THE STREET RAILWAY JOURNAL

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The Trolley Cars in Bremen.

Among the progressive communities of Northern Germany, the flourishing city of Bremen, with its white houses and well kept streets, was one of the earliest to adopt electric traction. The steady horse car had for many years carried the staid burgers of the old Hanse City by the Weser, along its narrow, picturesque streets, crowded with historical memories, when to be a city of the principal Hanseatic League meant almost to be a republic. But the expansion of the town by the growing trade of the world, a goodly part of which has chosen Bremen as its inlet to the vast markets of the North German territories, determined a beneficial change in transportation methods, and electricity has been chosen to replace the horse on its street railway system.

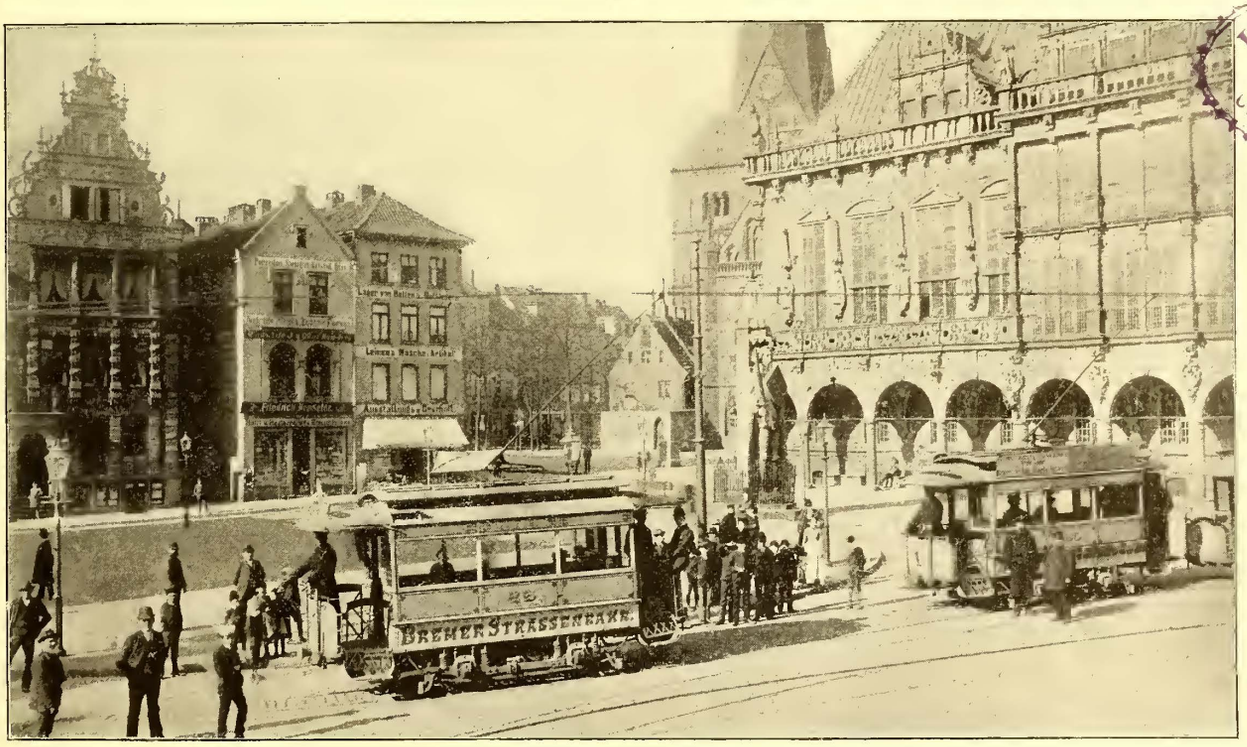


FIG. 1.—ELECTRIC CARS PASSING THE MARKET PLACE—BREMEN, GERMANY.

The noble Rathhaus of Bremen, with its statues of seven electors and one emperor of the Holy Roman Empire, and the Rolandsäule, erected in 1412, probably look down with surprise from their position on the Marktplatz, upon the swift moving trolley cars, the most modern method of transportation. It was in 1891 that the Bremen Strassenbahn Gesellschaft began seriously to consider the question of changing its system of traction. After considerable discussion, the Bremen Company finally decided to adopt the Thomson-Houston system as the most practical, and the contract was accordingly awarded to the Union Electricitäts Gesellschaft, of Berlin. In May, 1892, the road was completed, and the electric cars were doing business.

The length of the line is 6.21 miles, of which 4 miles is laid with single track, and 2.21 miles with double track. The entire system consists of two lines, one running from the Bürgerpark to Freihafen, and the other from Horn to the Hohen Thor, the lines from the railroad station to the corner of the Langen and Kaisers Strassen being common to both systems.

The power station for the generation and supply of current is located on the Schlachthof, near to the line to the Bürgerpark. It is a brick building constructed in three parts, one containing the engine and generator room, the second the boilers, and the third and smallest the coal bins. It covers 4,777 square feet of ground space. The roof of the engine room is of iron, wood and waterproof material; that of the boiler room and coal house is of corrugated iron. A 118 foot smokestack overtops the whole.

The steam plant consists of two Babcock & Wilcox water tube boilers, furnishing steam through jacketed pipes brought through the wall of the engine room to three McIntosh & Seymour high speed engines. To these are directly belted three standard 100 K. W. Thomson-Houston multipolar generators. In addition, there are two smaller engines driving two Thomson-Houston arc light dynamos, and furnishing current to the lamps in the Bürgerpark 500 yds. away.

The track is substantial and solid, laid down with that thoroughness which characterizes continental street management. It is laid in channeled girder rails resting upon longitudinal stringers and cross ties, the whole upon

a solid concrete foundation. The rails are brought flush with the surface of the street, and are carefully bonded for the return.

On account of the many narrow streets through which the cars have to pass, and the numerous curves and turnouts, the construction of the line is peculiarly striking, and none the less effective on account of its novelty, the electrical cars running, starting and stopping with no more difficulty than the discarded horse cars. The Langenstrasse and the Geeren are, perhaps, the narrowest streets on record along which electric cars have ever traveled. Another remarkable part of the line is that running from the Lögestrasse into the Schüsselkorb, where a curve and a turnout are found together at the corner of two extremely narrow streets.

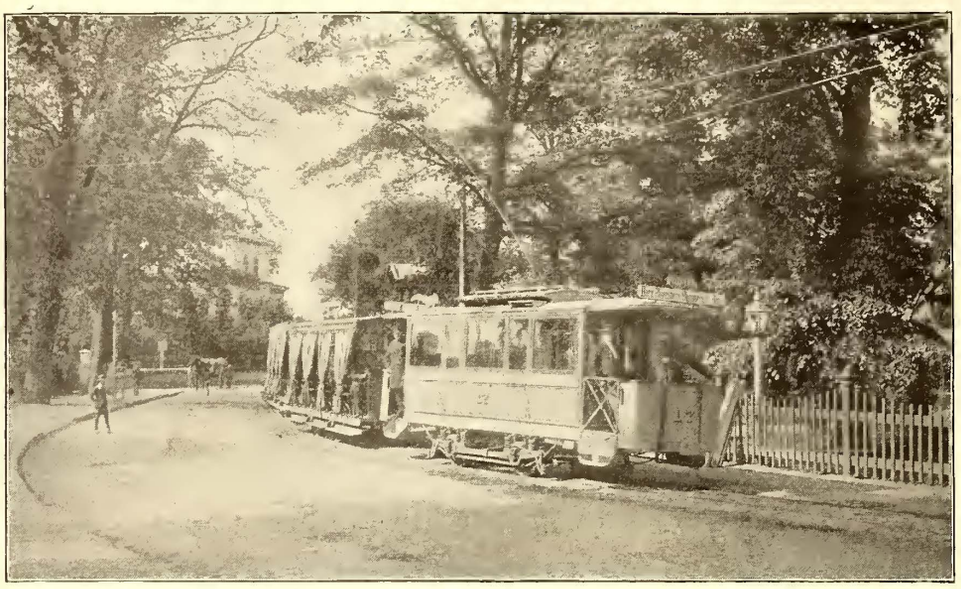


FIG. 2.—STREET SCENE—BREMEN, GERMANY.

Along these passages between houses—for they seem nothing more—the current is carried on trolley wires suspended by the usual insulating appliances from galvanized iron span wires, which are, on account of circumstances of location, stretched between ornamental suspension devices fastened to the sides of the houses. In the broader streets, the span wires stretch between tall steel poles set on both sides of the road. These, as in that part of the line farther from the Börse, are almost hidden by the trees, and only the slender overhead wires above the track can be seen. The outermost portion of the line, that running into Horn, is carried on ornamental side brackets, which are also to a great extent concealed by the foliage of the trees.

At the Marktplatz all the lines converge. Here the overhead and track construction becomes full of turnouts and switches, and is a fine example of perfect work in that direction.

At the present time the Bremer Strassenbahn Gesellschaft has twenty-five motor cars, eighteen of which are operated on week days and twenty-two on Sundays and holidays. The car bodies of the motor cars are to some extent the same as were used originally in the horse car service, but they have been properly altered and strengthened to meet the modern requirements. Each car is equipped with one of the well known W. P. 30 type of Thomson-Houston motors, motion being communicated to the axle through a single reduction gear, enclosed in a casing and running in oil. Control is secured through rheostatic controllers. The maximum speed in the city

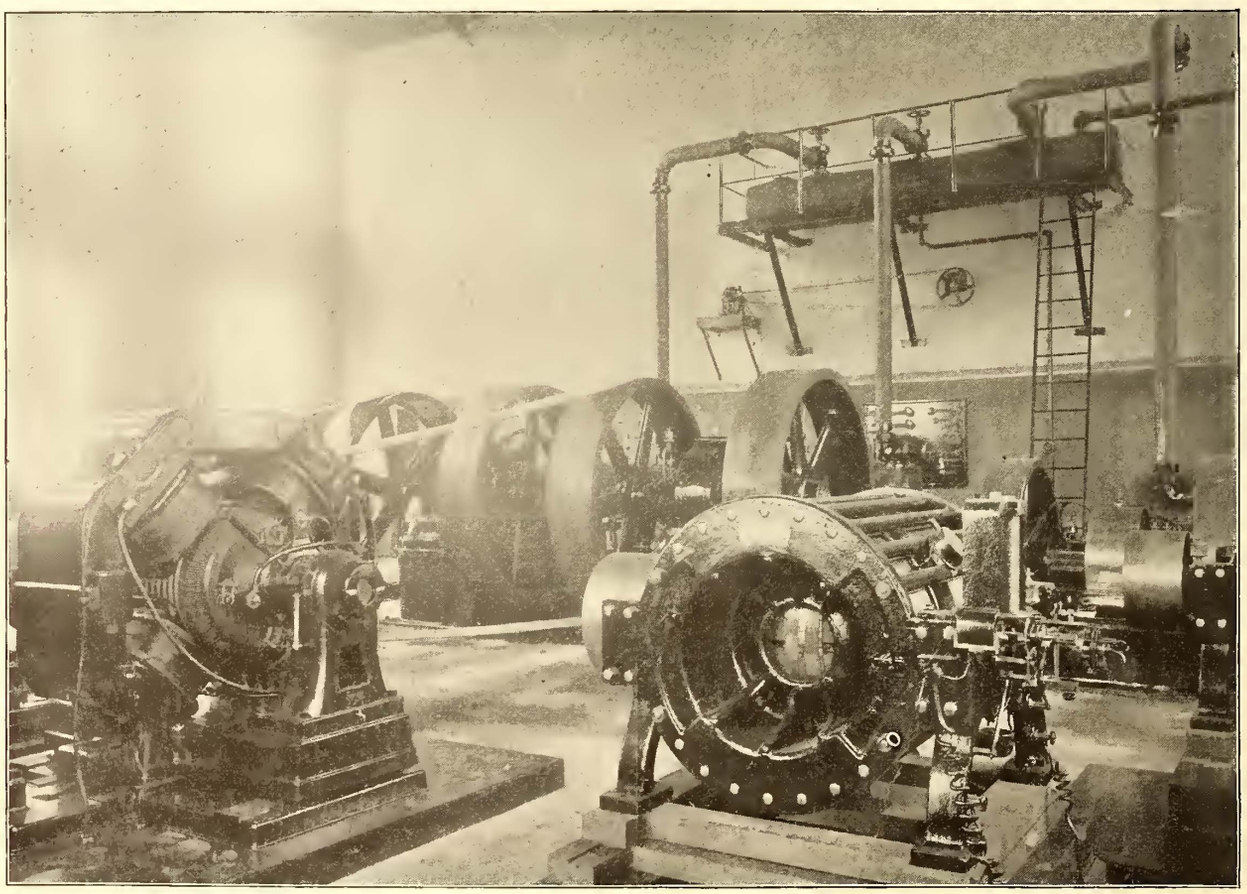


FIG. 3.—INTERIOR OF RAILWAY POWER STATION—BREMEN, GERMANY.

limits has been fixed at from nine to twelve kilometres (5.6 to 7.5 miles) per hour, and on the line nearer Horn, at from twelve to sixteen kilometres (7.5 to 10 miles) per hour. At this speed each motor car is able to draw after it one of the old tin horse cars, as a trailer. The motormen and the conductors are dressed in a semi-military uniform.

A few figures will suffice to show that the public is appreciative of the change. In 1891 the road to Horn was operated by six horse cars, while it is now operated by five electrical cars, the time occupied in the journey remaining the same; yet taking 1891 and 1892 and comparing the incomes, we find that only 71,119.70 marks, were taken in the former year, while in the latter the fares reached 86,950.30 marks, exclusive of extra cars and commutation tickets. This shows an increase in the business of 15,830.60, marks, or 22.2 per cent. by the abandonment of horse traction. The entire expense for the past eight months amounted to 32,284.97 marks, or 36 per cent. of the income. This result was, of course, vastly modified in 1893, as all the lines have since been equipped with electricity, and the station expenses are now distributed over a larger number of cars.

In conclusion, the Bremen road is now an example to continental cities, and, should they follow it, they will find it probably as productive of as excellent results as shown in the foregoing.

THE Cleveland Electric Railway Company intends to carry out the promises made by the East Cleveland Railroad Company, one of the old lines recently consolidated, with regard to the distribution of money prizes to the men working on that line. The amount was $3,000, one-half of which was divided last July. The remainder will be distributed as soon as possible.

THE formal transfer of the property of the West Side Railway Company of Milwaukee, Wis., to the Milwaukee Street Railway Company took place January 29.

The Repair Shops and Car House of the Albany Railway, Albany, N. Y.

The repair shops of the Albany Railway, and the car house for the Troy and Albany division, are located at North Albany, near the corner of Broadway and Erie Street. The buildings were originally the car house and stables of the Watervliet Turnpike & Railroad Company, but since the latter company has come under the management of the Albany Railway, they have been enlarged and adapted to the requirements of the electric system. Fig. 4 shows the exterior of the two buildings, the one at the left being the repair shop. The car house, the front of which is also shown, is 70 × 200 ft. It has seven

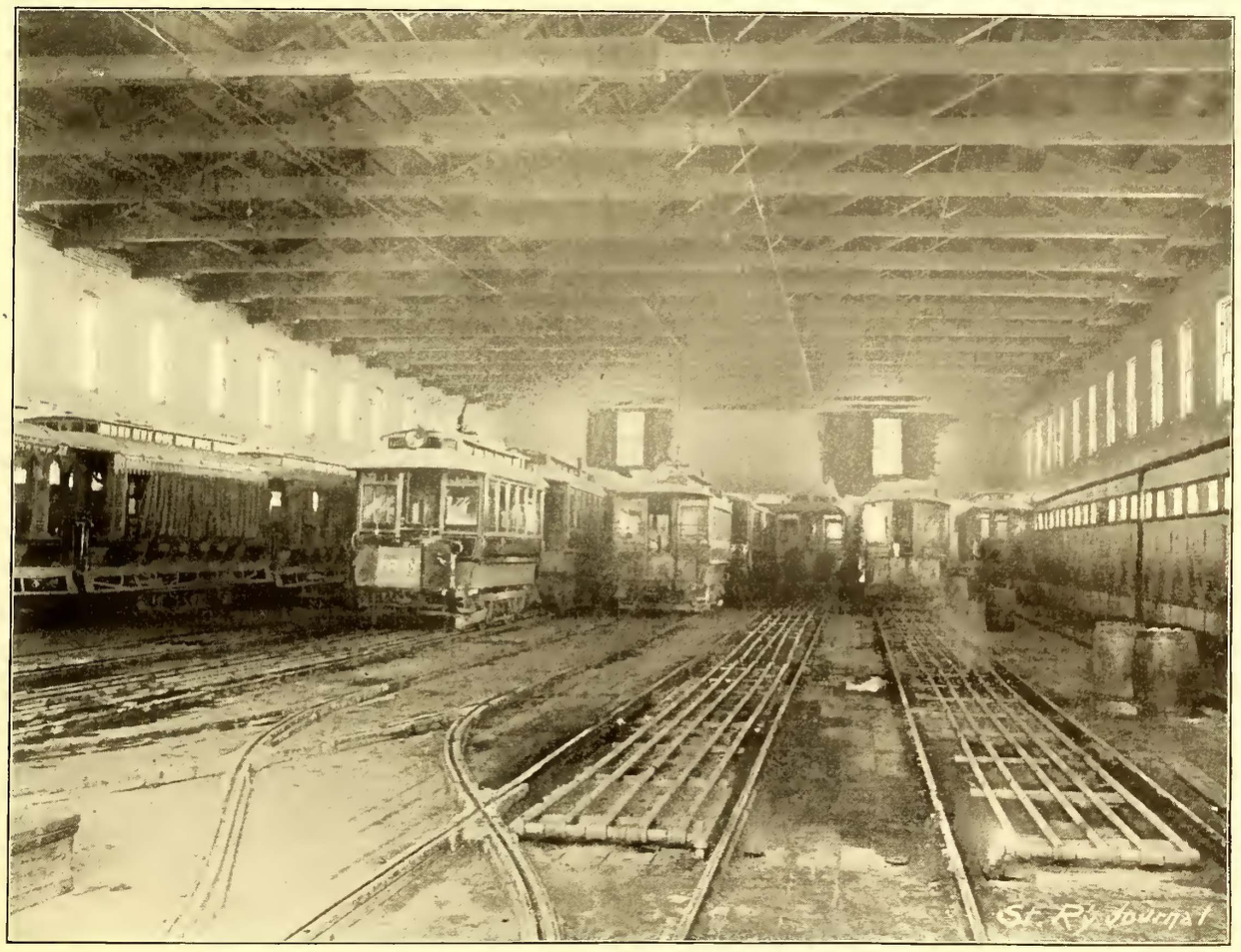


FIG. 1—INTERIOR OF CAR HOUSE, ALBANY RAILWAY—ALBANY, N. Y.

tracks. Between the rails of four of these tracks steam pipes are arranged, as shown in the interior view, Fig. 1.

