each end 3 ft. 4 ins. long. These are arranged in a novel manner, with the view to giving the motorman a complete enclosure when necessary, and at the same time preventing him from the intrusion of passengers. A portion of each platform, at diagonally opposite corners of the car, is vestibuled, and is provided with a double door, giving access to the station platform. This door is cut horizontally in the center, the upper half swinging back against the end of the car and the lower part folding against the dasher. An inner door leads upon the platform of the car, and is hinged so as to swing in both directions. This arrangement gives the motorman a small cab to himself, its width extending from the car door to the side of the platform. The sash in the windows of the cabs are double, the upper portion dropping when desired. The other side of the platform has the usual elevated railroad gate and railing. The platforms themselves are 43½ ins. above the head of the rail. As they are level with those of the stations, steps are unnecessary. This is a characteristic feature of the elevated railway practice, and is caused by the rapidity with which passengers must enter and leave the cars. Passengers are supposed never to enter or leave elevated trains except at stations having proper platforms, hence a stirrup step is the only means for reaching the car from the track level.

FIG. 2.—INTERIOR OF BROOKLYN ELEVATED CAR

The hood in general appearance is of the regular steam car pattern. Its construction, however, follows street railway practice. It is built over a "form." In this there are material advantages. As the speeds are moderate and great strength is not needed, it is not necessary to carry the main framing of this roof into the hood. In case of minor accidents this effects a great saving, because the whole head may be destroyed without injuring the body of the car or making any repairs upon the framing. With the rails and plates projecting into the hood, as in steam car construction, a comparatively small amount of damage to the hood calls for the splicing of the top plate, and possibly the rails. This is a costly job, usually involving the letter-board panel with the inside finish of the car as well. The steam car construction is much more costly, as plates and rails have to be in these cars at least 8 ft. longer than would otherwise be necessary. The repair of the separate hood is a small matter, and its complete destruction does not necessarily involve any injury to the body.

The body of the car shows an interesting combination of steam and street car practice. As in street car work, there are no panels between the windows, but a sort of compromise is effected. The posts are made in halves and hollowed out to take a tie-rod down through the center. The halves are glued together, thus obtaining space for the steam car tie-rod without using a double post. The strength obtained is greater than that of the single post, but is not quite equal to that of the double posts, with the outside panel and the blocking. At the bottom of the window there is the usual heavy steam car rail gained upon the posts and tying the whole side together very effectively. Below this the straight steam car side is used, but modified so as to let the windows drop, as in street car practice. The usual truss plank edge, bolted and screwed to the posts, is reinforced by a flat truss screwed and gained upon posts and belts. The parts are all put together with white lead. Outside of all comes narrow matched sheathing put on vertically. The truss side thus formed is good, strong and ample for the service, the speed of which usually does not exceed 35 miles an hour at the highest.

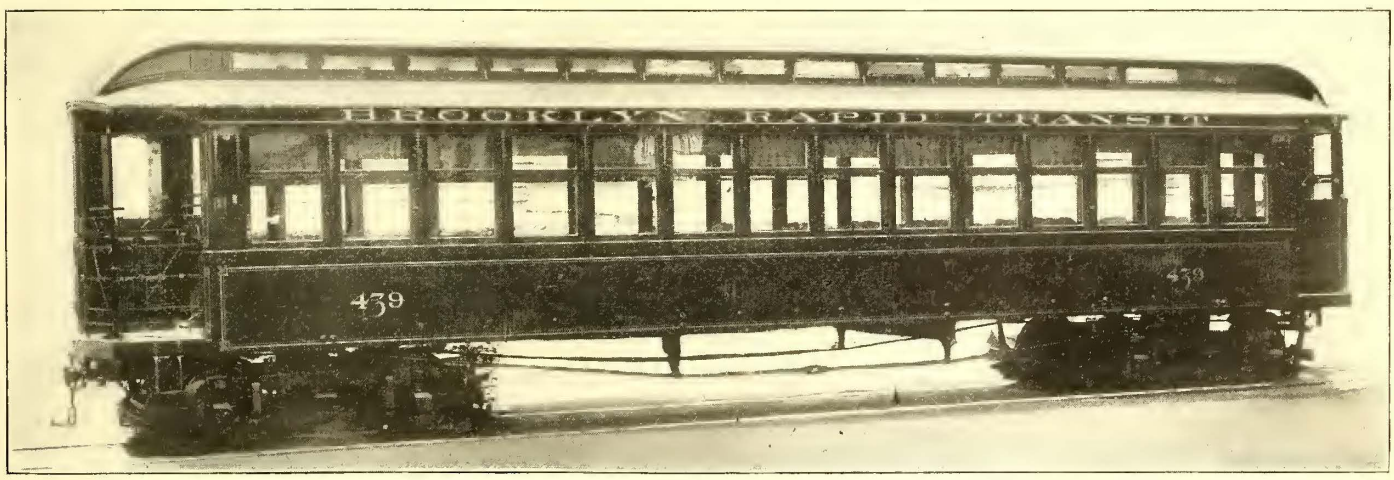


FIG. 1.—NEW MOTOR CAR FOR BROOKLYN ELEVATED RAILWAY

The roof itself is of the type that has become standard for both steam and electric cars. It has a monitor or raised deck, carried by the usual iron carlines, which are faced with wood.

The floor frame of these cars is unique, and does not resemble either steam or street car practice. There are four sills; two side sills and two in the center. These are nominally of wood, but are actually of the sandwich pattern, with an I-beam, instead

of a fish-plate, in each. They run straight from crown piece to crown piece of the platforms, passing directly through the end sills. This gives a very strong floor frame by itself, but still further strength is obtained from a pair of short intermediate sills of the same construction as the others, which, starting from the crown piece of each platform, run as far back as the bolsters. The bolsters are of plate iron, very heavy, and frames on the usual steam car lines, a lip at the ends coming down and turning under the side sills. The center sills pass through the bolsters. Under the side sills there are 1¼-in. truss-rods with 1⅜-in. ends. Upon these rods rest a pair of needle beams, supporting the car body in the usual manner. The I-beams, while giving the principal strength, are stiffened by the wood by which they are inclosed. The wood forms an effective means for connecting the posts and truss-plank with the floor. This construction gives a floor frame of enormous strength and rigidity. It is, in fact, quite as stiff and strong as the floor frames of ordinary parlor cars. These cars could be run in fast and heavy steam trains without the slightest danger, being quite up to the demands of that service. The weight of the body alone is 22,740 lbs., a weight below that of a steam car of the same seating capacity.

For the purpose of photographing these cars motor trucks were placed under each end, as will be seen from the engravings. In actual service, however, they are mounted in rather a peculiar fashion. At one end there is one of the Brill No. 27 trucks, carrying two G. E. 55 motors. The opposite end of the car is carried by a master car builders' standard swinging beam truck of the type used for passenger service.

Both motor and trail truck have a 6-ft. wheel base and M. C. B. standard 33-in. wheels. It is expected that the propelling power will be ample for any speed that may be desired upon the elevated road, and it is expected that with an adhesion due to half of the weight, they will be able to surmount any grade likely to be encountered. The No. 27 truck is beginning to be pretty well known among railway men, and it is hardly necessary to speak in detail in regard to it. The frames in this case are solid, and have the swinging links resting on top of the wheel pieces; these links carrying an extra set of springs, making three in all, instead of the two sets employed in the trail truck. These trucks have a rather severe service to perform, since the sharpest curve has only 65-ft. radius. Undoubtedly the motor end of these cars will have a considerably easier motion than the other.