The repair shop, a plan of which is given in Fig. 3, is 80 × 160 ft., and is fitted with tools and appliances for doing all the heavier repairs of both the Albany and the Troy divisions. Two brick walls running from front to rear separate the building into three sections. On one side are the carpenter and paint shops; on the other the armature room, machine and blacksmith shops. The middle section is used for the repairing of cars and trucks. It is provided with pits beneath the track, and is accessible either from the front or rear of the building. Tracks are secured to the walls by brackets; on these run two traveling cranes of 6,000 lbs. ultimate capacity; each with two self-sustaining 3,000 lb. hoists to each crane. The cranes were furnished by T. Shriver & Company, New York. Fig. 2 shows a car raised from its truck; also the means for taking hold of the body with the hoists.

The usual method of operation is to fit up a truck on the right hand track; then with the four hoists, one to each wheel, the truck is transferred to the left track. The car body is hoisted clear of its truck. The old truck is pushed ahead, and with the new one in its place the body is lowered upon it; the old truck is then transferred

to the left track to be overhauled, the whole transfer being easily and quickly done by four men. In each pit is a Cleveland hydraulic motor lift, made by the Fulton Truck & Foundry Company. With these the armatures and motor cases are handled with the greatest facility. The pits are heated by steam.

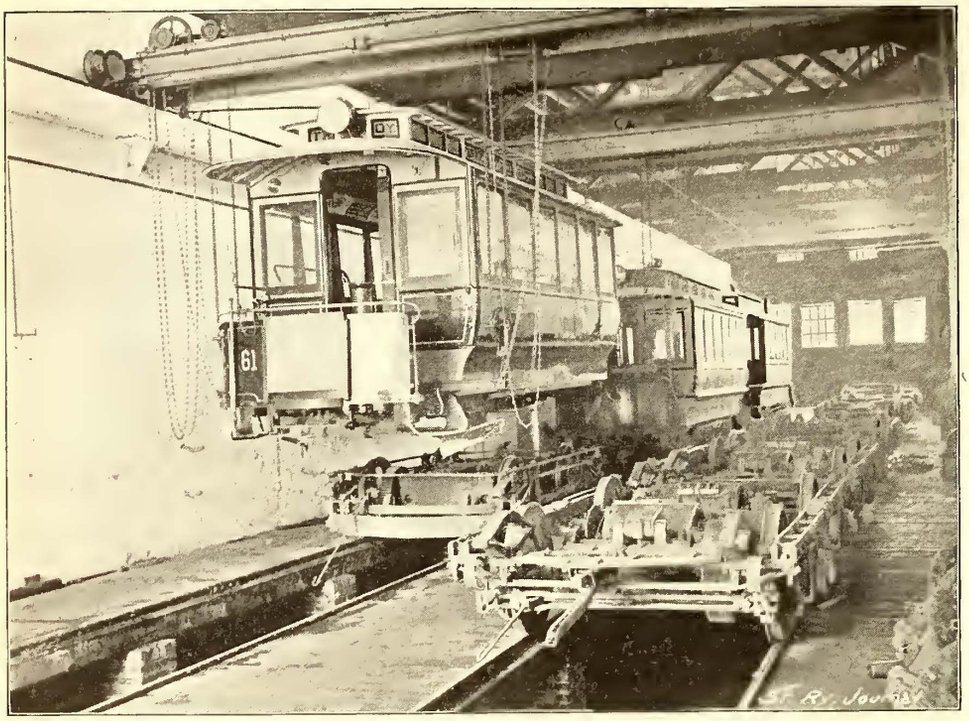


FIG. 2.—LIFTING CAR BODIES FROM TRUCKS—ALBANY RAILWAY.

In the machine shop there is one twenty inch and one forty inch upright drill; one 22 in. × 12 ft. Reed lathe; one 11 ins. × 5 ft. Reed lathe; a 100 ton Schaffer hydraulic wheel press; one 12 in. × 6 ft. Diamond hand lathe; one Pedrick & Ayre open side shaper, besides emery grinder, buffing wheel and blower. Motive power is furnished by a fifteen horse power Short motor taking the current from the overhead system. Machine tools were furnished principally by Manning, Maxwell & Moore and the Niles Tool Works Company, of New York City.

By means of a transfer table at the rear of the building access is obtained to the carpenter and paint shops, also to the blacksmith and machine shops.

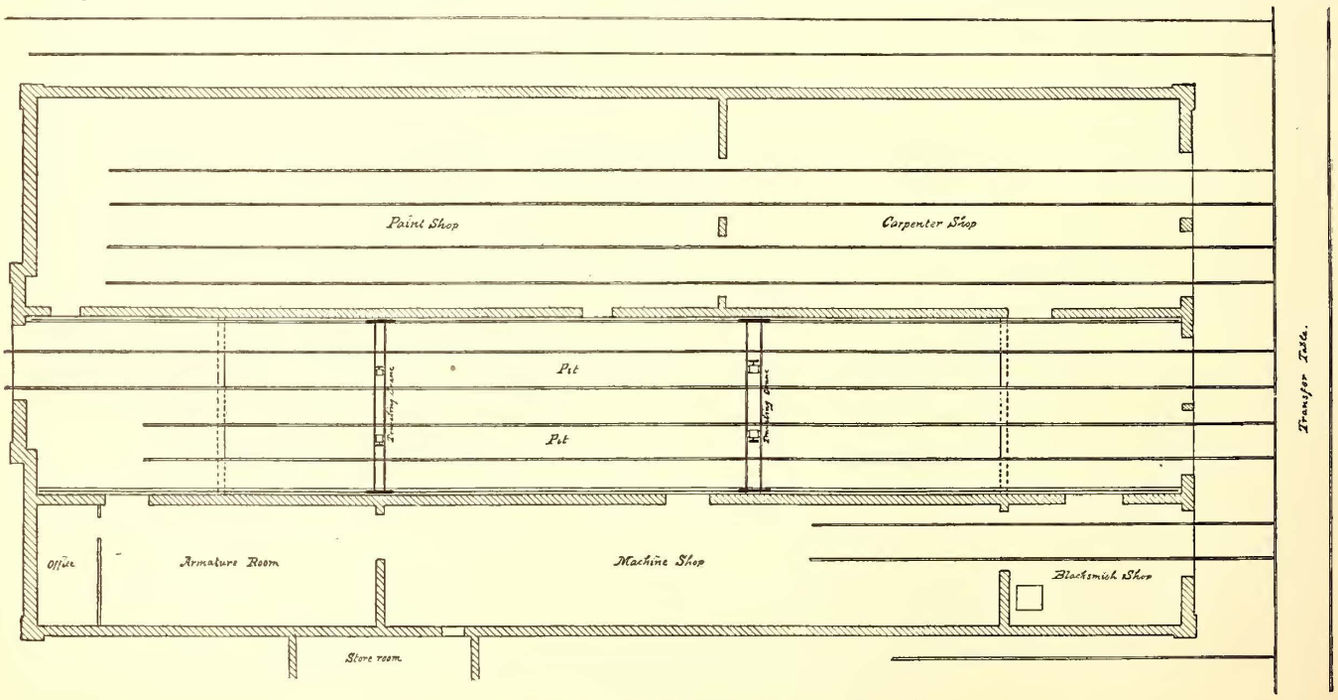


FIG. 3.—PLAN OF CAR HOUSE—ALBANY RAILWAY.

Annual Meeting of the Maine Street Railway Association.

The annual meeting of the Maine Street Railway Association occurred on Wednesday, February 7, and was quite largely attended by representatives of the street railway interests in that state. The city selected as the place of meeting was Portland, and among those present were the following: President, Wm. R. Wood, president of the Portland Street Railway Company; secretary and treasurer, E. A. Newman, general manager of the Portland Street Railway Company; Fritz H. Twitchell, treasurer of the Bath Street Railway Company; Amos F. Gerald, president of the Waterville & Fairfield Railway & Light Company; J. Manchester Haynes and George E. Macomber, of the Augusta, Hallowell & Gardiner Railroad Company; E. H. Banks, president of the Biddeford & Saco Railway Company; Everett K. Day, superintendent of the Mousam River Railroad Company, of Sanford; F. N. Laughton, president of the Bangor Street Railway Company; Frank W. Dana, president of the Lewiston & Auburn Street Railway Company, and A. K. Baylor of the General Electric Company.

Dinner was served at 2 P. M. at the rooms of the Cumberland Club. The secretary's and treasurer's reports were read and approved. Messrs Wood and Newman, officers, and the old board of directors were elected for the ensuing year.

The principal subjects discussed were fire insurance rates and taxes. The insurance rates in Maine have been arbitrarily increased by the companies from ¾ per cent., 1 per cent., 1½ per cent. to 1 per cent., 1¾ per cent. and 2¾ per cent. There has not been a fire in the state in railway power stations caused by electric current, and during the discussion no instance of one in any light and power station could be brought up. The Association has decided to protest against the action of the underwriters.

Considerable dissatisfaction was also expressed with the present tax laws, which class electric railways

for this purpose with the steam roads. The Portland road alone was taxed $700 more under these rules than before electricity was adopted, though the fare remains the same. Other topics relating to street railway interests were also discussed.

By invitation of the Rockland, Thomaston & Camden Electric Railway Company, it was voted to hold the midsummer meeting in that city. The subjects appointed for that meeting are "Grounds for Electric Railroads," and "The Care of Motors."

Rapid Transit in Vienna.

Two rapid transit systems will be constructed in Vienna during the coming year, at a cost of about 23,000,000. Of this sum 85 per cent. will be paid by the state of Austria, 10 per cent. by the city of Vienna, and 5 per cent. by the province of Lower Austria, and the lines will be operated by the government. There will be one elevated railway operated by steam locomotives and extending in a circle around the city, passing through the suburbs. Another semi-circular railway will be within the other, and will embrace part of the old city. This will be underground, and will be worked by electricity. In addition to this semi-circle, two other underground electric railroad lines will be constructed, crossing this semi-circle at nearly right angles. It is proposed to have both systems in operation by 1897.

FIG. 4.—EXTERIOR OF CAR HOUSE—ALBANY RAILWAY.

Fighting the Snow in Milwaukee.

The heavy snowstorm of February 12, which created so much trouble on the street railway lines in different sections of the country, visited Milwaukee and kept the street railway officials busy in combating it. Nine electric sweepers and eighteen scrapers were kept at work all the time under the supervision of General Manager Hommell, and a number of extra men were put at work. Salt cars were also busy distributing salt throughout the city. The only line which had to be abandoned was the Wauwatosa division, and traffic on this line was suspended for only a few hours on February 12. The system was well tested, and the success of the company in coming through the storm so successfully and with such few delays to traffic, was a subject of much congratulation on the part of the citizens and daiiy papers.

The Development of Electric and Cable Railways in London.

By ALEX. MCCALLUM.

The present seems to be a favorable time for calling the attention of American railway men to the enormous changes which are now on the eve of inauguration in London.

Let it be remembered that London is a city of about 5,000,000 of inhabitants. It is some fifteen miles long by nearly as many broad. On all sides railways from the different parts of the country converge, but many of these do not penetrate to the city proper, their terminal stations being a couple of miles or more away. This is notably the case with the northern and western lines. Numerous local railways and some of the other trunk lines thread the congested area, but they are quite incapable of coping satisfactorily with the local traffic, especially in the mornings and evenings. All these are ordinary steam railways and are carried either underground, as in the case of the Metropolitan & District lines, or overhead through private property as with the North London, and the Metropolitan Extension lines. It is practically certain that no more of these railways will be built in the central districts. The existing ones have proved white elephants, for though they carry as much traffic as can be run upon them, holders of common stock do not know as a rule what getting a dividend upon it means. These railways cost an enormous sum to construct, owing to the vast amounts which had to be spent on land. In some parts the cost was as high as $6,250,000 per mile.

Another evil is that owing to the density of the general traffic and the narrowness of streets in the central districts tramways are not allowed. Hence the thoroughfares are choked with omnibuses and cabs in addition to other traffic. Blocks are frequent, and but for the excellent police regulations they would be perpetual. Beyond this congested area horse tramway lines radiate in all directions, but they offer far too slow a method of locomotion where passengers wish to travel two or three miles at a stretch. Cable and electric tramways are still in the future, and besides, under English restrictions as to speed and trains, they would not solve the problem. The traveler can often find a steam railway to suit his destination, but he has probably some distance to go to the nearest station, and in many cases the route is so circuitous that the time occupied is absurd.

It has to be remembered that the difficulties in London are growing more and more acute every year. The population is increasing at an alarming rate, and the city congestion is in a similar flux. The local traffic also is increasing, despite insufficient facilities, at an extraordinary rate.

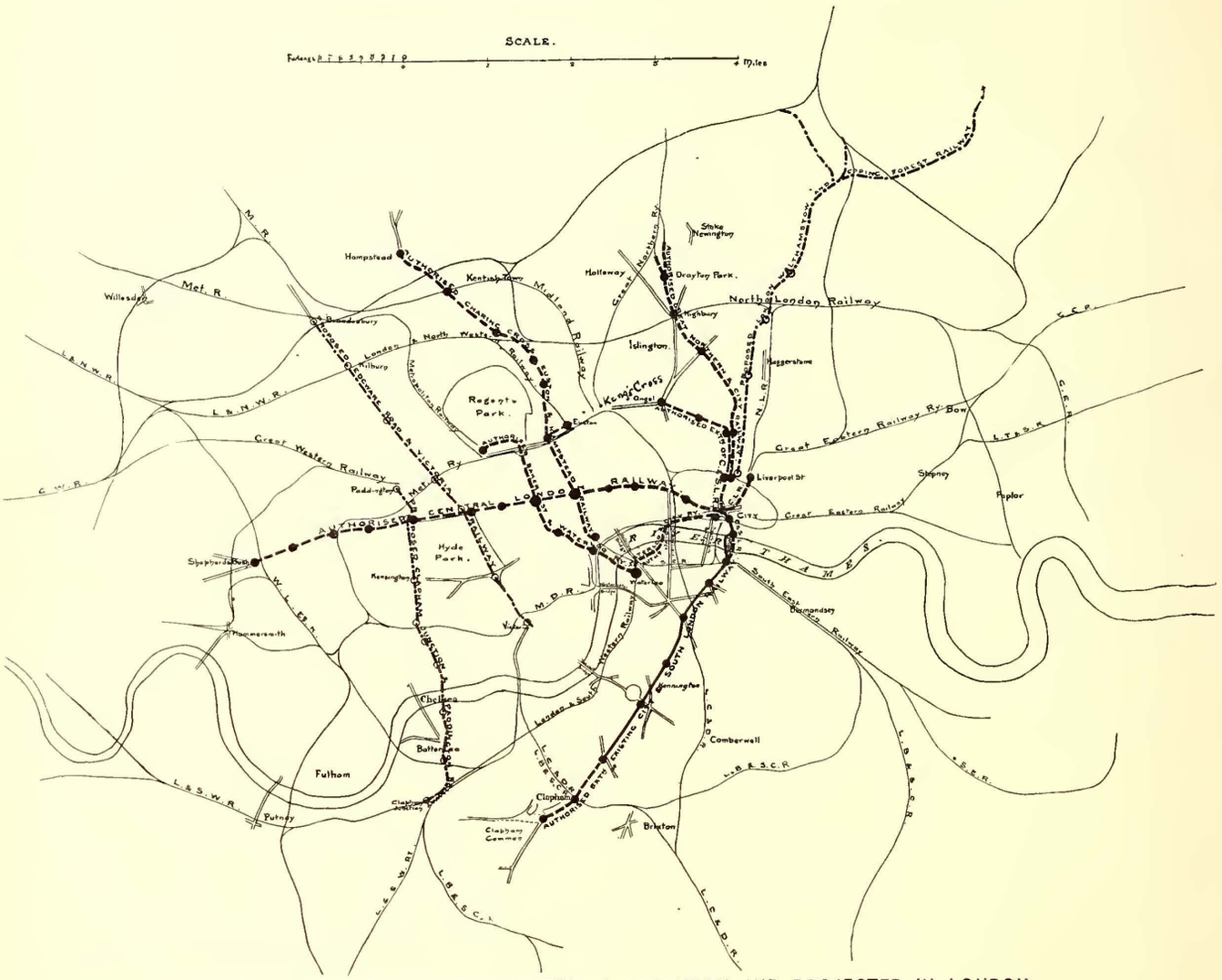
Something absolutely new, reasonably cheap and rapid, and large in carrying capacity is required in London. Necessity has again been the mother of invention, and in the Greathead tunnel scheme a bright promise is held out.