The cars are fitted with a motor-driven air brake. The floors are double with deadening between. The sash are in two parts, the lower, as we have said, drops into the side, as on street cars. When down, a patented locking device covers the opening completely, so that the usual accumulation of dirt in such pockets is avoided. This device, with the arrangement of the sash, was invented by John A. Brill, and is likely to prove of much value from a sanitary point of view. The covering board is locked in place with a thumb nut, securing the parts perfectly, but making access to them easy. The windows are provided with curtains of the usual spring roller type.

The seating arrangements are novel. The seats themselves are cane-upholstered chairs, with stationary backs, see Fig. 2, which shows the interior of the car. These chairs are arranged in pairs, so that the one next the window is diagonally behind the one next the aisle. When it is desired to reverse them they are released by a catch, and are then free to swing horizontally about a central pivot until both have made a half revolution and face in the opposite direction. These seats have not been in use a sufficient length of time to demonstrate their usefulness, but it would seem that they give a very satisfactory solution of the seating problem, since each person is given a seat by himself. At each end of the car at the doors there are the usual stationary seats, placed longitudinally. There are fifty-two of the chairs, giving the car with the longitudinal seats a total seating capacity for sixty persons.

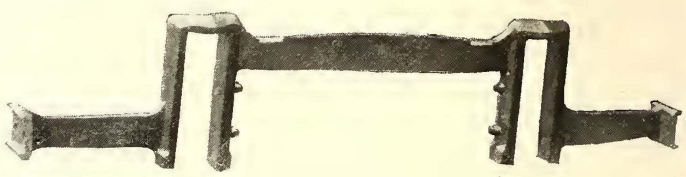
Comparing these cars with a steam railroad coach of a similar capacity, the weight is quite low, being but 38,560 lbs. without the motors. The latter will, of course, add considerably to the total, but as they are the propelling power, which is distributed to the individual cars, and as on the steam road the propelling power is concentrated in the locomotive, it is manifestly but fair to compare the weights without the motor with that of the steam car. In this case the elevated car certainly is lighter by at least 20,000 lbs.

The Liverpool Overhead Railway has recently completed the extension of its system involved in the construction of a tramway at the end of its existing lines to Waterloo and Seaforth. The rolling stock was supplied by Dick, Kerr & Company, and consists of top-seat cars of the standard Preston type similar to those used on the Liverpool Corporation Tramways, and illustrated in a past issue.

Wrought Iron Truck Frame

The accompanying engraving was made from a photograph of a new solid-forged wrought-iron truck side of one piece, made by the J. G. Brill Company for their No. 27 G truck. Heretofore complex truck sides of this pattern have been of steel. For a long time there has been a desire both on the part of the manufacturer and among street railway men to obtain solid forgings in the place of steel. It is generally recognized that forgings for all ordinary sizes are considerably superior in resistance to steel. They can be made lighter and much more shapely. The great expense of forgings, however, has in most cases prevented their use for such complex work as the No. 27 G side. By the most complexed system organized in the hammer department, the Brill company has at last succeeded in producing a truck side of wrought iron at a price closely approaching steel. The engraving represents one of the first of these forgings.

It will be noticed that the truck ends are dropped down very



WROUGHT IRON SIDE FRAME

low upon the jaws; this is for the purpose of enabling the truck to radiate under open cars and to bring the truck side so low as to clear the steps. The forgings are very smooth, and have repeatedly been mistaken for castings on account of their accuracy and the absence of hammer marks. Each jaw is fitted with a gib or wearing piece. This enables the jaws to be renewed to their original size with little difficulty and expense. Just inside of the jaw on the main bar are seen the seats for the links; these come so near to the center line of the jaws that the weight of the body is carried but a very short distance through the frame, practically less than 12 ins. The strains therefore in this important member of the truck frame are reduced to a minimum.

Considered as a piece of blacksmith work this forging is quite remarkable, and will command attention wherever it is seen by experts in the handling of wrought iron. The fact that so complicated a piece of work can be produced at anywhere near the price of steel makes it even more worthy of notice.

Street Railway Encyclopedia

The Mayer & Englund Company, of Philadelphia, is now compiling an elaborate catalogue of practically all the supplies which are used on steam and electric railways at present. The high standing and long experience of the members of this company in the electric railway business insure the accuracy and completeness of a catalogue of this kind. They state that it will be far ahead of anything which has ever been attempted in the line before. The book will contain, as at present laid out, some 544 pages. It will be printed on heavy enameled paper, and will be handsomely bound in silk cloth, making it an ornament as well as a most valuable feature in the library or desk of any railway manager. The extent and labor required in compiling a work of this kind can be appreciated only by those who have undertaken the same character of work. When to this is added the task of making a specialty of typographical appearance, the labor is more than doubled. Nevertheless, the Mayer & Englund Company promises to have the finished catalogue out by Jan. 1, 1901. In spite of the expense of compiling and publishing this book, the company intends to present copies to every manager, superintendent and purchasing agent in the world who is interested in getting the best materials. It is suggested, however, that applications should be made for it early, as the number of copies to be presented must necessarily be somewhat limited, and if there is any delay in making application, there is a possibility of belated requests not being filled.

Illumination from Arc Electric Headlights

The increasing use of arc electric headlights, particularly for high-speed suburban and interurban electric railways, indicates that many roads consider their employment a valuable adjunct in preventing accidents. An excellent idea of the degree of illumina-

tion produced by one of these headlights is afforded by the accompanying illustration. This engraving is from a photograph taken from the front platform of one of the cars of the New Jersey & Hudson River Railway & Ferry Company, as it was crossing one

VIEW TAKEN WITH ARC HEADLIGHT

of the many trestles on the Hackensack division of that line. The light is thrown a very long distance ahead, and by its means the motorman can easily distinguish any obstacle which may be on the track.

A New Contact Spring for Trolley Harps

The illustration herewith shows a new electrical contact spring for trolley harps, patent upon which has recently been granted to C. S. McMahan, of Chicago. The invention comprises a spring of conducting material pivoted centrally on the pin of the harp, and adapted to press against the inner side of the harp arm. The device has three or more curved radial arms which bear against the trolley wheel near its periphery, at points equally spaced about the wheel. The usual washer is inserted between the spring and the harp arm. The ends of the spring arms

CONTACT SPRING FOR TROLLEY HARP

remain fixed at given points on the periphery of the wheel and revolve with it; the friction due to the rotation of the wheel and spring occurs between the spring and the washer, which is inserted between the spring and the harp arm.

To replace a spring a rod is used which is of the same diameter as the harp pin, the rod gradually tapering to a point. Springs, washers and wheel are first placed approximately in position between the harp arms and the pointed tapering rod passed through to bring all parts to a common center, when the harp pin can be put in place without obstruction.