The Rapid Transit Commissioners of New York and Boston, in their reports in 1891 and 1892, rather threw cold water on this scheme so far as the needs of their respective cities were concerned. Little or no attention seems to have been paid since to the system in America, and it is necessary, seeing the wholesale approval which it has obtained from English experts, and considering that it promises to be adopted in many European cities, to refer to it in some little detail.

J. H. Greathead, the inventor, has for many years been

what may be called a specialist in the matter of tunnels. He was associated with the various schemes for carrying tunnels under rivers, such as the Thames in London, and the Clyde in Glasgow. In 1882 he proposed a tunnel for general traffic under the Thames, at the Tower of London. It was to be approached at either end by hydraulic lifts, in the same way as in the present scheme for the Clyde at Glasgow (in which the latter, by the way, an American firm, the Otis Elevator Company, is supplying the hydraulic machinery). A bill was introduced into Parliament to obtain the necessary powers, but the scheme, which would have been far preferable to the present movable Tower Bridge, and only one-fourth as costly, was thrown out.

In 1883, Mr. Greathead's idea being still maturing, he proposed a deep tunnel railway from the city to the point on the south side of the river known as the Elephant & Castle, a distance of about a mile and a half. This was the nucleus of the existing City & South London Railway. The application to Parliament for powers was met by a storm of opposition from the Corporation of the City of London, who were apprehensive of injury to London Bridge, and from all the local authorities along the route. By great good fortune, however, the bill got through in 1884. The general public then said that the thing was impossible, and so difficult was it to persuade investors that the scheme was feasible and likely to be profitable, that it was not until well on in the year 1886 that any steps were taken to begin the actual work of construction. It was then stated quite confidently that the whole capital of the company would not be sufficient to carry the two tunnels, one for the up, and the other for the down town line, under the Thames. For a beginning it was therefore decided to construct this part of the tunnels before any land for stations was bought, and before beginning any works elsewhere on the route. The first step was to sink a shaft in the bed of the river itself, and to drive both the tunnels from the shaft. It was about sixty-five feet deep from the surface of the water, and penetrated far into the London clay. At this point the tunnels were placed one above the other, and the upper tube was driven first. These are the tunnels now in use. As soon as they were completed, land was acquired at the points where the stations were to be situated, and the remainder of the tubes was constructed. Before the work was done, the company obtained power to extend its undertaking southwards as far as Stockwell, and the whole route is shown in the map accompanying this article. The original proposal was to work the road by cables, but owing to the great progress which was being made at that time in electric traction, it was decided to equip the railway electrically on the ground that greater train speed would thereby be attained. Having sketched the matter historically, it is time now to explain generally and as briefly as may be, the principles of the Greathead tunnel.



MAP SHOWING RAPID TRANSIT ROUTES IN OPERATION AND PROJECTED IN LONDON.

The City & South London Railway, the experimental pioneer of the Greathead class, was opened in the end of 1890, and has been working well ever since. In its essentials the scheme for such railways is this: First, the tunnel must be at a considerable depth below the surface, so as not to interfere with sewers, pipes and buildings, and to obviate the expense of buying land, except for stations. In London a depth of from forty to sixty feet has been found to be the most convenient. Each railway has two tunnels, one for the up and the other for the down track. This obviates any risk of a block on both lines should a train be derailed or meet with other accident. The railway must not have any physical junctions with other lines, so that trains may be run without any delays on an an exceedingly short headway. The tunnels, for the sake of economy, and in order to insure good ventilation, must

not be very much wider than the cars which thus force out the air in front of them, and the fresh air rushes in behind. Cable or electric power is used, thus ensuring a pure atmosphere. Very little surface land is required for stations, as only a ticket office, elevators and staircases have to be provided for. The easement to run through the subsoil costs little. The line may go either under streets or buildings, as there is neither noise nor vibration on the surface. The tunnels are cut generally through the London clay, which everywhere forms the subsoil, by means of a shield forced forward by hydraulic power. They are then lined with iron throughout, with a layer of watertight cement between the iron and the surrounding clay or other material. Water-bearing strata can be pierced, where necessary, in the same way, with arrangements for enabling compressed air to be used for keeping out the water till the work is finished. The following summarizes the advantages of the method:

(1.) It does not involve disfigurement of the streets nor surface noise and vibration. (2.) Blowholes or ventilating openings are not required. (3.) It provides a mode of transit more rapid than the underground railways of London, the elevated railways of New York, or the cable railways of Chicago, and nearly three times as rapid as the omnibuses and tramways in London. (4.) It can be carried out without the slightest interference with the streets or traffic during construction. (5.) It does not involve abstraction of street surface. (6.) It can be carried out without the wholesale demolition of property involved in the construction of ordinary railways. (7.) While economical in construction, it gives a rateable value to the subsoil of the streets. (8.) By adding a second story, as it were, to the streets, it will tend to reduce the congestion of street traffic. (9.) It will not derange existing sewers, pipes, etc. Passengers also find the advantages of pure air, owing to the absence of steam locomotives, comfortable cars, warmth in winter and coolness in summer, certainty of service in all weathers, and even when in frost, snow and fog all other conveyances fail.

The Boston Rapid Transit Commissioners objected to the system on the ground, *inter alia*, that the temperature in the tunnels in summer is apt to cause chills to passengers. But this temperature, which is pretty nearly the same all the year round, is admittedly not lower than 50 degs. Fah. In the past hot summer the City & South London Company actually found it to its advantage to put up notices at the entrances to its stations, calling attention to the cool atmosphere. Complaint was also made by the Boston Commission to the noise while the train is running, but in reality this is not excessive, and in the case of all the lines about to be constructed it will largely be obviated by a modification of the tunnel lining. The sharp curves on the existing line which give rise to disagreeable jerks at times, especially near the termini, will not exist on any of the forthcoming lines, and the gradients will not be so severe. It must be remembered that the City & South London Railway was built as an experimental line, and that from it a great deal has been learned.

The success of this railway led to the organization of companies to build other roads. We present here a map which shows the principal steam railways in London, the existing City & South London Electric Railway, the authorized deep tunnel railways, and the proposed lines of the latter class. To avoid complication on the map, the minor steam lines are not shown. It has to be borne in mind that the greater part of the area in question is densely built over. The thin lines are the steam railways, the thick continuous line the City & South London, and the thick dotted lines the prospective deep tunnel railways. The position of a few of the more important thoroughfares where they cross the new lines is indicated. Stations are also marked on the coming railways.

It is proper to mention that as regards the London, Walthamstow & Epping Forest Railway, which is to be promoted in the coming session of Parliament, only three and a quarter miles of the total is to be in tunnel and worked by electricity, the rest being in the country and in the open, and it will be operated by steam locomotives. Near the point where the railway emerges on the surface, as a glance at the plan will show, there are junctions with several lines, so that the continuation of electricity would be impracticable. But making this allowance, it will be seen that the total mileage on all the railways proposed to be operated by electricity or cable is thirty-eight miles. If we take this on the American plan of reckoning every mile of double track as two miles, the total of the roads to be worked is seventy-six miles. This when completed will be a glorious achievement, but even then it is doubtful whether London will have in proportion to its population a system of local communication approaching that of many of the cities of the United States. However, success will lead to extensions.

The following is a complete list of the authorized and proposed lines, with the lengths of each:

AUTHORIZED.	Miles.
Central London Railway	6½
Baker Street & Waterloo Railway	3
City & South London Railway, Islington & Clapham extensions	3¾
City & South London Railway as presently open	3¼
Great Northern & City Railway	3
Hampstead, St. Pancras & Charing Cross Railway	5
Waterloo & City Railway	1½
Total	26 Miles.

PROPOSED.	Miles.
Clapham Junction & Paddington Railway	4¼
Edgeware Road & Victoria Railway	4½
London, Walthamstow & Epping Forest Railway	14
Total	22¾ Miles.

The Central London Railway, of which the engineers are Sir John Fowler, Sir Benjamin Baker and J. H. Greathead, was the first of these railways to be authorized, and in many respects it is the most important. The stations will be at some of the busiest centers of London activity. It is intended at first to run trains, each seating 336 passengers, at intervals of three minutes. The total journey will be accomplished in about twenty-five minutes. Assuming each train to take on half as many passengers as it could seat at one time (as is the case on the City & South London), and that the working hours were 110 per week, a five minute service would carry twenty-four and a half million passengers per annum, while a two minute service would convey sixty-one and one-third million. This calculation for a railway three miles long will enable readers to have an idea of the capacity of the other projected lines.

Electric Railway Construction in Europe.

The *Allgemeine Elektricitäts-Gesellschaft*, of Berlin, has sent us the following list of electric railways which it had installed or was installing October 11, 1893. The first six are in operation; the remaining eight are in course of construction :

Name of Town.	Started.	Put in operation.	Length of street in km. (.62 mile.)	Length of track in km.	Gauge in meters (39.37 ins.)	Maximum grade.	System.	No. of Motor cars.	No. of Trail cars.	No. of Motors.
Halle	1891	1891	7.74	9.67	1	1.20	trolley	25	13	50
Halle extension to Wittekind-Trotha	1892	1892	4.82	7.24	1	1.20	"	10	....	20
Gera	....	1892	9.4	10.7	1	1.20	"	18	16	36
Kiew	...	1892	3	4	1.512	1.9.5	"	6	....	12
Breslau	....	1893	17.66	28	1.43	1.40	"	40	25	80
Essen, Altendorf-Borbeek line	....	1893	12 3	13.5	1	1.16	"	13	6	26
Essen, Nordstern & Essen B. Bredeney line	1893	....	6.78	9.15	1	1.35	"	7	....	14
Chemnitz	1893	....	11.7	20.8	.915	1.30	"	24	20	48
Dortmund	1893	...	10.5	11.95	1.435	1.40	"	26	20	52
Christiania	1893	....	6.5	7.5	1.435	1.15	"	11	7	22
Lubeck	1893	....	9.87	13.63	1.100	1.20	"	24	20	48
Berlin	1893	....	.....	.....	1.435	level	accumulator	3	....	3
Kiew Extension	1893	....	7	9	1.512	1.14.4	trolley	22	....	44
Plauen	....	...	3 5	5.8	1	1.12	"	8	...	16

The Altoona & Logan Valley Electric Railway.

The line of the Altoona & Logan Valley Electric Railway Company, of Altoona, Pa., is an interurban one, as will be seen from the accompanying engraving, which shows the route of the road. As the company owns 3,600 of the 4,000 shares of the City Passenger Railway Company, of Altoona, and operates the road of that company, it thus controls the entire electric railway system of Altoona. The line of the company is divided into three sections: Hollidaysburg, extending from the public square in Hollidaysburg to the 12th Street Bridge, Altoona, a distance of 6.6 miles; the city division, comprising the entire electric railway system in Altoona, twelve miles in length, and the Bellwood division, which passes through Juniata and Blair Furnace to Bellwood. This is now in course of construction, and will be, when completed, six miles in length. The entire system serves a population of about 60,000.

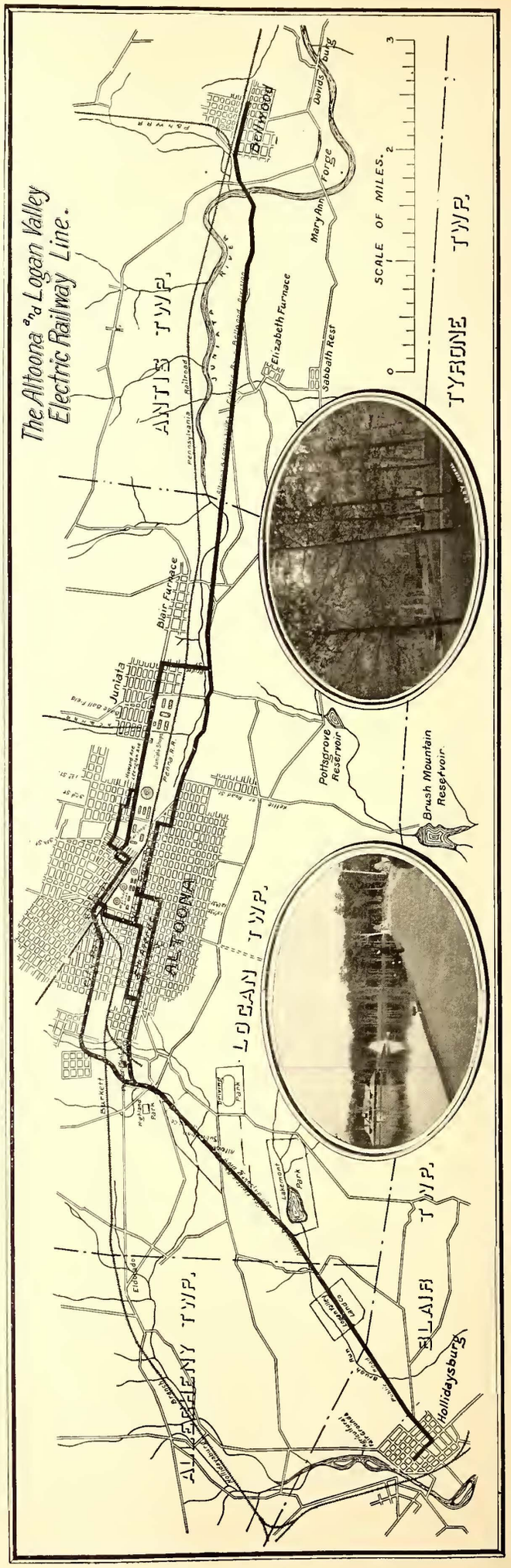
The power station is located about 1.8 miles from the center of Altoona, as shown on the map, and with the car house is contained in a building 118 × 105 ft. 6 ins. This structure is of brick with a slate roof, and was designed by W. B. Powell, of Philadelphia. The stack is of sheet iron, 100 ft. in height and five feet inside diameter. The engine room measures 42 ft. 6 ins. × 72 ft. 6 ins., and contains two 200 H. P., compound engines with cylinders measuring 20 × 24 ins., supplied by the Altoona Manufacturing Company. These engines are direct belted by means of sixteen inch Munson belts to two 200 K. W. General Electric multipolar generators. The switchboard is of the standard slate panel type, manufactured by the General Electric Company, and supplied with switches, automatic circuit breakers, etc. The boiler room measures 40 ft. 2 ins. × 35 ft. 6 ins., and contains two 250 H. P. Heine safety boilers and one 800 H. P. National feed-water heater. The piping is covered with asbestos covering. The station, being in the midst of the coal region, no condensers are used. Fuel costs $1.25 per ton of 2,000 lbs., and is delivered from the cars directly above the furnace doors, where it is shoveled into the furnaces.

The car house, which adjoins the station, as mentioned above, is separated from it by fire walls, and measures 34 × 118 ft. It contains three tracks with pits to facilitate the inspection of motors, running gear, etc.

The track is laid with seventy pound girder and fifty-six pound T rail, an eighty-five pound rail being used at the curves. The girder rail is used in the city limits of Altoona and the borough limits of Hollidaysburg, and the T rail across the country. The ties are of 6 × 6 ins. × 7½ ft., and number fourteen to a thirty foot rail. Wharton spring switches are used with the girder rail, and Pennsylvania Steel Company's point switches with the T rail. The joint connections are made with six hole, angle splice bars. The joints are then double bonded with No. 0 copper wire connected with channel pins. Each fifth rail is also cross bonded to the opposite rail with No. 0 copper wire, and ground plates are buried each 1,000 ft. The company cares for the pavement between the rails and for eighteen inches on either side. The paving is of brick and cobble stones, and the track is surfaced with engine cinders and ballasted with stone.

The overhead construction is carried on round chestnut poles thirty feet in length. The trolley wire is No. 0 B. & S. gauge, hard drawn copper, and the feed wire is No. 0 triple braided, weatherproof. All the line appliances are of the General Electric type.

The motor cars operated by the company are thirty-four in number, fifteen belonging to the Altoona & Logan Valley Railway Company and nineteen to the City Passenger Railway Company. The trail cars, of which there are fourteen, are divided, eight and six respectively, between the two companies. The gauge is five feet three inches. Both motormen and conductors are paid twelve and a half cents per hour. The cars are mounted on Brill rigid, No. 21 trucks. The motor equipment is the Edison sixty horse power, and the Westinghouse fifty horse power type. The interior furnishing of the cars is very tasteful, the seats being of mahogany covered with Wilton carpet. Lewis & Fowler registers are used.



The cars are heated by both stoves and electric heaters, the Consolidated Car Heating Company's apparatus being employed in the latter case. The company buys its wheels of the Lobdell Car Wheel Company and has adopted a thirty-three inch wheel with a two and a half inch tread. The rolling stock of the company also includes some snow plows supplied by the Brooklyn Railway Supply Company, of Stamford, Conn.

In its machine shop the company has installed a large lathe, vices, block and fall, etc., for making all ordinary repairs.

Two views of attractions established by the company for stimulating traffic on the road are given in the ovals in the engraving. These are views of Lakemont Park between Altoona and Hollidaysburg owned by the company, and where a first class pleasure resort has been created. The plan of improvement during the coming year at this point contemplates the erection of a gravity railroad, a merry-go-round, the purchase of electric launches, and the supplying of a baseball diamond. In addition to these attractions a considerable part of the park has been left in its wooded condition, so that every variety of pleasure seeker, whether anxious for rest or activity can be suited.

The officers of the Altoona & Logan Valley Railroad are: President, John Lloyd; secretary and treasurer, C. A. Buch; superintendent, C. L. West. The chief engineer is A. C. Shand, and the electrician W. H. Markland.

DURING January a contract was closed between the French Government and Mr. Berlier, the well known French engineer, relating to the construction and operation of electric underground railroads in Paris. About twenty-five miles of line will be built.