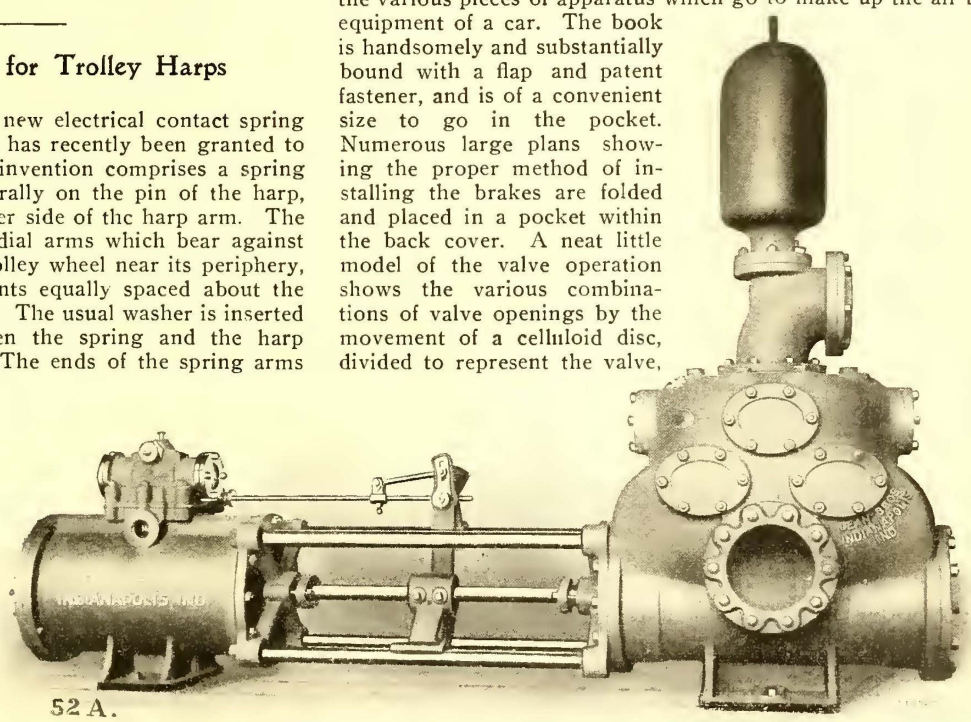
The spring is applicable to any of the existing forms of trolley harps. The chief advantages claimed for the device are: it requires no riveting to the harp; it can be replaced in a moment without the necessity of removing the harp from the trolley pole; it will prevent wobbling of the trolley wheel; it will wear longer than the old form, and, with its three or more points of connection with the trolley wheel, largely increases the contact surface between the wheel and pole, a feature which is especially desirable on large cars using heavy current.

A New Water Supply Pump

This pump is a new pattern, designed especially for water supply or for use in places where the pressure or head against which pump must work is heavy. The steam cylinder is of Dean Brothers usual type, with the noiseless valve gear and adjustable stroke. The stretcher rods connecting the cylinders are of polished steel. The piston rod is of bronze, and the cylinder bronze lined. The pump cylinder is a one-piece casting, with hand-holes of liberal size. The suction openings are on both sides of the cylinder, and the discharge opening may be turned in any direction. The pump may be used for fire protection or any purpose where water under pressure is required, and is manufactured by Dean Brothers' Steam Pump Works, Indianapolis, Ind.

Air Brake Instruction Book

The Christensen Engineering Company, Milwaukee, Wis., realizes that it is of the utmost importance to have the employees of railroads using its air brakes thoroughly understand their operation and care. With this object in view the company has followed the practice, found successful by other large manufacturers, of publishing manuals, showing how to take care of its apparatus. The latest hand book of this kind published by the company is ready for distribution. It contains some seventy pages, describing in great detail the construction and correct management of the various pieces of apparatus which go to make up the air brake equipment of a car. The book is handsomely and substantially bound with a flap and patent fastener, and is of a convenient size to go in the pocket. Numerous large plans showing the proper method of installing the brakes are folded and placed in a pocket within the back cover. A neat little model of the valve operation shows the various combinations of valve openings by the movement of a celluloid disc, divided to represent the valve, over a printed card, showing the inlet and exhaust openings, etc. The illustrations, with which the book is filled, show views of the brakes and parts, as well as many sectional drawings. It would be very advisable for every user of these brakes to have one of these handy volumes; indeed it seems hardly possible for any one to secure the best results unless he has one.



WATER SUPPLY PUMP

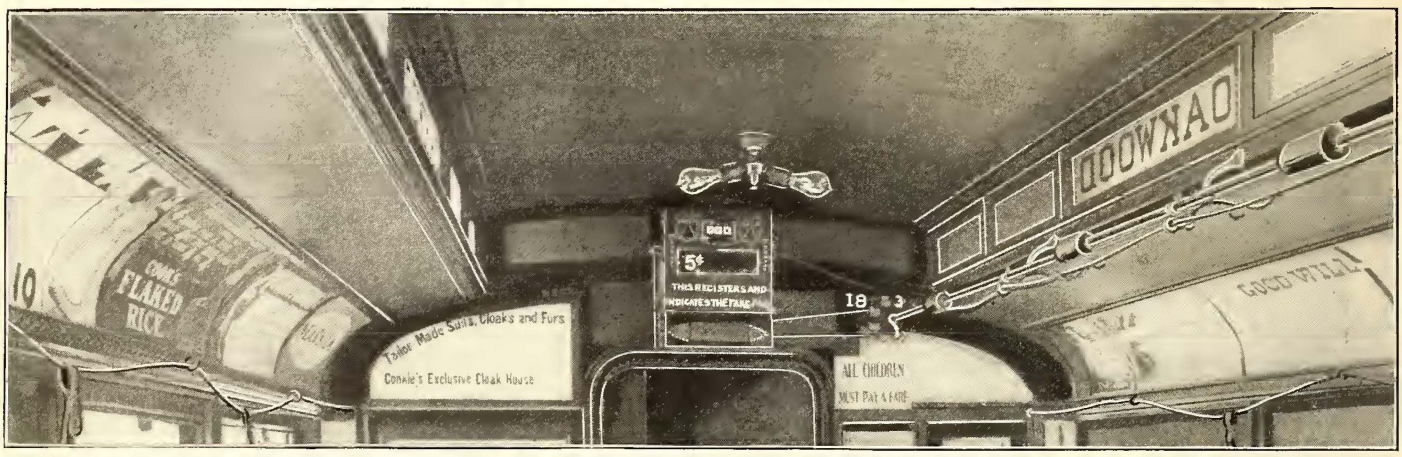
An Improvement in Fare Registers

There is no branch of the management of street railways more important than that which deals with the revenue. This question is a source of constant discussion, and a great amount of time and thought have been devoted to it, but in all the systems so far presented numerous ineffective features are constantly developing. It is an unfortunate thing that humanity is not strong enough to resist the temptations which beset it, but the fact is pretty well recognized that a few loose nickels are liable to become separated from their fellows before reaching the cashier's desk, unless some infallible method of checking is employed. Any system which does not prevent "knocking down" of fares is as objectionable to the honest conductor as to the management, for it not only puts a premium upon dishonesty, but places all the employees under constant suspicion.

The Ohmer Register Company, Dayton, Ohio, is placing on the market a fare register which contains many of the properties of an ideal checking system. At the same time it does its own record making, and is easily operated. The illustrations on this page show the appearance of the instrument and the form of record which it makes. These registers are made for any kind of fare or transfer, and keep a separate record and indication of each. The rod and cord running the length of the car, which are shown in the larger engraving, and which are within easy reach of the conductor's hand, although unlikely to be tampered with, either mischievously or accidentally, by passengers, take the place of the familiar pull straps in ordinary use. The fare is rung up by a pull on the cord, and the kind of fare which has been collected is regulated by revolving the rod in its supporting brackets. The enlarged portions of the rod give sufficient leverage to make the turning of the rod an easy matter. The kind of fare indicated is determined by the position of the rod, the register showing in plain figures the amount previously rung up. Dials in different parts of the car show the conductor the position of the register rod, and enable him to change it accurately and quickly.

There is no totalizer on the register, as it keeps its own record, and does not require that the figures be copied. The indicator at the top shows the number of passengers of all kinds which have been carried on the trip, and is a great help to inspectors or spotters. If the conductor fails to pull the register hard enough, or if he pretends to register and does not complete the operation, a flag rises in front of the indicating figures and shows "Not Registered." One of the cuts shows a sample report which was taken from a register, indicating six varieties of fares. As given, it is about one-third actual size. These records are removed from the register and turned in to the cashier with the conductor's money. They form the only report of fares necessary, and make a conductor's notebook unnecessary. The column on the left shows the number of the trip and the the figures in the other columns the condition of the register at the beginning of that trip. The conductor's report and relief card shows by punch marks the conductor who had a given car, and the time and by whom he was relieved. All that a conductor does, therefore, daily in the way of bookkeeping is to make three or four punches on these cards. It is impossible, therefore, to change the records, even though collusion exists between the cashier and the conductor.

Various other advantages are claimed for this register, a few of which follow in a brief general summary of those already referred to: It registers and keeps a separate account of each fare. It indicates at the time of registration the rate of fares, and this indication is the visible receipt to the passenger for the fare paid, and having given this receipt no doubt or suspicion can form or remain with the passenger as to the integrity of the conductor. It keeps a total record of all fares paid by passengers. It eliminates all bookkeeping by the conductor, and thereby lightens his labors.



GENERAL VIEW OF REGISTER, ROD AND CORD

ROCHESTER & SUBURBAN R. R. CO.
Conductor's Report.

Car No. 7 Register No. A137
Date Oct 6 1900
Conductor G Smith Badge No. 26
Motorman C Taylor Badge No. 17
Time out 7 A M. Time in 1 P M.
No. Hours 6
First trip to City or Lake

The Ohmer Car Register Co. System. Pat. Oct. 2, 1900

Con.	Trip	Rel'f		Con.	Trip	Rel'f
X	1				16	
	2				17	
	3				18	
	4				19	
	5				20	
X	6	●			21	
	7				22	
	8				23	
	9				24	
	10				25	
	11				26	
	12				27	
	13				28	
	14				29	
	15				30	

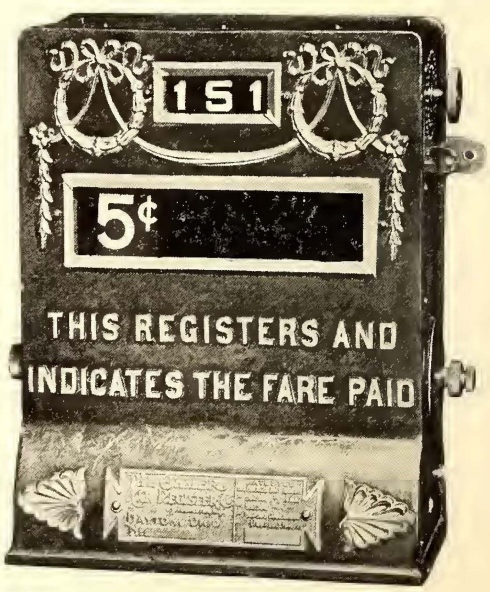
NOTE. The trip numbers are indicated by the register. Each conductor will punch the trip number to indicate his time of entering and leaving the car. This card must be returned with the collections from each car.
Note remarks, if any, on opposite side of card.

CONDUCTOR'S SLIP

	5 Cent	Tickets	Transfer	15 Cent	10 Cent	3 Cent	
11	2578	1672	1975	1751	2520	3204	OCT 8
11	2578	1672	1975	1751	2520	3204	OCT 8
10	2539	1651	1948	1725	2507	3178	OCT 6
9	2497	1627	1932	1710	2495	3172	OCT 6
8	2462	1589	1903	1687	2486	3164	OCT 8
7	2440	1572	1887	1674	2475	3156	OCT 6
6	2412	1550	1874	1671	2464	3149	OCT 6
5	2404	1543	1868	1666	2461	3147	OCT 6
4	2374	1513	1853	1656	2453	3142	OCT 6
3	2354	1498	1841	1650	2447	3136	OCT 6
2	2334	1478	1831	1640	2442	3131	OCT 6
1	2309	1453	1816	1625	2432	3121	OCT 6
	2309	1453	1816	1625	2432	3121	OCT 8
	269	219	159	126	88	83	
	5			.15	.10	.3	
				630	8.80	2.49	
				126			
				18.90			

$13.45 - 5¢
18.90 - 15¢
8.80 - 10¢
2.49 - 3¢
$43.67

REPRODUCTION OF PRINTED RECORD



FRONT VIEW OF REGISTER

It takes from the conductor the knowledge of the fares registered in their individual classification, and at the same time provides a way by which receipts may be given from one conductor to another, absolutely checking up the work of each as a whole, and at the same time fixing responsibility of each for the separate classifications of fares collected, the access to which record is given to the office management only. It provides a concise and accurate system for keeping in detail form the fares collected by the conductors, whereby any discrepancies or irregularities in the fares accounted for by the conductors are easily ascertained. It keeps a concise record of the efficiency of the service. The printed report taken from the register each day exhibits by the trip, and for any number of trips combined, all the fares in separate classifications which have been registered.

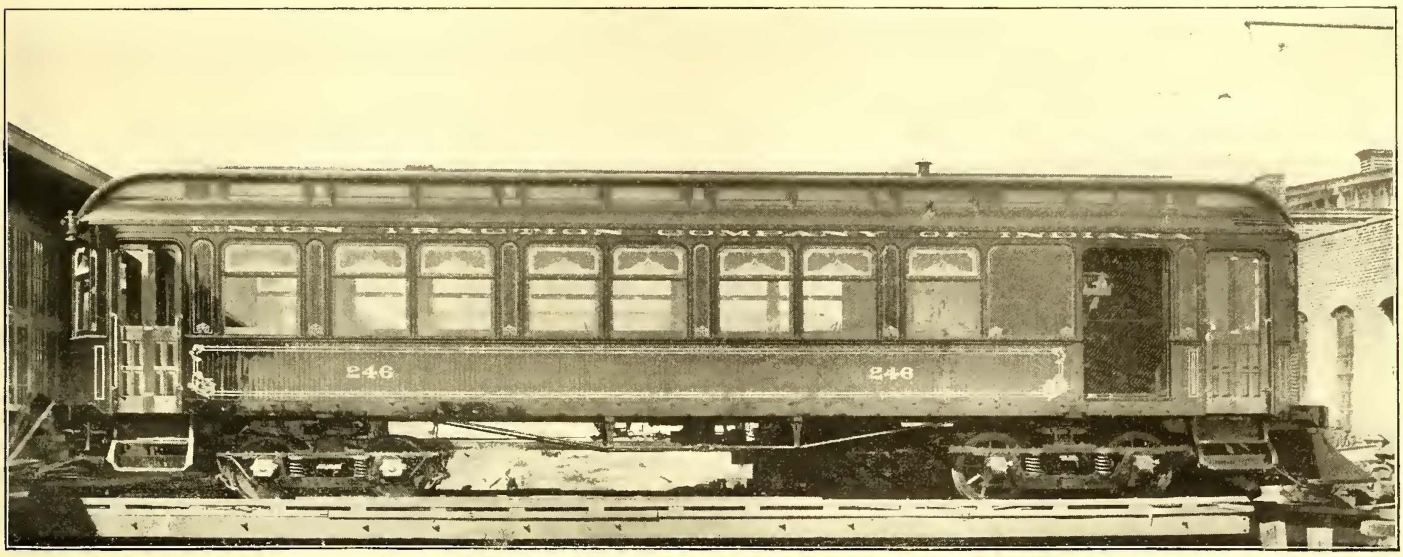
It relieves the office of a large amount of labor.