THE long projected railroad up the slopes of the Jungfrau, will, it is said, at last be constructed, permission having been obtained from the Swiss Federal Council. The rack system, in connection with electricity, will be employed.

A CONTROLLING interest in the Nashua (N. H.) Street Railway Company has been secured, it is said, by Boston capitalists.

The Pittsburgh, Allegheny & Manchester Traction Company.

The Pittsburgh, Allegheny & Manchester Traction Company of Pittsburgh, incorporated July 25, 1891, was formed by the consolidation of the Pittsburgh, Allegheny & Manchester Passenger Railway Company, a street railroad company dating from 1859, and the Pittsburgh Union Passenger Railway Company, incorporated in 1879. The charters and franchises granted to the Pittsburgh, Allegheny & Manchester Traction Company have a life of 999 years, as have those granted to the roads entering into the consolidation. The districts through which the lines of this company run, include the business part of Pittsburgh and Allegheny City, as well as the most desirable residence portion of Allegheny, while two of its branches serve a section of the city in which many of the large manufacturing establishments are situated. Connection between Allegheny and Pittsburgh is obtained by two bridges across the Allegheny, which are controlled by the company. One of these bridges, shown with its Pittsburgh approach on this page, is the most modern of the many Pittsburgh bridges, and claimed to be the finest bridge structure in Western Pennsylvania.

FIG. 1.—NEAT OVERHEAD WIRING—PITTSBURGH, ALLEGHENY & MANCHESTER TRACTION CO.

The road was operated as a horse road until 1891, when horse power gave way before electricity, and the road underwent entire reconstruction. In August, 1890, the reconstruction of the tracks was begun, and the heavy girder rails, sixty-three pounds per yard, laid upon a permanent roadbed with a concrete foundation. At the same time the entire length of all its branches was laid in block stone.

Desirous of escaping the many difficulties and dangers incident to overhead wires and accidents which might happen to them, a more than ordinary substantial overhead structure was determined on. The iron poles used are in three sections of extra heavy tubing of six, five and four inch iron respectively, put together in the following lengths: Six inch section twenty feet long, five inch section seven feet long, four inch section five feet long, making a pole twenty-eight feet in length. These poles are set in concrete along both sides of the street. Cross suspension methods are used throughout, the cross wires of heavy iron cable being fastened to the securing

devices on the poles by being bent round brass thimbles and then soldering the free end fast into a brass sleeve. The whole wiring system is divided into four main sections, and these sections are again further divided on the streets through section boxes. The insulators and overhead devices of all kinds are of General Electric manufacture, and are retained as standard by the road, and have given good satisfaction. Fig. 1 shows the approach to the new Sixth Street bridge across the Allegheny River, connecting Pittsburgh to Allegheny. The intricate special work shown in the foreground, built by the Johnson Company, is of its welded construction. All crosses, mates, etc., have been provided with removable floor plates, so as to prolong the life of otherwise expensive track maintenance.

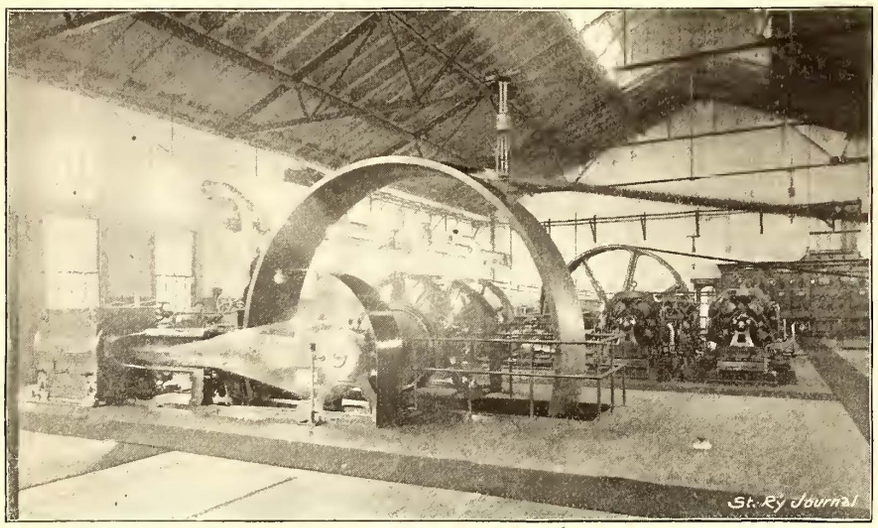


FIG. 2.—ENGINES—PITTSBURGH, ALLEGHENY & MANCHESTER TRACTION CO.

The power station of an electric railway company having been built, the cost of operation depends largely upon its location, design and equipment, and if any one of these elements has been overlooked or carelessly selected, the resulting increased cost of operation will remain a fixed charge always, from which there is no escape. In considering the matter of the power station, the Pittsburgh, Allegheny & Manchester Company decided to locate its plant on the lines of two competing steam railroad companies, and on the Ohio River, for reasons which are obvious. The boiler plant consists of two batteries of four horizontal water tube type boilers, equipped with locomotive shaking grates, built by the Robert Wetherill Company. The coal is delivered to the boiler room from drop bottom cars, run on an elevated trestle, and arrangements have also been made to obtain a coal supply direct from the river. The engine plant consists of two compound, condensing Wetherill-Corliss engines, and two smaller engines manufactured by Russell & Company of Massillon, O. Keystone injectors and Epping-Carpenter pumps are used.

The generator equipment consists of four General Electric multipolar, 300 K. W. generators, and four multipolar, 75 K. W. generators of the same make. Coupled together and belted with one Munson belt to each Corliss engine are two of the 300 K. W. generators, and belted tandem to each of the smaller engines are two of the 75 K. W. generators. Considerable attention has been given to the matter of foundations and alignment, so that the large generators, coupled and driven in the manner described, run without the slightest trouble. The entire generating plant, including boilers, piping, engine and generators, are in duplicate.

As brought out forcibly at the last Street Railway Convention, the greatest economy of operation can best be obtained by operating the engines and generators at their rated capacity, and this method is closely followed in the plant under consideration. When the load is light, one Corliss engine suffices, but in the morning and evening, when the travel is heavy, one of the smaller engines is thrown on, and, as more cars are put on, still a third engine is added, so that the plant is kept at work at its most efficient point under all conditions.

Special attention has been given to the station wiring to make it compact, accessible and safe. The wires from the generators reach the switchboard by conduits, and leave on permanent brackets. The switchboard is equipped with the usual main switches, ammeters, voltmeters, automatic circuit breakers with electrical reset, and recording wattmeters. Between the two smaller engines is a jackshaft carrying two pulleys. This shaft can be coupled to either of the small engines. From it the arc machine is run, which is used for lighting the power station, car station, repair shops and yards. All the electrical apparatus in the station was built and installed by the General Electric Company.

The car stations are located at the corner of Beaver and Island Avenues, Allegheny and Ohio and Chestnut Streets. The main car station has a capacity of sixty cars, and is designed with the special end in view of handling the cars rapidly. No repair work is done in this station. In order to facilitate the handling of the cars, an electric transfer table is used, power being applied directly on the axles by two railway type, three horse power each, motors, current being taken from a conduit in the center of the transfer table tracks. These motors are operated by the ordinary street car rheostat and reversing switches. This transfer table has proved a great saver both in time and labor, one man being able to handle the entire equip-

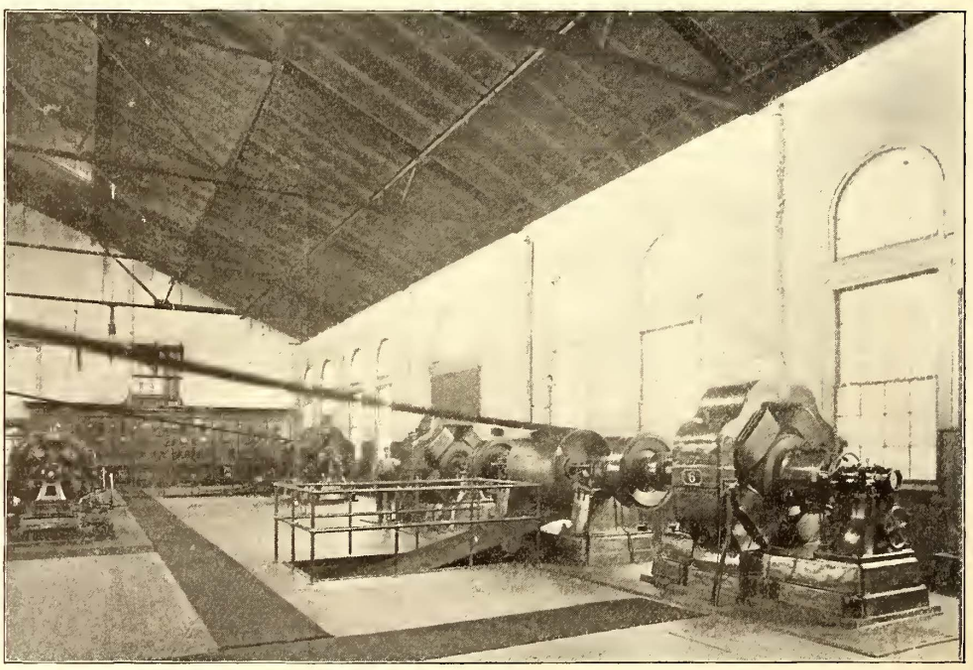


FIG. 3.—GENERATORS—PITTSBURGH, ALLEGHENY & MANCHESTER TRACTION CO.

ment of cars by its use. It is of special service in adding or taking off trailers as demanded by the variations in the traffic demand at different times of the day. There are two other car stations with a capacity of storing forty cars. The rolling stock consists of fifty-eight motor cars, fourteen trail cars, two snow sweepers, one sprinkling car, salt cars, etc. The motor cars are equipped with the General Electric motor, G.E. 800, which has been adopted by the Pittsburgh, Allegheny & Manchester Company on account of its lightness, efficiency and the perfect protection afforded in its construction from rain, snow or dirt. Control is effected by the series parallel controller.

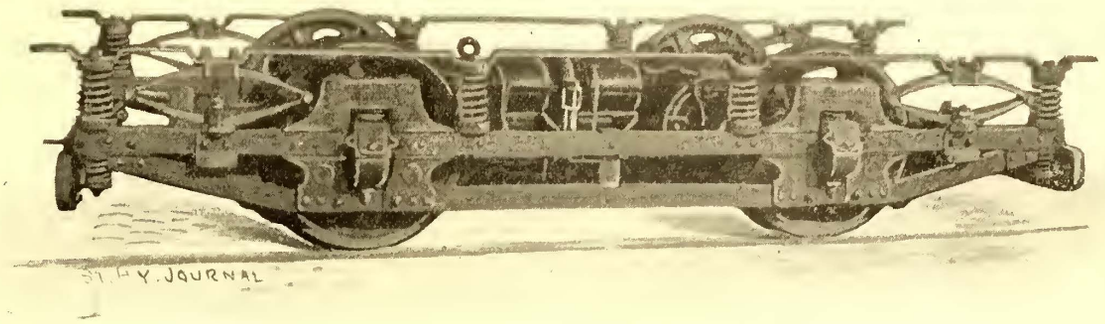


FIG. 1.—TWIN SERIES MOTOR TRUCK—UNION RAILWAY, NEW YORK CITY.

In addition to the power station a repair shop has been built, having in it paint shop, wood working shop, blacksmith's shop, assembling floor and machine shop. There is also a spacious store room, and the company is in a position to repair and maintain its entire equipment and power house, rolling stock, track and buildings. The tools in the machine shop and wood working shop are operated by electric motors, and all the buildings are heated by steam, which acts as a preventive on the charge of too high rates by the insurance companies.

Street railways operating through thickly settled cities, especially sections through where large manufacturing industries are carried on, are subjected to numerous annoyances, such as vehicles breaking down and blocking the tracks, fires and accidents of all kinds. To provide against such contingencies, an emergency wagon has been built, supplied with tools, jacks, hoists and various other devices. This wagon is operated on the same principle as a police patrol or ambulance, and is accorded equal rights on the streets with them. The comfort and convenience of the employes has also been looked after, and a nicely furnished, well lighted room has been provided for them. Well equipped wash rooms, etc., are also provided, and employes are required at all times to present a neat and business-like appearance. One of the novel features introduced by the road is the use of trail cars as smokers to take care of a constantly increasing traffic. They are a source of considerable traffic profit to the company and comfort both to smokers and non-smokers.

In the equipment of this road, the perfection of its operation and maintenance, the reliability of its service, the company has achieved for itself a most enviable record. That it has the universal good will of its patrons is perhaps the best evidence of the satisfaction it gives.

The capital stock of the company is $3,000,000, with a bonded indebtedness of $1,500,000. The officers are: J. H. Dalzell, president; Joshua Rhodes, vice-president; A. M. Neeper, secretary; William Montgomery, treasurer, and G. F. Greenwood, general manager.

THE Lewiston (Me.), & Auburn Street Railway has changed hands; the purchaser is Edward E. Proctor, of Wakefield, Mass.

The Twin Series Motor in New York.

One of the twin series motor equipments manufactured by the United Columbian Electric Company, of Kingston, N. Y., has been in operation for some time on the line of the Union Railway, of New York City. The motor, which was described in our November issue, is of fifty horse power, with two armatures geared directly to the axles. The truck used is a Peckham, type 6A, with a six foot wheel base, and the car employed is the St. Louis car, eighteen feet in length. The characteristics of the equipment are ease of riding and going around curves, with ease of starting. The car makes good speed, and shows particularly no slowing down on ascending a 6 per cent. grade. Some recent tests have been made of economy of current in comparison with motors of other types, which show very well for the twin series equipment. Fig. 1, shows the truck with motor equipment, and Fig 2, the car now in New York City. The handsome building in the background of the latter engraving is the car house of the Union Railway Company.

FIG. 2.—CAR EQUIPPED WITH TWIN SERIES MOTOR—UNION RAILWAY, NEW YORK CITY.

Four cars equipped with this type of motor have been in use in Mobile, Ala., for some time, but though operating under quite severe conditions, the amperage has rarely risen above fifty.

THE Shamokin (Pa.) & Bear Valley Electric Railway Company has been incorporated, with a capital stock of $100,000. The president of the company is E. C. Hamilton, of Shamokin. Others interested are: G. W. Smith, W. W. Ker, of Philadelphia; Charles M. Clermont, of Sunbury, and Martin Markle, of Shamokin.

THE TRANSFORMATION OF BALTIMORE.

PART II.

BALTIMORE TRACTION COMPANY.

Some important work in both cable and electric construction has been done by the Baltimore Traction Company during the past two years, and the mileage of the system has been largely increased by the absorption of other roads and the construction of new lines. Of the seventy-five miles of track now included in the system of this company, thirty-five miles are operated by electricity, fifteen miles by cable, and twenty-five miles by horses.

The Druid Hill Avenue cable line, which has been in operation since May 23, 1891, was the first step towards rapid transit on the part of this company; in fact, it was virtually the beginning of rapid transit in Baltimore. The Gilmor Street cable line, which runs West from the center of the city and then North to Druid Hill Park, is built upon the same general plan as the first line, with some changes in the driving machinery. The strictly unique feature of the Gilmor Street line is its power house, the "Epworth" power station, as it is called from the fact that the machinery is installed in what was formerly the Epworth Methodist church, at the corner of Gilmor and Mosher Streets. As this vacant church seemed to be the only property obtainable for the purpose, it was decided to transform it into a power station. The spire still stands, there is a great circular stained glass window in the front wall, and the chandeliers, gallery, etc. are undisturbed. A boiler house of the same style of architecture adjoins the church building, and an extension in the rear contains the tension run. Francis H. Hambleton, the chief engineer of the Traction Company, found it no simple problem to get the driving machinery inside the church walls, but he did it nevertheless, and the plant has been running smoothly for nearly a year and a half.