Large Cars for Anderson, Indiana

The St. Louis Car Company, St. Louis, Mo., has built twenty closed motor cars for the Union Traction Company, of Indiana, at Anderson, Ind. The length of the car body is 40 ft. Total length over bumpers, 52 ft. 5 ins., height of car from bottom of sill to top of roof, 9 ft. 6 ins. The style is similar in design to a standard railway coach, arranged with a passenger and baggage compartment. The former has eleven seats on each side of the aisle, nine reversible and two stationary end seats, with toilet room, water cooler and heater. The baggage compartment is 8 ft. long, arranged in one end of the car, with a partition and sliding door between the baggage and passenger compartments. The bottom construction is made extra heavy, with built-up steel bolsters, arranged to fit the Baldwin trucks used, and is modern and up to date in every particular. The vestibule has three drop sashes in the end. The car being intended to always run in one direction, the front vestibule is partitioned off between the step entrance and the motorman's compartment, thus permitting the motorman to remain unmolested.

The interior finish of the car is of cherry, the seats are St. Louis Car Company's walk-over type covered with plush, the headlinings are three-ply bird's-eye maple veneer, neatly ornamented. The car has one No. 8 Baker hot-water heater, equipped with the necessary piping, etc. The floors are covered with cocoa mats and Pantasote curtains are placed at the polished plate glass windows. Each car is equipped with eight brass bundle racks 24 ins. long and about 9 ins. wide, all the trimmings being solid bronze, highly polished.

The baggage compartment is arranged with folding seats, so that if at any time it is necessary it can be utilized for passengers. The baggage compartment is also equipped with a small cupboard, furnished with glass doors, containing the necessary tools for wrecking purposes of the same type as is ordinarily put in steam coaches. The baggage compartment is finished on the interior with upright wainscoting, made of ash, and finished in natural color, and is equipped with two side doors, one a solid panel door and the other a wire guard door for use in the summer time. The car is also furnished with wire screens on one side only, which are fastened with brackets so they can be easily removed. The cars are also provided with one signal bell placed in the center of motorman's cab, with bell cord suspended from center dome of ceiling on straps with bronze castings, as usually arranged in steam coaches. A 14-in. alarm gong is placed under the front vestibule. This end of the car is equipped with cow catcher, track scraper and Van Dorn couplers. Christensen air brakes, St. Louis Car Company's patent bevel ratchet brake wheel, and Wagenhals arc headlights are installed on the cars. Their general appearance is shown in the accompanying engraving.



LONG DOUBLE-TRUCK CAR FOR ANDERSON

Electric Heaters for Elevated Cars

The cars of the new electric train on the Manhattan Elevated Railway are equipped with the most improved type of Gold's standard electric heaters. The accompanying illustration shows one of these electric heaters, the construction of which is very simple.

The resistance coils are first wound on an open pitch, and supported on the familiar enameled crimped rod which has been used with such great success by the Gold Car Heating Company. These rods hold the heating coils firmly in place, and at the same time permit of a very free circulation of air through and round all parts of the heater. Three intensities of heat may be had.

The regulating switch is so arranged as to throw one-third of every heater in the car in circuit on its first point, two-thirds of every heater in the car on its second point, and the full capacity of all of the heaters on the third, or maximum, point. An even distribution of heat is maintained at all times in this way. The temperature of the car is thus uniform, and an agreeable heat is always supplied. The heater itself is compact, while the resistance wire is absolutely non-corrosive. As a matter of fact, although 60,000 of the Gold electric heaters have been put on the market within the last six years, not one single heater has failed to render entire satisfaction in every way. The heaters make a very handsome appearance in the cars.

HEATER FOR ELEVATED CARS

Subway Scheme for Chicago

It is announced that a syndicate of Chicago and Eastern capitalists have perfected arrangements for organizing a company with a capital stock of $50,000,000 to construct a subway to relieve the present traffic congestion. Gabriel J. Norden, of Chicago, repreсents the syndicate, but he will not divulge the names of those who are interested in the project. Engineers are now at work on the plans for the proposed road, and, as soon as they have completed their labors, application will be made to the City Council for a franchise. It is announced that the company will accept nothing but a fifty-year franchise grant.

CURRENT NEWS

Chicago's Mayor Petitioned to Adjust Tunnel Differences

Mayor Harrison has been formally petitioned by the executive committee of the Chicago River Improvement Association to confer with the officers of the Union Traction Company in regard to the terms of franchise extension ordinances, with a view to securing the lowering of the tunnels this winter. In a memorial signed by the members of the committee the attention of the Mayor is pointedly called to the fact that the city is in imminent danger of losing the bulk of its river commerce, and he was urgently requested to take steps to avert the threatened calamity. It was pointed out to Mayor Harrison that in the present bankrupt condition of the city the only apparent means of securing the lowering of the tunnels without delay is by reaching an equitable agreement with the Union Traction Company, whereby that corporation will furnish the necessary money and do the work.

To Restrain the Watering of Tramway Lines

An English contemporary states that an effort is to be made under the auspices of the National Cyclists' Union to restrain and test the rights of tramway companies to cleanse their lines by means of the use of water. Several members of the National Cyclists' Union are said to have been injured because of the excessive wetting of the streets by tramway companies, and the cycling organization urges that it is an offense under the "Highway Act" to place anything on the highway which endangers life or interrupts traffic. In many instances, however, franchise grants stipulate that the companies shall keep the highways on which they operate and their tracks in a clean condition, and it is difficult to see how this can be done without the liberal use of water. The companies do not entertain any fears of the contemplated action, but believe that, if suit is brought, it will result in a severe reprimand for those reckless riders who continuously endanger their fellow wheelmen and pedestrians alike. It is hardly possible for one exercising the proper amount of care to meet with serious mishap because of the excessive watering of a street by a tram company.

The Atlanta Controversy Settled

The Atlanta Rapid Transit Company and the Atlanta Railway & Power Company have entered into an agreement by which the long drawn out fight between the two companies and their various interests is brought to a satisfactory close. The actual fight began about two years ago, when H. M. Atkinson asked the City Council for grants in behalf of the Atlanta Rapid Transit Company along certain unoccupied streets and the right to condemn certain stated lengths of tracks belonging to the Atlanta Railway & Power Company. These grants were strenuously and bitterly opposed by the latter company. Fully three months were consumed in arguments before Councilmanic committees having the matter in charge. Finally, by a close vote, Mr. Atkinson and his associates were granted the franchises they had asked for. This was but the preliminary skirmish to the fight that at once began and which has continued without cessation up to the present time. Injunction suits were filed by both parties. The city, State and Federal courts were appealed to, and at length the United States Court of Appeals in New Orleans. While these suits were in progress a board of arbitrators named $12,000 as the price to be paid by the Transit Company for the right to use the tracks of the Atlanta Railway & Power Company on Peachtree and other streets, which had been condemned. The Rapid Transit Company objected to this price and another suit was begun. According to the agreement entered into by both parties, all litigation is to cease. The Atlanta Railway & Power Company agrees to withdraw all its injunction suits now pending against the city of Atlanta. In turn the Atlanta Rapid Transit Company has agreed to pay the Atlanta Railway & Power Company $12,000 for the use of its tracks. In addition the company agrees to cease opposition to the effort of the Atlanta Railway & Power Company and its interests to secure an electric light franchise from the City Council.