The driving machinery is placed on the old floor level of the church, high enough above the street level to give abundant daylight in the lower part of the building. The engine room is 79 × 58 ft., the tension room is 51 × 72 ft., the boiler room is 41 × 104 ft., and the coal room is 41 × 47 ft. The machinery consists of two plain Corliss engines, 36 × 60 ins., built by the Corliss Steam Engine Company, of Providence, R. I., and driving gear for two ropes, built by the Robert Poole & Son Company. The steam plant consists of three batteries of two boilers each, room being left for an additional battery when required. All the steam piping and connections in the engine room are beneath the floor. Owing to the scant width of the building, one engine stands outside the original church wall in an extension, the twenty-four foot flywheel being inside the engine room, and clearing the arches of the roof by a scant inch. The two cables, 10,000 and 22,000 ft. in length, are driven at the same speed—eleven and a half miles—but each has its independent driving gear. A rope drive of twelve ropes is used, the driving pulleys being ten feet in diameter, and the driven wheels twenty-four feet. In this rope drive, Mr. Hambleton has introduced a device for equalizing the strain on the cables. Instead of driving the two twenty-four foot pulleys of each set of gears from a single ten foot pulley on the main engine shaft, the driving pulley is split and provided with a compensating gear on the order of the Whit-

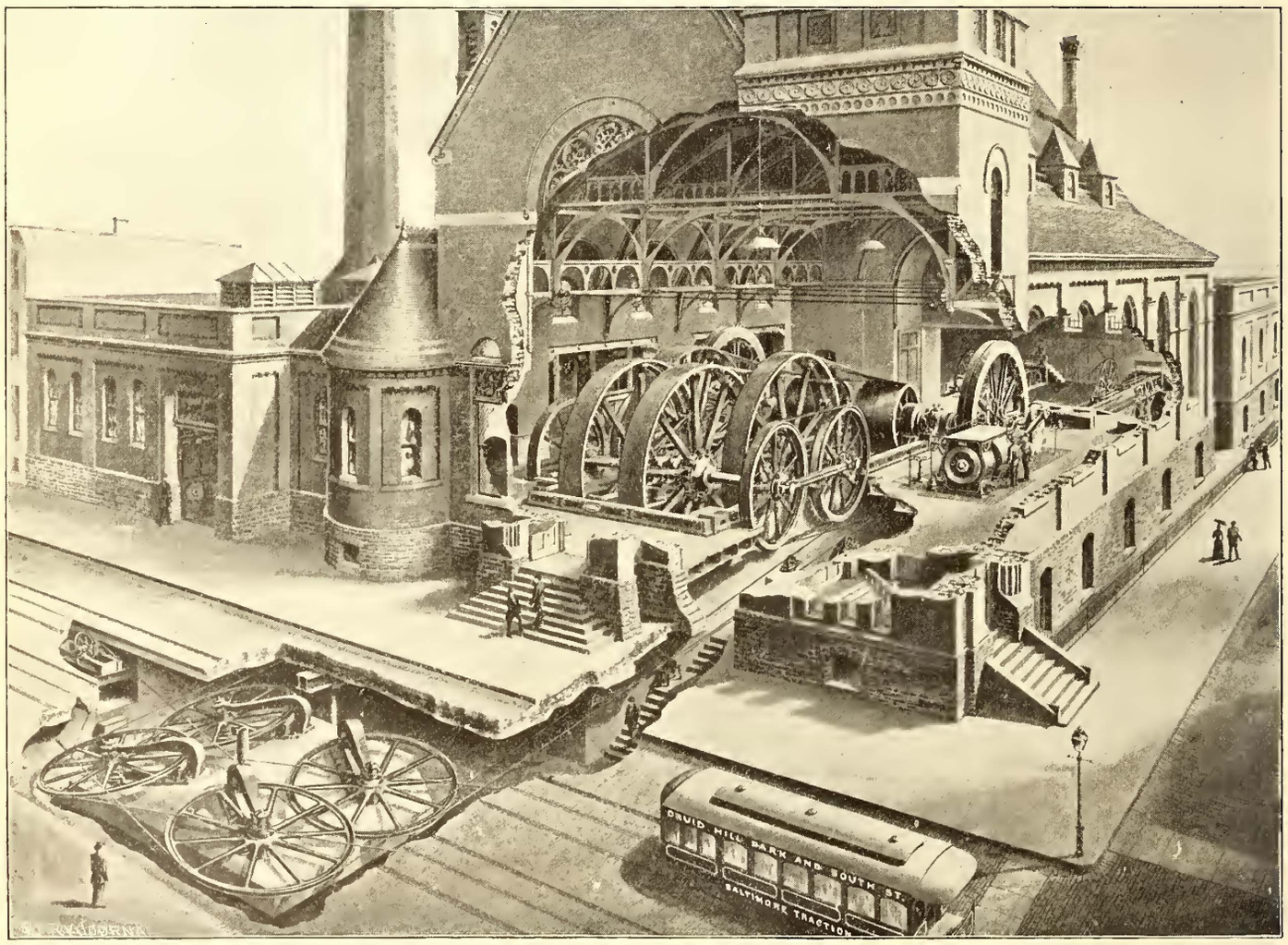


FIG. 1.—GILMOR STREET CABLE POWER STATION—BALTIMORE TRACTION CO.

ton gear for cable drums. With this compensating gear on the rope drive, and the Walker differential cable drums, a complete equalization of the power is assured. The cable drums are thirteen feet six inches in diameter. The tension device, which was designed by the engineers of the company and the builders, the Robert Poole & Son Company, consists of the usual traveling carriage and weights rising and falling in a fifteen foot pit. The tail rope of the carriage passes over a fixed sheave at the extreme end of the run, through a sheave on the weight, and up again to a geared drum, by which any abnormal variations in the tension or length of the cable can be met. By this arrangement the entire length of the run is utilized and the somewhat limited space is used to the best advantage. This plant has capacity in excess of its present requirements, but it was designed with a view to future needs and possible extensions of the line.

The suburban lines of the Traction system form an interesting feature. The Pikesville line, which starts at the terminus of the cable lines at Druid Hill Park, follows the turnpike to Pikesville, a distance of about seven miles. This line was first changed from a horse road to a single track electric line in 1892, by E. D. Smith & Son, but soon afterwards it was double tracked for its entire length by E. Saxton. It is laid with fifty-six and fifty-eight pound T rails, from the Pennsylvania Steel Company, and is rock ballasted. Wooden center poles are used, and the overhead work is especially noteworthy, because of the care with which it was done. The roadbed, too, is in excellent condition, and the entire line is a good example of first class suburban construction. The line passes several race tracks and other resorts which furnish a heavy summer travel, and the country traversed promises to be the scene of important suburban development, a feature that has hitherto been almost wholly lacking in Baltimore. Lewis & Fowler sixteen foot cars are used on this line, with two twenty-five horse power Westinghouse motors to each car. When travel is heavy trailers are used. About midway on the line a double track spur runs to Arlington, a small suburb, and it is probable that the importance of the road will be largely increased by the construction of other feeders.

Power for the Pikesville line and portions of the other lines is furnished from a small plant in the power house of the Druid Hill Avenue cable road. This plant contains a 250 H. P. Westinghouse direct coupled unit, a 250 H. P. McIntosh & Seymour engine belted to an Edison generator, and two 150 H. P. Ball engines, with two 150 H. P. Edison generators. From this station is also supplied a portion of the current for operating the Carey Street electric line, which was changed to its present power during the last fall. This line runs from Druid Hill Park to Fort McHenry at the extreme southeastern limit of the city, using the cable tracks of the company for a portion of the way to the center of the city. Lewis

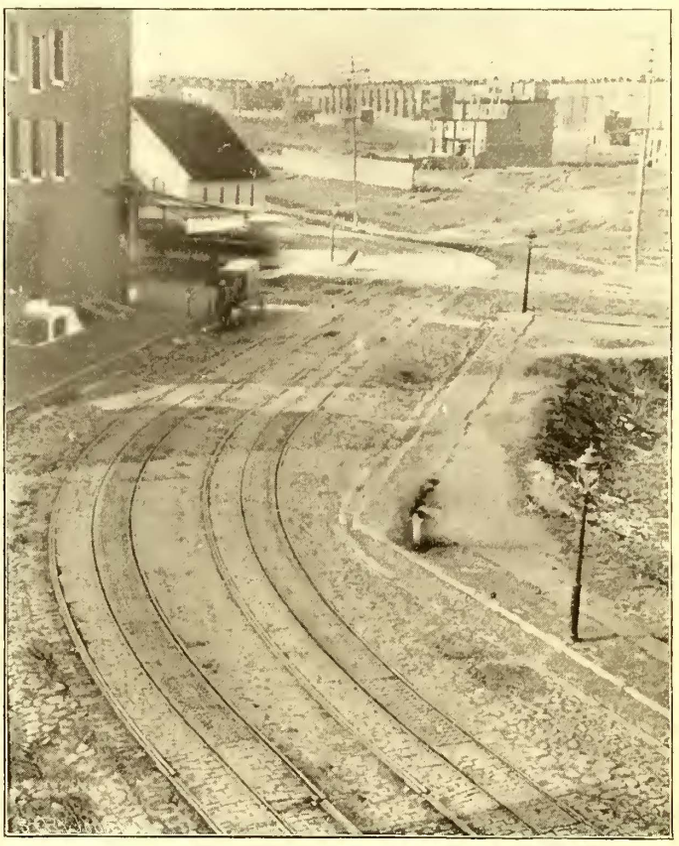


FIG. 2.—VIEW ON DRUID HILL AVENUE—BALTIMORE TRACTION CO.

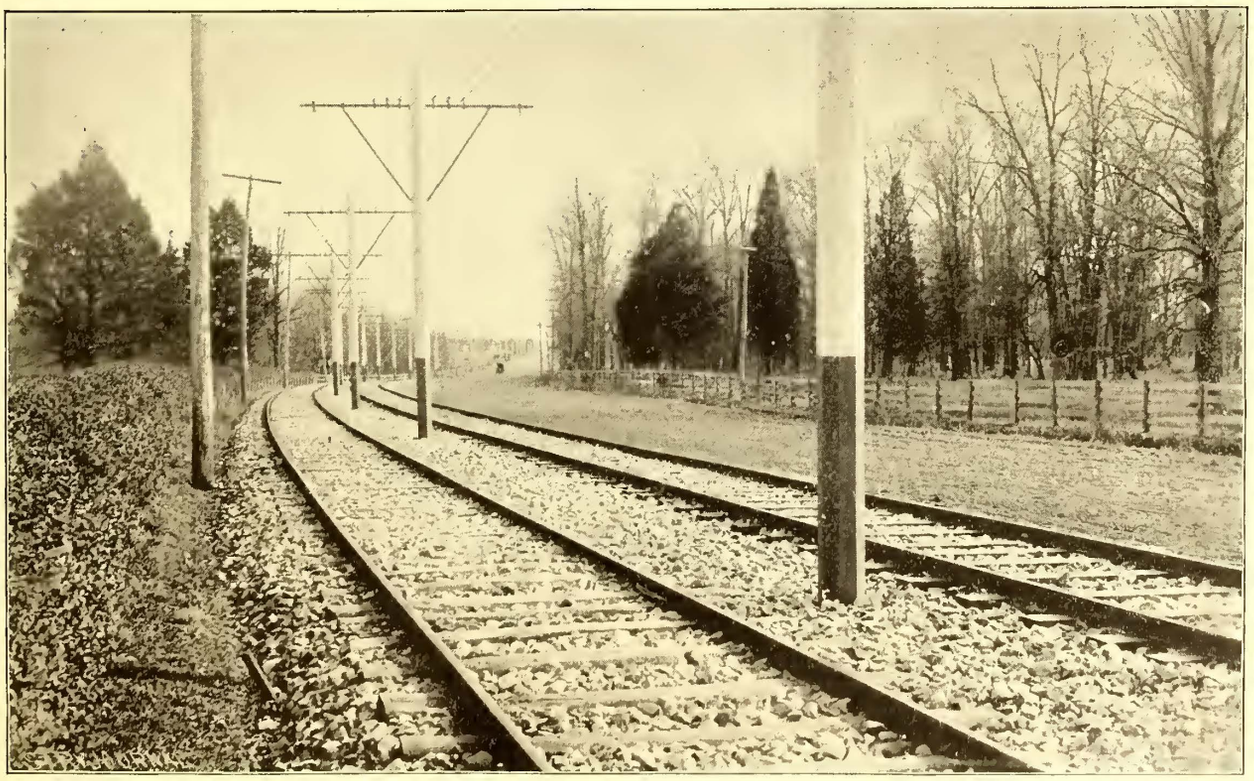


FIG 3.—PIKESVILLE ELECTRIC LINE—BALTIMORE TRACTION CO.

& Fowler and Lamokin cars and Westinghouse equipment are used on this line. Last June the Traction Company purchased the Curtis Bay electric road which commenced operations in May, 1892. This line starts from the lower part of the city and runs across the Patapsco River to Curtis Bay, a manufacturing suburb of considerable importance located about five miles below the city limits on the water front. The Carey Street line of the Traction Company gives this road a city connection and makes it an important link in the system of the company. The Curtis Bay line has its own power plant on the south side of the Patapsco River, consisting of three 250 H. P. McIntosh & Seymour engines and Edison generators, and three 150 H. P. Baschor boilers and two 300 H. P. Climax boilers. Below the city limits this road runs chiefly through a rural section and is laid with fifty-eight pound T rails. This line has twenty-five sixteen and eighteen foot Lewis & Fowler cars, each with two twenty-five horse power Edison motors.

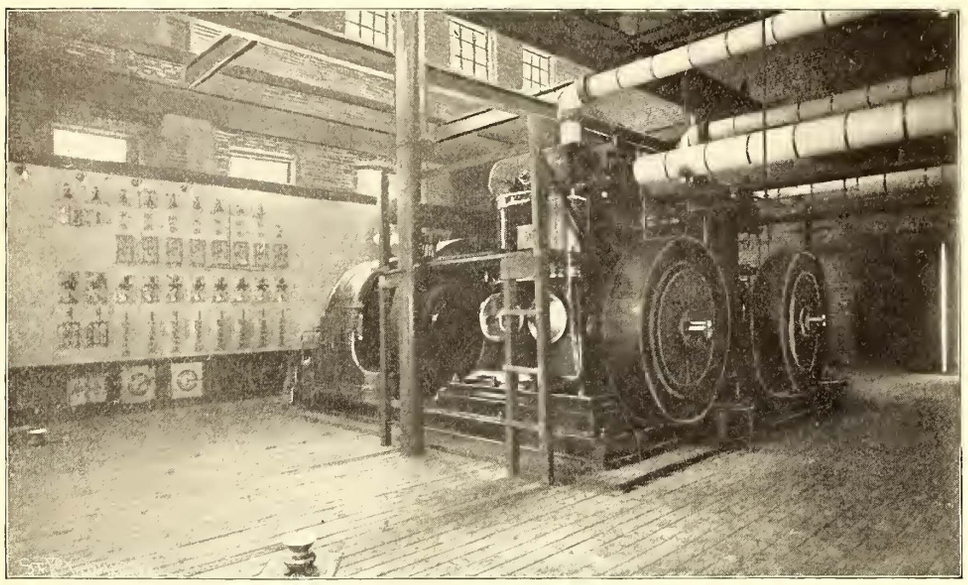


FIG. 4.—CHARLES STREET POWER STATION—BALTIMORE TRACTION CO.

The Linden Avenue and Huntingdon Avenue lines are two short north and south lines in the center of the city, both of which have been rebuilt and changed to electricity. On both, Johnson eighty pound, six inch, girder rails on two inch chairs, are used. These two lines have Brownell "Accelerator" cars, and, like the other lines which have been equipped by the Traction Company, have Westinghouse apparatus. The Edmondson Avenue line, an important crosstown road, is now being changed to electricity, and its construction and equipment will be the same as the two just mentioned. Starting from the northwestern terminus of the Edmondson Avenue line, the old Powhatan horse railway extends out into the country a distance of about four miles. This is still an example of primitive transit, but its reconstruction in the near future is probable.

On South Charles Street, near the center of the city, the construction of a central station for the electric lines of the company has been commenced, and power is already being furnished from this point for a portion of the system by two 250 H. P., direct-coupled Westinghouse units, to which steam is supplied by two 500 H. P. Climax boilers. This plant will be increased by the addition of a 500 H. P. Westinghouse direct-coupled unit, which is now under construction. The location of this station will enable it to serve conveniently the principal lines of the company, and it has been planned upon a comprehensive scale, although only a portion of the plant is now being installed. When completed this station will have a nominal capacity of 2,000 H. P. In this house there is a magnificent white marble switchboard, 30×12 ft., with a handsome equipment of instruments.

At the corner of Mt. Royal Avenue and McMechin Street, in the upper part of the city, foundations have been laid for a handsome car barn to accommodate the lines embraced in the North Baltimore division of the company, the Linden Avenue, Huntington Avenue and Fremont Street lines. There will be room for about ninety cars.

All of the work done by the Traction Company shows regard for economical operation and long life. Doubtless some of the work could have been done at a considerably less expense, but the policy of the company has been to pay more attention to future economies than to first costs.

FIG. 5.—JUNCTION OF CABLE LINES—BALTIMORE TRACTION CO.

THE CENTRAL PASSENGER RAILWAY COMPANY.

The Central Passenger Railway was first put in operation as a horse line in February, 1893. It runs southward from Druid Hill Park on the northwest into the residence portion of the city, and then crosses to East Baltimore, whence it strikes south to the water front. Its entire route is practically through the residence portion of the city without touching the business center, but the communication with the park which it has afforded to a large portion of the population has given it good traffic in addition to its regular crosstown travel. A free transfer arrangement with the Lake Roland road at the intersection of Guilford Avenue and Preston Street gives the road an entrance into the business center of the city, and there is a heavy exchange of business between the two lines. An extension of the line, for which ordinances have been introduced, will carry the tracks from their present eastern terminus to the vicinity of Patterson Park, and thence to the eastern limits of the city.

The change to electricity was made in 1892, regular operation with electric power commencing September 17. This was practically the first road in the city proper to be operated wholly be electricity. When the change was made, the entire road was rebuilt and newly equipped, and the line was extended a mile and a half from its former terminus at Fulton Station to Druid Hill Park. The line now consists of six and a half miles double track. The track is eighty pound, center bearing, Johnson girder rails, spiked to Georgia pine ties, two feet centers. There are several grades of 4 to 6 per cent. on the line, one 6 per cent. grade on Caroline Street in East Baltimore being nearly half a mile in length.

The power station is on Preston Street, about the center of the line. It is an annex to the car barn and former stable. The plant consists of four 250 H. P. McIntosh & Seymour tandem compound engines and four 200 K. W. Thomson-Houston generators. Steam is supplied from four 250 H. P. Campbell & Zell boilers. The plant is very plain and simple, but does its work satisfactorily, often carrying sixty cars. In addition to operating the cars of this road, power is supplied by this plant for a portion of the City & Suburban system.

There are now in service on this road twenty Stephenson cars with McGuire trucks, and ten Brill cars with trucks from the same builders. Two twenty-five horse power Thomson-Houston motors are used for each car. Ordinarily single cars are run, but when traffic demands, trailers are used, ten Stephenson cars that were used on the horse road being utilized for this purpose. The cars of this line are painted an orange color. President Blakistone, of the Central Company, is much interested in the car fender question, and is equipping his cars with a device of his own invention. It is a hooked fender, fastened to the front end of the platform and extending back under the platform. A light board suspended from the front edge of the platform, automatically throws the fender down to the track when struck by any obstruction, or the fender may be thrown down by the motorman. Experiments with this fender have given satisfactory results, and in the single instance in which it has had the test of actual use it has worked successfully.