Trial Train on the Manhattan Elevated

On November 22 the first official trial trip of an electric train was run on the Manhattan Elevated Railway. A start was made at 10 o'clock from the Sixty-Seventh Street switch yards, and a party of invited guests was taken up the Second Avenue line for about 1½ miles. Several trips were made during the morning, and the train was returned to the yards about 12:30 p. m. Among those on the train were the officers and engineers of the Manhattan Railway Company, Messrs. Vreeland, Starrett and Pearson, of the Metropolitan Street Railway Company; C. L. Rossiter, of the Brooklyn Heights Railroad Company; W. E. Potter, of the General Electric Company; E. E. Gold, W. T. Van Dorn, etc.

The train consisted of six cars, of which the two end cars were motor cars. It was heated throughout with Gold heaters, eighteen to a car, and Van Dorn couplers were used. The motors, of which there were eight to the train, were made by the General Electric Company, and were of 150-hp each. An L 13 controller was used. W. E. Baker, electrical engineer of the company, received many congratulations on the successful operation of the train.

Chicago Traction Suit

Allegations of wrongful use of large amounts of funds of the Chicago Union Traction Company by Charles T. Yerkes and other former officers of the North Chicago Street Railroad Company and the West Chicago Street Railroad Company are contained in an intervening petition filed, Nov. 23, in the original suit brought by Sutro Brothers, of New York, against the Consolidated Traction Company and the Chicago Union Traction Company. The petition is filed in the names of Edwin M. Post and David Christie, shareholders in the Union Traction Company. The validity is questioned of the agreement made in April, 1900, by which the Chicago Consolidated Traction Company secured the right to use the downtown lines controlled by the Union Traction Company in exchange for $6,750,000 of its bonds, which were to be placed with the Equitable Trust Company, to be given in exchange for shares of the capital stock of the Consolidated Company. The bonds were to be guaranteed by the Union Traction Company. The agreement is alleged to be the result of a secret understanding in the petition. "Intervenors charge the actual financial result of said secret understanding and scheme was that Yerkes and his associates in the Consolidated Company fraudulently, illegally and without any real consideration, obtained a gratuitous use of a large amount of valuable property rights of the Union Traction Company—over $400,000 of its cash and several millions of dollars of its personal interest-bearing obligations."

PERSONAL MENTION

MR. JOHN FLINT has resigned as treasurer and superintendent of the Webster & Dudley Street Railway Company, of Webster, Mass. J. Boles Porter has been elected his successor.

MR. A. D. CLAFLIN, president of the Commonwealth Avenue Street Railway Company, of Boston, Mass., has recently been elected president of the Newton & Boston Street Railway, H. B. Parker having resigned.

MR. HARK H. THOMAS has resigned as general manager of the St. Thomas Street Railway Company, of St. Thomas, Ont., to become connected with the J. H. Still Manufacturing Company, of St. Thomas.

MR. H. F. J. PORTER, of the headquarters staff of the Bethlehem Steel Company, has recently presented two papers before the Brooklyn Institute of Arts and Sciences. The lectures were given under the auspices of the department of chemistry, and treated upon the development and modern methods of forging steel. They were profusely illustrated with excellent lantern slides, and included a most interesting description of the Bethlehem steel works.

MR. EUGENE CHAMBERLAIN has been connected with the Brooklyn Rapid Transit Company, Brooklyn, N. Y., for a little over a year, having accepted his present position of superin-

tendent of equipment in October, 1899. Until that time he had had no practical experience in street railway operation. Beginning his engineering work in the humble position of a mechanic in the West Albany shops of the New York Central & Hudson River Railroad, he forced his way to that of assistant superintendent before leaving the shops to become master car builder of the Western division, Syracuse & Niagara Falls, and leased lines. He resigned from this position after having held it for eight years, in order to join the B. R. T., and has already not only completely reorganized the repair shops of that company from a mechanical point of view, but has introduced changes in the accounting and bookkeeping systems which have greatly simplified and improved them. During his connection with the New York Central, Mr. Chamberlain took an active interest in the affairs of the Master Mechanics' and Master Car Builders' Associations, having been on the executive committee of the latter for four years. Mr. Chamberlain's work in Brooklyn is another striking example of the value of steam railroad experience in the operation of street railways.

ENGINEERING SOCIETIES

FRANKLIN INSTITUTE.—A stated meeting of the committee on science and arts of the institute will be held Dec. 5.

ENGINEERS' CLUB OF COLUMBUS.—A regular meeting of this club will be held Dec. 1. Col. James Kilbourne will present a paper entitled "Management of Factory Employees."

THE ASSOCIATION formed by the high-speed engine builders of the country will hold its annual meeting in New York City at Sherry's, Dec. 4. The session promises to be unusually interesting, as papers will be read on "The Relation Between the Engine and Generator" by representatives of the General Electric Company and the Westinghouse Company, from the standpoints of lighting and power. Mr. Armstrong, who has given much attention to steam engine tests, will read a paper on "The Economy of the High-Speed Engine." Builders of high-speed engines will be welcome at this session, whether members of the association or not.

New Publications

Street Pavements and Paving Materials. By George W. Tillson. Published by John Wiley & Sons, New York. 544 pages. Illustrated. Price, $4.

The author has succeeded in treating his subject in a most thorough and comprehensive manner. The book is up to date in every feature, modern methods crowding out antiquated practice in every chapter, although many interesting examples of historical pavements continually keep the student in touch with happy comparisons illustrating the growth of the art of road making. The author has, in fact, taken particular pains to make the opening chapter of the treatise an accurate account of the development of pavements dating back to the days of the ancients. Through the co-operation of consular agents and municipal officials many important data have been collected, and the numerous specifications which have been furnished regarding the construction of standard roadways from all over the world increase greatly the value of this feature. The first few chapters treat of the various materials in more or less of an abstract manner, the separate varieties of any class of material being described and compared before taking up the actual operation of combining them in the completed pavement. A special chapter is devoted to the drawing up of plans and specifications, giving numerous hints as to the best methods of avoiding irregularities and misunderstandings, a large portion of which is as applicable to all engineering undertakings as it is to the particular branch under discussion. More than half of the illustrations in the book are found in a chapter on "The Construction of Street Car Tracks in Paved Streets and Roadways," which points out in detail the relative advantage and disadvantages of the various rails in use and the methods of laying them. On the whole, the volume presents a clear and complete exposition of the subject to the student, and furnishes to engineers an almost encyclopedic book of reference with regard to roads and pavements.

Municipal Improvements. By W. F. Goodhue. Published by John Wiley & Sons, New York. Third Edition. Enlarged. 215 pages. Illustrated. Price, $1.75.

This little book has now reached its third edition. While its aim is not to make thorough engineers of those into whose hands it comes, it has undoubtedly proved of great usefulness in pointing out the numerous difficulties which beset the managers of municipal affairs, and in bringing before them the importance of the problems which it is incumbent upon them to solve. It would hardly be possible for an honest municipal officer without engineering training to read a book which shows in as clear a manner as this one the responsibilities of his position, without becoming impressed with the necessity of weighing carefully his decisions affecting the building or changing of the city works under his control, and selecting with discrimination his technical advisers. Although intended primarily for this class of readers, and written in a manner easily intelligible to them, there is much in the volume which the consulting and municipal engineer will find of advantage. Three new chapters have been added, among them a timely warning against the evils of mismanaged municipal ownerships.

NEWS NOTES

WASHINGTON, D. C.—The Washington Traction & Electric Company recently awarded the St. Louis Car Company a contract for fifty new cars of similar design to those used on the Third Avenue Railroad Company, of New York, and which were described in the STREET RAILWAY JOURNAL. The first instalment of ten cars has begun to arrive, and one of the cars was run over the F Street line Nov. 17. The seating capacity of the cars is forty persons, and the seats are placed crosswise, with an aisle in the center. The new cars are fitted with vestibules, and this is the one feature in which they differ from the New York cars.

BRUNSWICK, GA.—The Council of this place has recently granted a franchise for the construction of an electric railway here.

CHICAGO, ILL.—A car of the Metropolitan Elevated Railroad caught fire a few days ago and was badly damaged. Several men who were on the car made their escape and sought the safety of the street with the aid of ladders. Others journeyed along the foot path to the nearest station.

JOLIET, ILL.—The Joliet Railroad Company has contracted with the Economy Power Company, of this city, to furnish the power for operating its lines in Joliet and Lockport, and for the new line to Chicago.

INDIANAPOLIS, IND.—The City Council has recommended that changes be made in the franchise granted to the interurban lines entering the city, so as to permit the charge of a straight 5-cent fare to city passengers and the issuance of transfers to the local company; also to provide for a tax of 2 cents a round trip for each line.

ELLWOOD, IND.—Henry F. Stillwell, of this city, is at the head of a newly organized company to construct an electric railway from this city to Indianapolis, extending through Tipton.

INDIANAPOLIS, IND.—The County Commissioners have granted Nathan Morris and George C. Webster a franchise for the construction of an electric railway from this city to the west county line. The promoters have already been granted a franchise for a line through Hendricks County.

DETROIT, MICH.—The Detroit Citizens' Street Railway Company has made application to the Council for a renewal of its franchise on Guion Street.

ST. LOUIS, MO.—The City Council of St. Charles has granted the St. Louis, St. Charles & Western Railroad Company a franchise to operate an electric railway in St. Charles. The franchise is to run fifty years, and the road must be completed by July 1, 1902. During the life of the franchise the company must pay to the city, in addition to ordinary taxes, a total of $18,000.

ST. JOSEPH, MO.—J. P. Gibson, of Philadelphia, has become interested in a plan to construct an electric railway between Kansas City and St. Joseph.

ST. LOUIS, MO.—Solomon Boehm and others have made application for a franchise for an electric railway over the Gruvor's road from the western limits of the city to Mt. Sinai Cemetery. The distance is less than a mile. Negotiations are pending with the St. Louis Transit Company for extending its California branch over the proposed route. The right to operate express and funeral cars is asked.

ST. LOUIS, MO.—A car of the St. Louis Transit Company took fire a few days ago and was completely consumed before the fire apparatus arrived on the scene. The passengers all escaped from the car without injury.

WORCESTER, MASS.—President Dewey, of the Worcester Consolidated Street Railway Company, was fined $25, Nov. 19, on complaint that the cars have not been heated to the temperature required by law. The case has been appealed to the Superior Court.

HOLBROOK, MASS.—The Selectmen have granted the Weymouth & Holbrook Street Railway Company a franchise for the construction of its proposed lines through this place.

FOXBORO, MASS.—The Norfolk-Bristol Street Railway Company has made application to the Legislature for articles of incorporation. The company proposes to operate in Foxboro, Mansfield, Sharon, North Attleboro and Attleboro.

AMESBURY, MASS.—The Exeter, Hampton & Amesbury Street Railway Company has made application to the Selectmen of Amesbury for a franchise for the extension of its present lines to the Newton (N. H.) line, where they will connect with the proposed tracks of the Haverhill & Newton Electric Railway, which was recently incorporated at Concord.

WARE, MASS.—The Hampshire & Worcester Street Railway Company has elected directors as follows: H. N. Bates, John A. Perry, of Brookline; James F. Hill, of Warren; S. A. Clark, of North Brookfield; E. E. Beeman, of West Brookfield, and Henry M. Clark, of Ware. At a meeting recently

held it was voted to levy a 10 per cent assessment on the capital stock. The company has accepted all the franchises through the different towns between North Brookfield and Gilbertville, and the road is expected to be in operation by July 1, 1901.

WORCESTER, MASS.—The preliminary organization of the new Worcester & Holden Street Railway Company has been completed. The company proposes to build an electric railway from Chadwick Square in Worcester to Jefferson, with a branch line from Grove Street through Forrest Street to Salisbury, thus connecting with the lines of the Worcester Consolidated Street Railway Company, both at Salisbury and West Boylston Streets. The directors of the company are: Stephen Salisbury, J. E. Fuller, Otis E. Putnam, Jerome Marble, A. B. R. Sprague, John R. Thayer, of Worcester; Henry W. Warren, of Holden.

BOSTON, MASS.—The Railroad Commissioners have dismissed the petition of the Lawrence & Reading Street Railway Company for the approval of a location granted by the Selectmen of Andover, on the ground that the Selectmen did not state whether the tracks were to be laid on the side of the street or the present tracks of the Lowell, Lawrence & Haverhill Street Railway Company, now in the middle of the street, be changed.

WESTFIELD, MASS.—At the annual meeting of the stockholders of the Woronoco Street Railway Company, held Nov. 14, the following directors were elected: James H. Bryan, R. D. Gillett, D. L. Gillett, James A. Crane, Henry W. Ely, Henry M. Van Deusen, Charles J. Little and L. S. Stowe. At a subsequent meeting of the directors the following officers were elected: James H. Bryan, president; Robert B. Crane, vice-president; Charles J. Little, treasurer.

WORCESTER, MASS.—At a recent meeting of the stockholders of the Worcester & Shrewsbury Street Railway Company the following directors were elected: H. H. Bigelow, James M. Drennan, George A. Stevene, F. H. Bigelow and Irving F. Bigelow; H. H. Bigelow was elected president, and Irving F. Bigelow, treasurer and clerk.

LINCOLN, MASS.—As a sequel to the contest which has been going on in this town between the Concord & Boston Street Railway and Lexington & Boston Street Railway, for locations, a remonstrance has been filed with the Railroad Commissioners against the Lexington & Boston's location on Massachusetts Avenue in North Lincoln. At a recent hearing on the matter, Charles Francis Adams, a resident of this town, appearing in remonstrance, made some remarkable statements. He candidly admitted that the Massachusetts Street Railway Law of 1898, passed after a report by a special investigating board, of which he was chairman, was framed under an entire misapprehension of the conditions. He said it never entered his mind that it would be so construed as to prevent a street railway from running over private land without special legislation. It was passed, he continued, under the idea that the electric railway was the successor and counterpart of the omnibus, while in fact the board was dealing with a new force, electricity, which made an electric car in fact a railway running in the highway. He advocated making electric lines vincinage roads, running the cars in trains, permitting them to go over private land as soon as they left thickly settled towns, and permitting them to carry freight. He said no steam road ought to attempt to transport freight within 20 miles of Boston under present conditions, and believed the street railway act should be at once repealed and a new law drawn.

PORTSMOUTH, N. H.—The Portsmouth, Exeter & Newmarket Street Railway Company has just been incorporated with a capital stock of $100,000 to construct an electric railway from Exeter to Portsmouth, passing through Stratham, Greenland, Portsmouth Plains, Newmarket and Newfields. The line will be 20 miles in length. The incorporators of the company are: W. D. Lovell, of Boston; Warren Brown, of Hampton Falls; John Templeton, Rufus N. Elwell, A. S. Wetherell and William Burlingame, of Exeter.