A New Street Railway Motor.

We show in the accompanying engraving views of a new street railway motor, designed and built by W. E. Moore and R. J. Edenfield, both of Augusta, Ga. It is

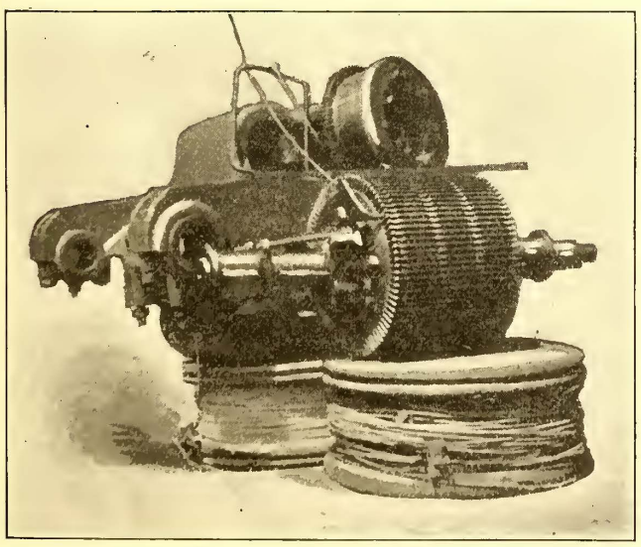


FIG 1.—GENERAL VIEW OF MOTOR AND PARTS.

a six pole, iron clad, single reduction motor of thirty horse power, designed especially with an eye to simplicity and ease of repair. The armature is of the Pacinotti ring type, made very light by reason of the six pole construction, and is wound with a modified drum winding, so arranged that any one coil may be removed without the necessity of removing any of the others. The coils are lathe wound and taped, then laid in place in the slots, each coil being of the same size, and symmetrically arranged with regard to the other coils.

As there are no wires through the inside of the armature, it is left with a very large opening which secures good ventilation and cool running.

The commutator is built in the most substantial style, being twelve inches in diameter, with a four inch face. The bars, which are made of hardened copper one and one fourth inches deep, are bedded on mica, and held by

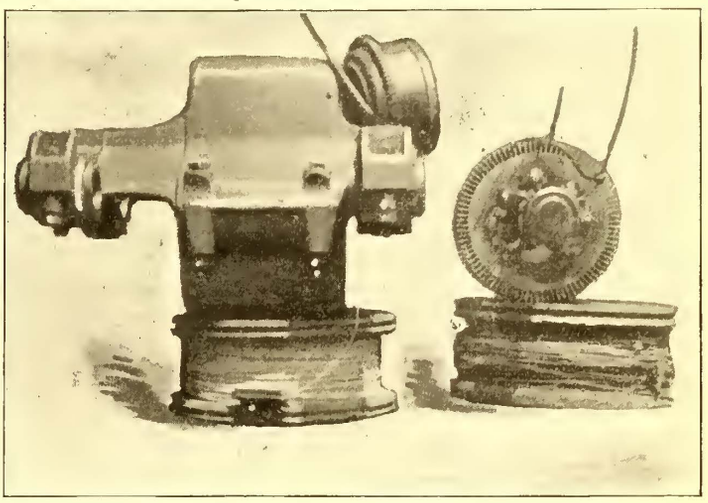


FIG. 2.—END VIEW OF ARMATURE AND MOTOR, SHOWING ONE COIL IN PLACE.

heavy clamps insulated with mica covers for the full depth of the bars, thus making it practically impossible for a bar to work loose or become "high." The attachment of the commutator is secured by four machine bolts fitting in T slots in a projection of the armature spider. This method does away with keys, keyways and loose commutators.

The armature shaft is of steel, two and one sixteenth inches in diameter and is pressed into the bearing sleeves, which are made of hardened steel four and a half inches in diameter by five and a half inches long for pinion end, and four inches long for the commutator end.

The field magnet and frame consists of but two castings, has six poles, three consequent and three salient, and carries three field coils, which are wound with a wire of rectangular section. The lower half of the field magnet

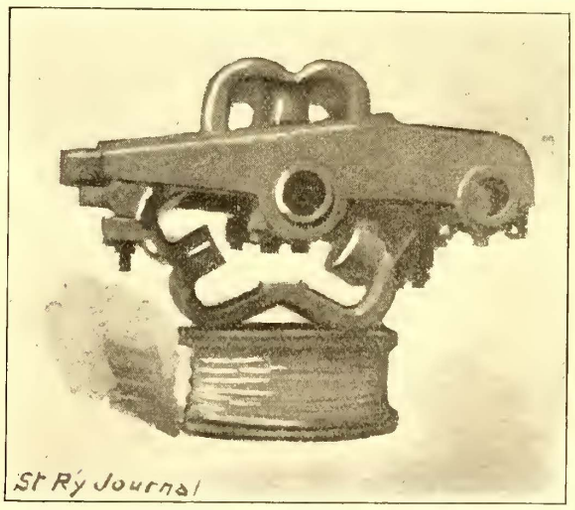


FIG. 3.—SIDE VIEW OF FIELD MAGNET FRAME.

may be swung back on eyebolts out of the way by simply taking off two nuts, thus allowing access to the field coils and armature. The armature may then be lowered into the pit by unscrewing four cap bolts. It is not necessary to remove the brushholders or disconnect any of the cables to get out an armature. The ease of removing the armature and field coils was made an especial study in the design of this motor.

The side arms carrying the armature and axle brasses

are heavily ribbed, have large grease boxes cored in them and are cast integrally with the upper half of the field magnet. Ordinary standard machine bolts have been used throughout, where it has heretofore been customary to use cap screws, so that in case of breakage, it is not necessary to drill and tap out, but is only a minute's work to put in a new bolt. All bolt heads fit into square sockets, and National nut locks are used under the nuts. The brush holders are conveniently located on top of the commutator 60 degs. apart.

The motor is suspended by means of bolts and springs under the ends of the side arms.

The disposition of metal has been carefully studied and the machine made as light as possible (1,725 lbs. without axle gear) consistent with the great strength and rigidity necessary for the rough usage of street railway service.

One of these motors under car No. 21, when running on the hill line, at Augusta, is said to have used 20 per cent. less current than another car equipped with two motors of another make, and 25 per cent. less than a third car equipped with two motors of a still different make, all three cars weighing about the same and making the same trip in about the same time.

Street Car Fenders.

By Henry Root, San Francisco, Cal.

The form of the front of the modern cable and electric car is the outgrowth of two things, viz: The pilot or cow catcher of the locomotive, and the dashboard of the horse car; but the essential requirements of a modern cable or electric car are different from either. The controlling consideration in the design of the front of such a car should be the safety to life and limb of the general public, who lawfully occupy and use the public streets in common with the street car companies, and not the safety of the motor, grip car or engine, which the pilot or cow-catcher was designed especially to protect. Again in the cable and electric car there is no need of the dashboard for the purpose of protection from the splash of animals travelling in front and drawing the car; its changed purposes are to form a safely rail to prevent people falling off the front of the car, to form the most complete, strong, and impenetrable barrier from without against the poles and other projecting parts of vehicles and their loads, also against telescoping with other cars in case of an accidental collision; but further than this the front should be of such a form and construction as to do the least possible harm to persons not passengers who might be accidentally struck by the moving car, or dragged or pushed along the ground, or run over and crushed beneath the wheels and running gear. In this respect there is certainly a chance for improvement in a majority of cases, but in my opinion the desired improvement is not so much a subject for future invention as for good judgment and mechanical skill in utilizing and adapting to local requirements and conditions what has already been invented.

There was a season here in San Francisco, some ten years ago, while the fender invention fever was on, that it seemed as if every one who had nothing else to do, no matter how little he knew of the requirements of such a device, took to designing street car fenders. Some persons had their inventions patented, but others applied to the railroad companies for a trial; not meeting with the encouragement they thought themselves entitled to, or finding that what they had invented was already old, allowed their inventions to drop out of sight. The work of the great majority of inventors in that line at the present time is merely thrashing over old straw.

There is a large number of patented revolving fenders for similar purposes, having a "street sweeper movement," but the earlier ones of this kind were designed from the locomotive pilot, and for such a purpose were a total failure. I saw one of that kind used here on a street car about ten years ago; while it would throw obstructions off the track, it raised a cloud of dust under the car and was a nuisance generally; however, I think its speed of rotation was too great, and it might have been improved.

There was a novel suggestion at that time, in connection with the fender question, which was to cover the entire front end with an inflated rubber bag. I am confident that a fender of the Bennett & Fitch or Loftis kind, illustrated in the December, 1893, issue of the Street Railway Journal is practical. I believe it will come into general use, especially where it is impossible to carry a fixed fender less than four or five inches from the surface, as in cases where it is necessary to attach it to the vibrating spring body. It does not seem as if any device operated by hand from the front of the car can prove as effective and certain as a fixed or automatically operated device, for the reason that in a majority of cases it is impossible for the operator to anticipate which way a person will dodge, as people thrust themselves into danger suddenly and without warning and appear at the most unexpected times and places. There are a few general ideas in the matter, which I believe should be followed, and of the importance of which I am fully convinced.

First.—That the front of the car as well as the fender itself, should be free from all projecting irons; that the corner should be rounded and padded as well as the drawhead.

Second.—There should be a small ledge or step projecting forward at the bottom of the fender and as near the surface of the ground as possible, even if its horizontal width is not more than three inches; that the front or projecting edge of this ledge should be soft wood, either padded or covered with rubber; and furthermore that any fender sloping from its lower edge upward and backward without any ledge step or horizontal belt near the ground to prevent bodies rolling off, if once picked up, is radically and essentially wrong.

Third.—That the front should be nearly at right angles to the track. and not V shaped like the outline of the locomotive pilot. There is more danger of injury to a body in rolling it towards the sides and wheels than directly ahead; the purpose, however, should be to pick up the body unharmed and not roll it at all; suitable soft handles should be provided across the front and on the corners to enable persons in danger to catch hold and save themselves, as they can sometimes do.

The most desirable plan seems to be to carry the fender from solid boxes, either from the bottoms of the main axle boxes or from inside boxes specially provided for that purpose, and not from the spring body, which is necessarily subjected to a large movement through the effect of variable and badly distributed loads, but in some cases it may be desirable to have a double fender, one attached to the axle boxes, the other to the spring body. In case the fender is under the front end, care should be taken to have no projecting bolt points or brake rods over the fender, as they might injure a prostrate body.

It seems to me impracticable to use any of the long, scooping devices which have been invented during the past twelve years.

It is very difficult to prevent cars from closing up to each other; if in so doing the safety guard is in jeopardy, it is a vital defect; furthermore, a large device extending any considerable distance ahead is almost certain to be damaged by some cause or other in the course of a day's run; the more iron hollow pipes or wire nettings are used in such a device, the more obstinate and unmanageable it becomes in case of any slight injury to it. The so-called improvement in substituting iron, steel and wire netting for wood for such purposes is frequently, if not generally, a step backward.

Eighth Annual Meeting of the International Street Railway Association.

The eighth annual meeting of the International Street Railway Association, which includes among its members the principal street railway managers of France, Germany, Italy, Belgium, Holland, Austria, etc., will be held at Cologne, August 25 to 30, 1894.

THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS.*

BY EDWARD E. HIGGINS.

THIRD PAPER.

Class III. b. Surface Railways in American Cities of from 35,000 to 50,000 Inhabitants.

There are thirty-one cities in the United States having a population of from 35,000 to 50,000 by the census of 1890. Twenty are in the Eastern States, five in the Western, three in the Central, and three in the Southern. The total track mileage now exceeds 1,000, of which 75 per cent. is operated by electricity, 13 per cent. by horses, and the balance by various systems of motive power.

Eighteen of these cities are represented in the Table of Statistics, although but twelve appear in the class now under consideration, the population of two cities with their suburbs exceeding 50,000, while four are connected with metropolitan systems so that their statistics cannot be given separately. Of the remaining thirteen, one is a purely residential city, having an insignificant local street railway system; one has undergone so many changes during the past three years that its statistics are of little value; and the statistics of the remaining eleven cannot be obtained in a sufficiently complete form for present purposes. Two cities of less than 35,000 inhabitants are also represented in the table, being brought into this class by reason of the added population of their suburbs.

At the end of the various fiscal years ending in 1890, six of the fourteen systems represented in the table were in operation wholly by horses, one was operating wholly by electricity, six were changing from horses to electricity, and one was operating partly by horses and partly by steam. At the end of the fiscal year of 1892 nine systems were in substantially complete operation by electricity, three by horses, and two were in process of change from horses to electricity. In 1890 141 miles of track were in operation by horses as against but 85 miles by electricity, while in 1892 221 miles were operated by motive powers other than horses as against but 70 miles by horses.

The fact that a majority of these systems were changing from horses to electricity as early as 1890 makes it impossible to discuss their characteristics by the methods hitherto adopted. They can best be treated by separating them into three groups based on the maximum gross earning power per capita developed up to 1892. The first group contains two systems only, which have earned less than $2.00 per capita per annum, the second group contains four which have earned between $2.00 and $3.00 per capita, and the third group contains seven which have earned over $3.00 per capita.

DISCUSSION OF TWO SYSTEMS SHOWING A PASSENGER INCOME LESS THAN $2.00 PER CAPITA PER ANNUM.

The small earning power of these two systems is easily explained. Case No. 72 operated 6 miles by horses in 1890, and 7 miles by electricity in 1892, serving a manufacturing city of 40,000 inhabitants with from 3 to 5 car miles per capita per annum. The street mileage is below the average for a city of this size, and the car service is of course much too small for large passenger income. Nevertheless, this road earned about $7,000 net in both 1890 and 1891 with horse operation, and nearly $28,000 in 1892 with electric, equivalent to a return of 14 per cent. on both the old capitalization ($7,600 per mile of track), and the new ($25,000 per mile of track). It is possible, therefore, that this road has profited by not following the prevailing fashion of pushing out extensions and greatly increasing the service when equipping by electricity.

Case No. 66 is a 9 mile horse railway serving a country district tributary to a manufacturing town of 27,000 population. It is a question if this case is not, strictly speaking, an interurban road. A service of less than 5 car miles per capita produced an income of $6,800 per mile of street, $.33 per car mile (due in part to ten cent fares between the towns), and $1.90 per capita. The operating expenses in 1890 were 83 per cent. of the passenger income, but in the following year rose to 97 per cent. and again fell in 1892 to 89 per cent. The corresponding net income was equivalent to a return of but 7 per cent., 3 per cent. and 6 per cent. in the respective years on capital liabilities of less than $10,000 per mile of track. This road is now being largely extended and equipped by electricity, and will doubtless show a marked increase in both gross and net earnings.

DISCUSSION OF FOUR SYSTEMS SHOWING A PASSENGER INCOME OF BETWEEN $2.00 AND $3.00 PER CAPITA.

It is at once noticeable that three of these four systems serve cities of 35,000 population—the smallest of the class now under consideration—while the fourth serves 49,000—the largest.

Case No. 65, as a horse railway in 1890, operated 11 miles of road and gave a car service of 22 miles per capita. Its passenger earnings were $7,100 per mile of street, $.096 per car mile, and $2.16 per capita, figures which correspond very well with several roads described in the preceding class. Its operating expenses were 91 per cent. of the passenger income and its net earnings were less than $7,000, equivalent to 1.4 per cent. on capital liabilities of $34,500 per mile of track, a part of which may possibly represent the unexpended balance of moneys obtained for change of motive power.

Case No. 68 is a much better horse railway statement. With but 7 miles of road and with a car service of 14 miles per capita, it earned somewhat more than Case No. 65, and operated at 81 per cent. of the passenger income, so that the net earnings were over $16,000, equivalent to nearly 5 per cent. on capital liabilities of $41,000 per mile of track. This is an excellent showing, and tends to confirm the evidence previously given that it is frequently unwise for these small roads to largely increase their track and car mileage.

Case No 69 is in some respects peculiar. It serves an exceedingly compact city of 35,000 inhabitants, the business district of which is centrally located both as to population and area. In 1889–90 the system consisted of five horse roads and one small electric road. The horse roads were miserably constructed and were operated in a poor and "shiftless" manner. The fact that there were 21 miles of road in the city means little when the conditions are understood. For example, one road 5 miles in length was operated by an individual owner with but a single car, of which he was himself the driver, while others were leased to parties who had no interest in keeping the property in good condition. Little reliance is to be placed on the figures of operating expenses and net earnings in 1890, but in 1892 they are believed to be correct. This system is now (1894) serving a population of over 40,000, is operated entirely by electricity, and is earning about $2.50 per capita gross.

Case No. 78 is a reasonably capitalized and thoroughly well managed property. As a horse road its passenger income was fair on a moderate car service; it operated for 75 per cent. of the passenger income, and earned 10.5 per cent. on capital liabilities of $21,000 per mile of track. As an electric road it has not yet reached its full development, but is even now earning $8,500 per mile of street and $2.76 per capita, is operating at 75 per cent. of the passenger income and returns 12.3 per cent. on capital liabilities of less than $17,000 per mile of track. It should be noted, however, that its present floating debt is equal to about $17,000 per mile of track in addition to

TABLE III.—AMERICAN STREET RAILWAY SYSTEMS

PART I.—STATISTICS OF CAPITALIZATION.

See "Intrinsic Value of Street Railway Investments." Horse Railways are given in Roman figures.

Case Number	Miles of Track					Miles of Street	Capital Stock			Funded Debt			Capital Liabilities			Floating Debt		Case Number
	Horse	Electric	Cable	Miscel.	Total		Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Memo.	
A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T
65	13.9	.....	.....	.....	13.9	10.6	330,000	23,700	9.40	150,000	10,800	4.30	480,000	34,500	13.70	.....	.....	65
	2.0	*19.5*	.....	.....	*21.5*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
66	14.0	.....	.....	.....	14.0	8.9	144,000	10,300	4.10	.....	.....	.....	144,000	10,300	4.10	s 9,028	Net.	66
	15.0	.....	.....	.....	15.0	9.8	144.000	9,600	4.10	.....	.....	.....	144,000	9,600	4.10	10,858	"	
67	*2.4*	*11.5*	.....	*8.0*	*21.9*	*19.2*	*234,467*	*10,700*	*6.70*	*69,700*	*3,200*	*2.00*	*304,167*	*13,900*	*8.70*	.....	.....	67
	.....	*15.0*	.....	*8.0*	*23.0*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
68	8.4	.....	.....	.....	8.4	7.2	150,000	17,900	4.30	192,500	23,000	5.50	342,500	40,800	9.80	.....	.....	68
	9.0	.....	.....	.....	9.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
69	17.4	5.0	.....	.....	22.4	21.3	175,696	7,900	5.00	153,051	6,800	4.40	328,747	14,700	9.40	18,852	Net.	69
	12.5	*13.0*	.....	.....	*25.5*	*23.1*	*266,519*	*10,500*	*7.60*	*200,000*	*7,800*	*5.70*	*466.519*	*18,300*	*13.30*	*27,910*	"	
70	14.6	.....	.....	.....	14.6	11.3	200,000	13,700	5.60	.....	.....	.....	200,000	13,700	5.60	28,851	Net.	70
	14.6	.....	.....	.....	14.6	11.3	200,000	13,700	5.60	.....	.....	.....	200,000	13,700	5.60	74,778	"	
71	13.7	4.5	.....	.....	18.2	14.1	195,000	10,700	7.20	150,000	8,200	5.60	345,000	19,000	12.80	17,615	Net.	71
	4.3	*26.2*	.....	.....	*30.5*	*23.3*	*335,000*	*11,000*	*9.10*	*355,000*	*11.600*	*9.60*	*690,000*	*22,600*	*18.60*	*191,522*	"	
72	6.6	.....	.....	.....	6.6	5.9	50,000	7,600	1.30	.....	.....	.....	50,000	7,600	1.30	15,025	Net.	72
	.....	*8.0*	.....	.....	*8.0*	*7.1*	*200,000*	*25,000*	*5.00*	.....	.....	.....	*200,000*	*25,000*	*5.00*	*943*	"	
73	*10.0*	*13.0*	.....	.....	*23.0*	*11.3*	*567,600*	*24,700*	*13.90*	*240,000*	*10,400*	*5.90*	*807,600*	*35,100*	*19.70*	.....	.....	73
	.....	*37.0*	.....	.....	*37.0*	.....	*852.000*	*23,000*	*20.80*	*450,000*	*12,200*	*11.00*	*1,302,000*	*35,200*	*31.80*	.....	.....	
74	.....	*18.0*	.....	.....	*18.0*	*16.0*	*400 000*	*22,200*	*9.80*	*200,000*	*11,100*	*4.90*	*600,000*	*33,300*	*14.60*	*253*	Net.	74
	.....	*22.0*	.....	.....	*22.0*	*18.5*	*700,000*	*31,800*	*17.10*	*315,000*	*14,300*	*7.70*	*1,015,000*	*46,100*	*24.80*	*59,291*	"	
75	16.1	.....	.....	.....	16.1	13.3	260,000	16,100	6.30	93,000	5,800	2.30	353,000	21,900	8.60	12,591	Net.	75
	12.8	3.8	.....	.....	16.6	13.8	260,000	15,700	6.30	100,000	6,000	2.40	360,000	21,700	8.80	30,303	"	
76	15.0	.....	.....	12.0	27.0	25.0	60,000	2,200	1.40	450,000	16,700	10.50	510,000	18,900	11.90	.....	.....	76
	.....	*37.3*	.....	*4.0*	*41.3*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
77	*3.1*	*8.0*	.....	.....	*11.1*	*18.5*	*199,000*	*17,900*	*4.50*	*575,900*	*51,800*	*13.10*	*774,900*	*69,800*	*17.60*	*71,429*	Net.	77
	.....	*11.1*	.....	.....	*11.1*	*18.5*	*201,500*	*18,200*	*4.60*	*639,500*	*57,700*	*14.60*	*841,000*	*75,800*	*19.10*	*26,759*	"	
p 78	5.5	5.2	.....	.....	10.7	10.3	225,000	21,000	4.60	.....	.....	.....	225,000	21,000	4.60	6,237	Net.	p 78
	.....	z *16.5*	.....	.....	z *16.5*	*15.8*	*274,988*	*16,700*	*5.60*	.....	.....	.....	*274.988*	*16,700*	*5.60*	*265,622*	"	

s. Current assets exceed current liabilities. z. Approximate. p. This report does not include one insignificant horse road.

the capital liabilities, so that the true capitalization is about $34,000 per mile of track. The road will probably earn from 8 to 10 per cent. on this capitalization.

DISCUSSION OF SEVEN SYSTEMS SHOWING A PASSENGER INCOME OF OVER $3.00 PER CAPITA.

It is a pleasure to turn to the seven systems of this group, not only because they represent the highest development of the street railway industry yet encountered, but also because it is clear that we are coming "out of the woods" and into a region of values sufficiently large to be attractive to investors. It is with special interest, therefore, that we study the characteristics of these seven systems.

The passenger income of five of the seven ranges from $150,000 to $175,000; the sixth serves a city of 36,000 inhabitants and probably earned in 1892 not less than $145,000 with horses, equivalent to over $4.00 per capita; and the seventh, which serves a comparatively unimportant Western city of 41,000 inhabitants, earned $136,000, equivalent to $3.32 per capita. Two of the seven roads report earnings in 1890 only, and their 1892 figures doubtless considerably exceed those of 1890, especially Case No. 76, which was operated by horses and steam power in 1890 and by electricity in 1892. All these totals are good. It is especially gratifying to find that the largest earnings per capita were made by a system serving only 37,000 inhabitants, 10,000 of whom were in small townships tributary to a brisk manufacturing city of 27,000 inhabitants. The cause of this is partly found in the large street mileage (23) and good car service, but it is also true that the factories of this city are exceptionally prosperous, pay good wages to their employes and have fewer "poor seasons" than is found in most industries. Another city system serving but 36,000 inhabitants—Case No. 70—earns over $4.00 per capita, being the commercial metropolis of an important state.

The street mileage of nearly all of these roads is much in excess of the others of the class, and points to one cause of their greater prosperity. The population per mile of street of five of the seven roads ranges from 2,500 to 3,600, and of the other two is about 1,700. The roads are giving a service of from 14 to 19 car miles per capita, one road operating 27 miles per capita.

The roads operating the largest street mileage are earning from $7,500 to $8,000 per mile of road, while those operating from 11 to 14 miles are earning from $12,000 to $14,000 per mile. Three roads are earning from $.25 to $.30 per car mile, two from $.15 to $.20 and one (1890) but $.11.

Again we find that the horse roads in 1890 are operating at very nearly 80 per cent. of the passenger income. The electric roads appear to do somewhat better, the percentage of operating expenses ranging from 70 to 78. Case No. 73 shows operating expenses of but $.076 per car mile equivalent to 51 per cent. of the passenger income, but however true this showing may have been in 1890, this low percentage of operating expenses cannot

SERVING FROM 35,000 TO 50,000 POPULATION.

PART II.—STATISTICS OF OPERATION.

Electric, Cable and Steam Railways are given in italics.

Case Number	Population Served	Area	Population Per Mile Street	Population Per Square Mile	Year Ending	Car Mileage Total	Car Mileage Per Capita	Passenger Income Total	Passenger Income Per Mile Street	Passenger Income Per Car Mile	Passenger Income Per Capita	Operating Expenses Total.	Operating Expenses Per Car Mile	Operating Expenses % Passenger Income	Net Earnings Total	Net Earnings Per Car Mile	Net Earnings % Passenger Income	Net Earnings % Cap. Liab.	Case Number
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
65	35,000	....	3.300	.....	6-30-1890	785,264	22.4	75,463	7,100	.096	2.16	68,771	.088	91.1	6,692	.009	8.9	1.4	65
	.....	....	.....	.....	8- 1893	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
66	35,000	....	3,900	.....	9-30-1890	166,291	4.7	56,802	6,400	.342	1.62	47,348	.285	83.3	10,378	.062	18.3	7.2	66
	35,000	....	3,600	.....	9-30-1892	201,040	5.7	66,275	6,800	.330	1.90	58,817	.293	88.7	8,860	.044	13.4	6.2	
67	*35,000*	....	*1,800*	.....	*6-30-1890*	*586,900*	*16.8*	*105,564*	*5,500*	*.181*	*3.03*	.....	.....	.....	.....	.....	.....	.....	67
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
68	35,000	....	4,900	.....	6-30-1890	481,800	13.8	80,229	11,100	.166	2.29	65,316	.135	81.4	16,532	.034	20.7	4.8	68
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
69	35,000	....	1,600	.....	6-30-1890	.....	.....	48,491	2,300	....	1.39	38,863	....	80.2	9,630	....	19.9	2.9	69
	35,000	....	*1,500*	.....	*6-30-1892*	.....	.....	*84,179*	*3,600*	....	*2.41*	*59,500*	....	*70.7*	*26,030*	....	*30.9*	*5.6*	
70	36,000	....	3,200	.....	9-30-1890	432,603	12.0	136,011	12,000	.314	3.77	112,330	.258	82.4	26,324	.061	19.3	13.2	70
	36,000	....	3,200	.....	9-30-1891	.....	.....	140,751	12,500	....	3.92	125,691	....	89.4	16,760	....	11.9	8.4	
71	27,000	....	1,900	.....	9-30-1890	416,853	15.4	102,647	7,300	.247	3.81	81,364	.195	79.0	22,735	.054	22.0	6.6	71
	37,000	....	*1,600*	.....	*9-30-1892*	*690,296*	*18.6*	*174,484*	*7,500*	*.252*	*4.70*	*128,316*	*.186*	*73.6*	*48,734*	*.071*	*28.0*	*7.1*	
72	40,000	....	6,800	.....	9-30-1890	125,182	3.1	33,885	5,700	.271	.85	27,541	.220	81.1	7,170	.057	21.2	14.3	72
	40,000	....	*5,600*	.....	*9-30-1892*	*186,445*	*4.7*	*64,614*	*9,100*	*.347*	*1.62*	*37,380*	*.201*	*57.9*	*27,607*	*.148*	*42.7*	*13.8*	
73	*41,000*	....	*3,600*	.....	n	*1,104,000*	*26.8*	*164,913*	*14,600*	*.150*	*4.02*	*83,746*	*.076*	*50.7*	*83,643*	*.076*	*50.7*	*10.3*	73
	41,000	....	.....	.....	*1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
74	*41,000*	....	*2,600*	.....	*6-30-1890*	*688,025*	*16.8*	*74,604*	*4,700*	*.108*	*1.82*	*49,098*	*.071*	*65.8*	*26,049*	*.038*	*34.9*	*4.3*	74
	41,000	....	*2,200*	.....	*6-30-1892*	.....	.....	*136,207*	*7,400*	....	*3.32*	*97,414*	....	*71.6*	*39,079*	....	*28.8*	*3.8*	
75	41,000	....	3,100	.....	9-30-1890	538,829	13.1	143,000	10,800	.265	3.49	116,702	.217	81.8	29,021	.054	20.3	8.2	75
	41,000	....	3,000	.....	9-30-1892	569,135	13.9	167,871	12,200	.295	4.10	130,491	.228	77.4	38,981	.069	23.2	10.8	
76	43,000	....	1,700	.....	6-30-1890	815,400	19.0	157,488	6,300	.193	3.65	129,844	.160	82.8	29,804	.037	19.0	5.8	76
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
77	*44,000*	....	*2,400*	.....	*6-30-1890*	.....	.....	*128,963*	*7,000*	....	*2.93*	*91,862*	.. .	*71.2*	*22,298*	....	*17.3*	*2.9*	77
	44,000	....	*2,400*	.....	*6-30-1892*	.....	.....	*151,674*	*8,200*	....	*3.45*	*117,810*	....	*77.6*	*19,758*	....	*13.0*	*2.3*	
p 78	49,000	....	4,800	.....	6-30-1890	667,510	13.6	94,410	9,200	.141	1.93	70,676	.106	74.9	o 23,734	.035	25.1	10.5	p 78
	49,000	....	*3,100*	.....	*6-30-1892*	.....	.....	*135,060*	*8,500*	....	*2.76*	*100,169*	....	*74.1*	o *34,891*	....	*25.8*	*12.3*	

n. Fiscal years of the several roads end at different dates. o. From operation.

possibly be maintained under the conditions set forth in the statistics. The operating expenses per car mile in this class as in the others so far discussed are so widely different as to make it evident that no generalizations can yet be made on these figures, where so many diverse influences are at work to affect results.

We note with satisfaction that the net income of six of these systems ranges from $20,000 to $50,000, with the seventh (Case No. 73 previously referred to) showing $84,000. The net is now becoming sufficiently large to make it possible for these roads to secure good managers at a fair compensation, and thereby avoid many of the disasters which befall small properties from lack of careful and conservative handling.

Coming now to returns upon investment, we find that two of the roads have capital liabilities of $14,000 and $19,000 per mile of track respectively, and that their net earnings are equivalent to a return of from 6 to 13 per cent. upon these liabilities. Two roads are capitalized at about $21,000 per mile of track, and are earning 7 and 11 per cent. respectively upon the capital liabilities. Case No. 73 is capitalized at $35,000 per mile of track and is *apparently* earning 10 per cent. on these liabilities, but, as previously stated it is probably impossible for this road to keep up so large an earning power. Case No. 74 is capitalized at $46,000 per mile of track and is earning about 4 per cent. on these liabilities, and case No. 77 is earning but 2.3 per cent. on a capitalization of $76,000 per mile of track, and is now in the hands of a receiver because of default on the interest of its bonds.

DISCUSSION OF SIX ROADS OPERATING CHIEFLY BY HORSES IN 1890 AND BY ELECTRICITY IN 1892.

There are four fully reported systems in this class which were in operation partly by horses and partly by electricity as early as 1890; one which was in operation by horses only; and one by electricity only. In 1892 the process of conversion to electricity was substantially completed in four of the six systems, the fifth operated 26 miles by electricity and 4 miles by horses, and the mileage of the sixth was nearly evenly divided between the two motive powers. It is evident, therefore, that these roads were partially developed in 1890 and had not, in 1892, reached the full measure of their earning power. The returns for 1893 or 1894 would doubtless show a much greater increase, in both gross and net earnings, over those of 1889, than is shown in comparing the report of 1892 with that of 1890. Nevertheless, the last named comparison is decidedly interesting and in most respects satisfactory.

The total track mileage was increased from 87 (46 horse, 41 electric) in 1890, to 114 (17 horse, 97 electric) in 1892. The funded debt in 1890 was $12,400 per mile of track and in 1892 only $13,200, while the total capital liabilities which were $26,700 in 1890 were $30,600 in 1892. This average capitalization is not excessive, though above

the actual cost of duplicating tangible assets. It should be noted that the floating debt in 1890 was $129,000 and in 1892, $572,000. It is probable that the latter will be converted into funded debt later on.

The passenger income of these six roads in 1890 was $483,000, equivalent to $5,600 per mile of street and $2.00 per capita. The passenger income in 1892 was $746,218, equivalent to $7,000 per mile of street and $2.97 per capita, an increase of 54 per cent.

The operating expenses in 1890 were 74.3 per cent. of the passenger income, and in 1892, 72.5 per cent. It is probable that the returns of the following year would show some reduction of this percentage by reason of more complete electric operation.

The net income in 1890 was $121,616, and in 1892 $196,099, an increase of 61 per cent. The return on the capital liabilities was very nearly the same, being 5.3 per cent. in 1890 and 5.6 per cent. in 1892. Here again the following year will doubtless show more favorable results.

GENERAL CONCLUSIONS.

1. American cities of from 40,000 to 50,000 inhabitants will usually patronize a well managed electric street railway system 12 to 18 miles in length to the extent of from $3.50 to $4.50 per capita of passenger income. One or two Western cities of this size are earning over $5.00 per capita gross on exceptionally large street and car mileage.

2. If it were possible to construct these electric railway properties anew, according to the best engineering practice of the present day, they could be operated in most cases at from 70 to 75 per cent. of the passenger income. Unfortunately, however, many of the roads have purchased early or inferior apparatus and material, and the operating expenses cannot be kept down to these figures, but will probably average at least 80 per cent. of the passenger income.

3. Under the most favorable conditions of operation a net earning power of about $1.00 per capita is a reasonable expectation of profit, but $.75 per capita is, and will be, a more usual figure.

4. $.75 per capita is a return of 5 per cent. per annum on capital liabilities of $15.00 per capita, and of 7.5 per cent. on capital liabilities of $10.00 per capita, the latter figure representing about the average cost of building and equipping electric railway systems of from 12 to 18 miles in length in cities of this size. $1.00 per capita—which represents the approximate net earning power of a *perfectly constructed and equipped* street railway system in cities of this size—is equivalent to a 10 per cent. return upon the actual cost of its construction (apart from franchises), and it may be said, therefore, that the electric railway properties of this class are *intrinsically* 10 per cent. investments.

5. Only two or three of the properties represented in the table appear to be overcapitalized according to the standard of a 5 per cent. return on both capital stock and funded debt, although many have been overcapitalized on the basis of cost of duplicating the tangible assets.