PORTSMOUTH, N. H.—The Portsmouth, Great Bay & Dover Street Railway Company has been incorporated, with a capital stock of $75,000, to construct an electric railway from Portsmouth to Dover, passing through Newington, Durham, Madbury and Greenland. The road will be 15 miles long. The incorporators and directors of the company are: Arthur W. Simpson, of Madbury; Rufus N. Elwell and Albert E. McReel, of Exeter; Wallace D. Lovell, of Boston; Warren Brown, of Hampton Falls, and Joseph Hett and Herbert B. Dow, of Portsmouth.

PORTSMOUTH, N. H.—The Haverhill & Newton Street Railway Company has been incorporated, with a capital stock of $40,000, to build an electric railway from Newton, extending through South Hampton, Plaistow, Merrimac, Mass., and Haverhill, Mass. The incorporators and directors of the company are: Warren Brown, of Hampton Falls; Rufus N. Elwell and Albert E. McReel, of Exeter; Ralph D. Hood, of Haverhill, Mass.; Wallace D. Lovell, of Boston, and John E. Hayford and Irving M. Heath, of Newton.

YONKERS, N. Y.—Two cars of the Yonkers Railroad collided Nov. 18. One of the cars left the track. The passengers were thrown upon the floors of the cars and several of them were cut and bruised.

NIAGARA FALLS, N. Y.—The Niagara Falls & Suspension Bridge Railway Company has defeated the city of Niagara Falls in its fight against an assessment of $39,000 on what was termed improvements on real property. Justice Hooker in the Special Term of the Supreme Court has handed down a decision ordering the amount to be stricken from the rolls.

NEW YORK, N. Y.—The *New York Commercial*, for Nov. 21, says: "Proposals for the establishment of an electric light plant and an electric railway system in the Cuban city of Matanzas are being solicited by Jimenis & Company, of this city, acting for the municipality of Matanzas. The proposals can be made for including both lighting and tramways, or either. The electric light plant is to furnish not less than 225 lights of about 1500 cp, the machinery to have a reserve capacity of at least 15 per cent more lamps. The contractor will be required to furnish a bond in $3,000 American gold, as guarantee for the performance of his obligations. Specifications are in the hands of the local agents, who say that several bidders have already come forward.

MIDDLETOWN, N. Y.—The annual meeting of the Middletown-Goshen Electric Railway Company was held Nov. 15. The old directors were re-elected as follows: W. B. Broomall, Frank D. Graham, W. W. Doughten, J. Howard Roop, Louis H. Duhring, Edward H. Pyle, H. B. Royce and W. B. Royce. At a subsequent meeting of the directors the following officers were elected: William B. Royce, president; W. B. Broomall, vice-president; Herbert B. Royce, secretary and treasurer; Frank D. Graham, assistant secretary.

NEW YORK, N. Y.—Flint, Eddy & Company, Ltd., of New York, have been granted a Virginia charter, giving the company the privilege of conducting a general importing and exporting business, presumably between the United States and the South American republics, preferably Argentina. The capital of the company is placed at $500,000, and the officers are as follows: W. B. Flint, of New York, president; Louis E. Odio, of Buenos-Aires, vice-president; Diego Campbell, of Buenos-Aires, treasurer; William H. Stevens, of New York, secretary. These officers, with Frederick B. Jennings, T. L. Park, Ulysses D. Eddy, Alfred De Buys, George L. Duval and Thomas A. Eddy, of New York, compose the board of directors.

MAYSVILLE, OHIO.—The Cincinnati, Dayton & Maysville Electric Railway Company has been successful in securing a franchise in Loveland. The franchise is for twenty-five years, and the company agrees to have the line in operation by December, 1901. The complete road will extend from Cincinnati through Madisonville, Remington, Loveland, Foster's, King's Mills, South Lebanon, Morrow, Blanchester, St. Martins, Georgetown, Ripley and Maysville. S. Woodward, of Morrow, is largely interested in the new line.

COLUMBUS, OHIO.—The County Commissioners of Pickaway County have granted A. G. Grant, general manager of the Grove City & Green Lawn Street Railway, a twenty-five-year franchise for the construction of an electric railway through the county. As the company now has considerable new construction work in hand, it is believed that the construction of the extension through Pickaway County will be begun at once.

CANTON, OHIO.—T. L. Childs, of Akron, will make another effort to secure a franchise from the County Commissioners for his proposed Akron-Canton line.

GERMANTOWN, OHIO.—The County Commissioners have granted the Miamisburg & Germantown Traction Company a twenty-five-year franchise for the construction of an electric railway between Germantown and Miamisburg. The franchise requires that the construction of the line be begun by May 1, 1901, and that the line be completed within one year from that date.

CIRCLEVILLE, OHIO.—The County Commissioners of Pickaway County have granted the Columbus & Southern Electric Railway Company a franchise for the construction of an electric railway through the county. The franchise is for a period of twenty-five years.

CANFIELD, OHIO.—The construction of the proposed Canfield-Youngstown Electric Railway has been abandoned. Charles Fowler, of Canfield, the local promoter of the line, is authority for the statement. Detroit capitalists were to finance the project.

AKRON, OHIO.—The Cleveland Construction Company was incorporated at Columbus Nov. 19, with a capital stock of $100,000. The incorporators of the company are: Will Christy, J. R. Nutt, W. E. Davis, R. E. Inskeep and D. W. Pell, and the purpose of the company is to promote, finance, own, buy and sell, and contract for the construction of electric railways, railroads, electric light plants, power stations, buildings, telephone systems, gas and water systems; also to act in the capacity of consulting and mechanical engineers. The Cleveland Construction Company is the reorganization of the Cleveland Construction Company, a co-partnership formed in 1889, and composed of Will Christy, president of the Southern Ohio Traction Company; C. W. Foote, general manager of the Arrowhead Reservoir Company, of San Bernardino, Cal., and James Christy, Jr., of Akron, Ohio. The offices of the company will be in the Hamilton Building, this city.

TOLEDO, OHIO.—A number of the prominent citizens of Fremont were recently given a trolley party and a banquet by the officials of the Toledo, Fremont & Norwalk Electric Railway Company. Complimentary speeches were made by the city officials, and deep gratification was expressed at the successful completion of the road. President Comstock, of the company, was presented with a handsome gold-headed cane, and General Manager Stout was presented with a fine silk umbrella.

COLUMBUS, OHIO.—J. M. Wilson, of Dayton, promotor of the Columbus & Southern Electric Railway Company, has applied to the Franklin County Commissioners for franchises over three routes in this county. The first is for a road to extend from Columbus to Washington Court House; the second for a line toward Circleville and Chillicothe, and the third for a road to connect the two, making a loop in Franklin County. Applications have also been made for franchises in the towns mentioned.

NORWALK, OHIO.—The Cleveland, Elyria & Western Electric Railway and the Sandusky & Interurban Electric Railway are having a contest for a franchise over the old State road into Norwalk. The Cleveland, Elyria & Western proposes to extend its road from Oberlin, passing through Florence and Berlin Heights. The Sandusky & Interurban desires to construct a branch line from Ceylon, through Florence and Berlin Heights.

PORTLAND, ORE.—The Portland Traction Company has recently granted its employees a raise in wages. First-year men will receive 17 cents an hour; second-year men, 18½ cents an hour, and third-year men, 20 cents an hour. Formerly the highest paid men in the employ of the company received 18¾ cents an hour, so that the raise is one which will be very acceptable. About a year ago men of more than three years' service were advanced from $2 a day to $2.25, which was the highest wages paid to Portland street-car men up to that time. As all car men work twelve hours a day, the men who have been more than three years with the company will now receive $2.40 a day. The change will affect about ninety men.