It must be understood that all of these deductions are of the most rough and general character, and cannot be applied to individual cases without careful study of local conditions.

STREET RAILWAY INVESTMENT COMPANIES.

It may not be out of place to point out the fact that in dealing with these small roads whose comparatively petty issues of securities are not readily marketable, "Traction Companies" or "Street Railway Investment Companies" find a legitimate and profitable field when honestly and conservatively managed. Few bankers care to handle a $100,000 bond issue, not only because the expenses, time and trouble involved are nearly as great as in much larger transactions, but also because the results from mismanagement of such properties, located, as they frequently are, far away from the financial centers, are more serious than will be the case in larger systems where the margin of profit is not so easily destroyed. There would consequently be a true advantage in organizing a company for the purchase of the entire bond and stock issues of a number of these small roads after careful expert examination of each property, and for the exercise of a sharp supervision over their managements by means of a permanent representation on their boards of directors. The bond issues placed in trust would serve as security for the issue by the Investment Company of collateral trust bonds at low rates of interest. The purchasers of these collateral trust bonds would, therefore, average their risks over a larger number of underlying securities, and would have, in addition, the guarantee of the Investment Company, backed by its credit and capital stock. It is true that investment companies of this character formed in recent years to purchase as collateral real estate mortgages as well as various stock and bond issues have been somewhat discredited in conservative investing circles. This is due, however, not to any theoretical imperfection of the system, but to the gross mismanagement of many of such companies which has been shown especially in the purchase of "cats and dogs" as underlying securities for the collateral trust bonds.

The usual table follows, presenting in convenient form for study the principal information about the systems of this class represented in the Table of Statistics.

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 35,000 TO 50,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
MILES OF TRACK.				
No. of miles operated	140.7	85.2	70.2	221.4
FUNDED DEBT PER MILE OF TRACK.				
No. of miles not reporting	.	....	9.0	85.8
" " having no funded debt	45.9	...	29.6	24.5
" " " an indebtedness less than $5,000 per mile	.....	21.9	.....	.....
" " " " " from $ 5.000 to $10,000 "	56.7	....	16.6	25.5
" " " " " " 10,000 to 15,000 "	13.9	41.0	....	89.5
" " " " " " 15,000 to 20,000 "	27.0	....	....	.....
" " " " " " 20,000 to 30,000 "	8.4	....	....	.....
" " " " " " 30,000 to 50,000 "	.....	....	....	.....
" " " " " over 50,000	.....	11.1	....	11.1
CAPITAL LIABILITIES PER MILE OF TRACK.				
No. of miles not reporting	..	....	9.0	85.8
" " capitalized at less than $10,000 per mile	6.6	....	15.0	.....
" " " at from $10,000 to $ 15,000 "	51.0	21.9	14.6	.....
" " " " 15,000 " 20,000 "	45.2	....	....	42.0
" " " " 20,000 " 30 000 "	26.8	....	16.6	38.5
" " " " 30,000 " 40,000 "	13.9	41.0	....	37.0
" " " " 40,000 " 50,000 "	8.4	...	....	22.0
" " " " 50,000 " 76,000 "	.....	11.1	....	11.1
POPULATION SERVED PER MILE OF STREET.				
No. of roads not reporting	.....	....	1	4
" " serving less than 2,000 inhabit. per mile	3	1	....	2
" " " from 2,000 to 3,000 " "	.....	2	...	2
" " " " 3,000 " 4,000 " "	4	1	3	1
" " " " 4,000 " 5,000 " "	2	....	....	.....
" " " " 5,000 " 6,000 " "	.....	....	....	1
" " " " 6,000 " 8,000 " "	1	....	....	.....
CAR MILEAGE PER CAPITA.				
No. of roads not reporting	1	1	2	8
" " giving a service of less than 5 car miles per capita	2	....	....	1
" " " " of from 5 to 10 " " "	.....	....	1	.....
" " " " " 10 " 15 " " "	4	....	1	.....
" " " " " 15 " 20 " " "	2	2	....	1
" " " " " 20 " 25 " " "	1	....	...	.....
" " " " over 25 " " "	.....	1	....	.....
PASSENGER INCOME.				
No of roads not reporting	.....	....	1	4
" " earning less than $50,000 gross per annum	2	....	...	.....
" " " from $50,000 to $75,000 gross per annum	1	1	1	1
" " " " 75,000 " 100,000 " "	3	....	....	1
" " " " 100,000 " 125 000 " "	1	1	....	.....
" " " " 125,000 " 150,000 " "	2	1	1	2
" " " " 150,000 " 200,000 " "	1	1	1	2
PASSENGER INCOME PER MILE OF STREET.				
No. of roads not reporting	.....	....	1	4
" " earning less than $3,000 per mile	1	....	....	.....
" " " from $3,000 to $ 5,000 per mile	.....	1	....	1
" " " " 5,000 " 6,000 "	1	1	....	.....
" " " " 6,000 " 7,000 "	2	....	....	.....
" " " " 7,000 " 8,000 "	2	1	1	2
" " " " 8,000 " 9,000 "	.....	...	...	2
" " " " 9,000 " 10,000 "	1	....	....	1
" " " " 10,000 " 15,000 "	3	1	2	.....
PASSENGER INCOME PER CAR MILE.				
No. of roads not reporting	1	1	2	8
" " earning less than 10 cents per car mile	1	....	....	....
" " " from 10 to 15 " " "	1	1	....	...
" " " " 15 " 20 " " "	2	2	....	.....
" " " " 20 " 25 " " "	1	...	....	.....
" " " " 25 " 30 " " "	2	....	1	1
" " " " 70 " 75 " " "	2	..	1	1

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 25,000 TO 35,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
PASSENGER INCOME PER CAPITA.				
No. of roads not reporting	....	....	1	4
" " earning less than $1.50 per capita	2	....	....	....
" " " from $1 50 to $2.00 per capita	2	1	1	1
" " " " 2.00 " 2.50 "	2	1	1	1
" " " " 2.50 " 3.00 "	....	....	....	....
" " " " 3.00 " 3.50 "	1	1	....	2
" " " " 3.50 " 4.00 "	3	....	1	....
" " " " 4.00 " 4.50 "	....	1	1	....
" " " " 4.50 " 5.00 "	....	....	....	1
OPERATING EXPENSES PER CAR MILE.				
No. of roads not reporting	1	2	2	8
" " operating at less than 10 cents per car mile	1	2	....	....
" " " from 10 to 15 cents per car mile	2	....	....	....
" " " " 15 " 20 " "	2	....	....	1
" " " " 20 " 25 " "	2	....	1	1
" " " " 25 " 30 " "	2	....	1	....
PERCENTAGE OF OPERATING EXPENSES.				
No. of roads not reporting	....	1	1	4
" " operating at less than 60 % of pass. income	....	1	....	1
" " " from 60 to 65 % of pass. income	....	....	....	....
" " " " 65 " 70 % " "	....	1	....	....
" " " " 70 " 75 % " "	1	1	....	4
" " " " 75 " 80 % " "	1	....	1	1
" " " " 80 " 85 % " "	7	....	....	....
" " " " 85 " 90 % " "	....	....	2	....
" " " " 90 " 95 % " "	1	....	....	....
NET EARNINGS.				
No. of roads not reporting	....	1	1	4
" " earning less than $7,500 net	2	....	....	....
" " " from $7,500 to $10,000 net	1	....	1	....
" " " " 10,000 " 15,000 "	1	....	....	....
" " " " 15,000 " 20,000 "	1	....	1	1
" " " " 20,000 " 30,000 "	5	2	....	2
" " " " 30,000 " 40,000 "	....	....	1	....
" " " " 40,000 " 50,000 "	....	....	....	1
" " " over 50,000	1	....	....	....
PERCENTAGE OF NET EARNINGS TO CAPITAL LIABILITIES.				
No. of roads not reporting	....	1	1	4
" " earning less than 2½ % on capital liabilities	1	....	....	1
" " " from 2½ to 5 % " "	2	2	....	1
" " " " 5 " 7½ % " "	3	....	1	2
" " " " 7½ " 10 % " "	1	....	1	....
" " " " 10 " 12½ % " "	1	1	1	1
" " " " 12½ " 15 % " "	2	....	....	1

Electrolysis of Underground Pipes in Brooklyn.

Geo. W. Plympton and Fred. R. Lee, Commissioners of Electrical Subways of Brooklyn, submitted to the Mayor on February 27 a special report on the corrosion of water pipes, gas pipes, and telephone cables by the return current of the electric railways in that city. The report which was presented to the Hon. Charles A. Schieren, Mayor of Brooklyn, was in part as follows:

The Board of Commissioners of Electrical Subways begs leave to submit the following report as an appendix to the annual report submitted December 15, 1893. It relates to a single subject, viz., the corrosion of water pipes gas pipes and telephone cables by the return current of the trolley electric system. The following report would have formed a part of the earlier communication, but the materials for it were not then obtainable.

The injury briefly referred to in the previous report can now be more completely specified and described by the aid of the specimens submitted herewith, which include the following:

The lead covering of a telephone cable in a conduit near corner of Court Street and Fourth Place. The cable laid in pitch on the bottom of the duct. The pitch proved no protection.

The covering of a telephone cable in a conduit on Court Street between First Place and Fourth Place.

The covering of a cable in a manhole at corner of Atlantic Avenue and Smith Street. The failure of the cable afforded the first intimation of the injury. A heavy trolley current had apparently followed the cable and left for the ground at this point.

From a cable under the rail of the Fifth Avenue trolley line near Flatbush Avenue. The same cable was also badly corroded at Bergen Street.

An iron water pipe which had been in the ground under the trolley track in Second Avenue for about a year.

An iron pipe used to replace the one just mentioned which had been destroyed by corrosion. The indentation and perforation near the left hand end of the pipe, were produced in thirty days.

A lead water pipe taken from four feet below the surface on Second Avenue near 54th Street.

The experience of Brooklyn is not notably different from that of Boston and Cambridge, Mass., Milwaukee, Wis., Columbus, O., Indianapolis, Ind., and Hamilton, O. In each of these cities similar corrosions have been detected, and in none is there any doubt as to the cause. It is known to be due to the imperfections of the means provided by the trolley companies for the conveyance of the electrical current back to the generator. It was at first supposed that the rails would be sufficient, but the current declines to take that route exclusively. An account of some experiments published in *The Electrical Engineer* may be profitably quoted here: "The resistance per mile of double track road was found to be .7675 ohm in dry earth without bonds connecting the rails. Where the rails were bonded with iron wire of No. 3 gauge and cross connected without a continuous return wire, the resistance was .0797 with dry and .0717 ohm with wet earth. Where the track was formed with No. 3 copper wire bonds riveted to the rails, each bond soldered to a continuous copper wire of the same gauge and the rails cross connected every 200 ft., the resistance was .0207 ohm with wet earth. When the track was made in the same way as in the last example, but further improved by soldering the riveted bonds to the rails and spacing the cross connections closer together, the resistance, when the earth was dry, amounted to .0254 ohm. Track bonded with two No. 4 galvanized iron wires without a continuous return wire had a resistance of .0577 ohm, when the earth was dry."

These figures show that some bond is necessary, and furthermore that the resistance of the rail section is so slight that the calculated resistance of the bonds accounts for nearly all of that observed. This suggests a practical point, namely, the desirability of making the bonds larger than is now the usual practice and omitting the return wire. The effect of this wire has long been generally acknowledged to be small, and its value to be chiefly as a supplement to the bonds. There is a strong tendency now to do away with it entirely. It increases the conductivity of the return circuit somewhat, but probably not as much as if the metal in it were used to make larger bonds. This shows that water, gas and telephone mains can be protected by better track construction, which will prove as advantageous to the railway company as to the other interests. This is one of the means of protecting mains from electrolysis, and suggests the following as a second method, which, in most cases, can probably be applied without much trouble.

The second method is merely the connection by metal conduits of the water mains, gas pipes and telephone cables, to which some electricity will probably always pass, with the generators at the points where there is the least resistance to return currents. These are not necessarily the points where the distance between the pipes and the generators is the shortest, for it is possible to have this shortest line through the dry sand and a line nearly a few hundred feet longer through moist earth with less resistance. The electricity of the return current would be apt to leave the pipes at the moist places under such conditions, and it is possible that the return metal circuit should be located here, although somewhat longer than at another point. Old rails, heavily bonded, have been suggested for this use, and would probably prove satisfactory.

It should be said in regard to this second method, that in making connections with the underground systems of pipes and cables that the points of such connections would require frequent examination. A copper connection with an iron pipe underground would not long remain a reliable conductor, unless special care and watchfulness were given to it. A better way to insure the conduction of the current is, doubtless, to make the car rail continuous by welding. This method will be employed on the new trolley line soon to be built in the southern part of the city. The most complete solution of the problem is afforded by the double trolley by which the return current is provided for by an overhead wire similar to the one for the outgoing current. But it is to be hoped that it will not be necessary to resort to this method.

Some notes of experiments, obtained through the kindness of I. H. Farnham, electrician of the N. E. Telephone Company, and relating to the early experience in Boston, are here given:

"When the action of the current was first noticed, the experiment of grounding the cables to lead plates buried in manholes was tried on quite an extensive scale, but was soon abandoned as being impracticable. The quantity of electricity to be dealt with was so enormous that the buried plates offered no appreciable protection to the cables. If such a system was feasible, the expense for the constant renewal of the plates would be very large."

As there has been some misunderstanding in regard to the potential measurements made in connection with the numerous corrosion investigations, it should, perhaps, be impressed upon those who are about to carry on similar investigations, that the potential measurements between the cables and pipes, and the material surrounding them, should, in the majority of cases, only be looked upon as the direction in which the current tends to flow.

To say that the pipes and cables are even practically safe from corrosion when the measurements are below a specified figure, would be extremely misleading. These measurements are, in a certain sense, like the measurements which might be made in an electrolytic cell, between one of the electrodes and various portions of the electrolyte, so that it is possible to conceive of almost zero potentials in the immediate vicinity of the most violent electrolytic corrosive actions.

The fact should be closely borne in mind that whenever we have a current passing from an easily oxidizable metal to the liquid, such as would be encountered in the earth, corrosion is bound to occur. A large number of electrolytic experiments have been carried out, showing the extremely low potentials (measurements between the electrodes) at which corrosion is likely to take place. In many cases iron and lead were destroyed under the conditions encountered in the underground systems, at potentials considerably under .5 volt.

The conclusions fairly drawn from these notes and from our own experience is that considerable injury is being done to underground pipes and cables, and that it will continue along the lines of the trolley roads (except where the elevated railway extends above them) until better methods of returning the current to the generator are put in practice. The electricians of the several trolley roads are fully aware of the situation, and have speedily applied means of prevention in localities where the corrosion has been detected. But it is doubtful if the method of final cure of the difficulty has yet passed the experimental stage.

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Jas. H. McGraw, Managing Editor. C. B. Fairchild, Editor.
H. W. Pool, Advertising Department. H. W. Blake, Associate Editor.

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

Address all communications to

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Most Gratifying Replies have been received by us in answer to nearly all requests for information for our financial supplement. It seems to be the general sentiment of bankers, street railway financiers and managers that a compilation of this kind is greatly needed, that our plans are the best and most comprehensive for the purpose, and that the supplement will be found a benefit to both the street railway companies and the investing public. New York bankers in particular are co-operating with us by advising the street railway companies in whose securities they are, or have been, interested to furnish us with full data of their roads. It will be admitted that these bankers are in a good position to weigh the relative advantages of silence and publicity, and that they decide upon the latter is not only gratifying, but significant. We respectfully ask that all reports be in by April 1, at the latest, in order to secure publication in the first issue of "American Street Railway Investments."

The Plans for Increasing Traffic, or for educating people to ride, that are efficient in some sections of the country, cannot in all cases be effectually employed in other localities, because there is a difference in existing conditions. For instance, park attractions that are so effectually employed in the West, fail when applied to some of the Southern cities, because of the existence in these communities of classes or clans, who will not mingle with each other or patronize resorts which are frequented by a rival set. This condition is not so marked in the larger cities, but does exist in some localities to an extent that is not appreciated by those who operate their lines in a more cosmopolitan community. Street railways, however, properly managed, are the most potent factors for correcting this state of affairs, and although the ingenuity of Southern street railway managers may be severely taxed to devise plans for increasing the patronage, their labors in this direction will doubtless eventually be rewarded by largely increased returns.

One of the Chief Annoyances incident to a superintendent's duties is the attention he must give to the numerous applicants, for work which besiege his office, especially during the present glut in the labor market. When his quota of employes is full, he should relieve himself as far as possible from personally meeting these people. In order to accomplish this, it is a good plan to provide a register in an ante-room, which should be in charge of a clerk, in which all the applicants should be required to record their names and addresses, with the understanding that should any additional help be required the applicants will be notified by mail, in the order in which they are registered, when they can report and fill up the necessary application blanks. This would work to the advantage of the company in two ways: It would save time and annoyance on the part of the officers, and, doubtless, reduce the number of applicants, as those who came having a chance to see that large numbers were registered ahead of them would so report, and discourage others from applying.

In Efficiency, Politeness and Honesty, the employes of street railway lines in Southern cities, so far as our observation goes, rank favorably with those of like occupations in Northern cities. In the matter of politeness to passengers they may be said to excel. On the principal street railway lines in Atlanta, the conductors, although the rules of the company do not require it, usually step down from the platform and assist ladies to board or alight from a car, and in stormy weather they take a lady's umbrella, raise it, and politely hand it to her after she has left the car. Such attentions are more or less fatiguing to the conductors, for it is hard work to step down from and return to the platform so many times during a day; but it tends to avoid accidents, and cultivates a favorable sentiment towards the company. It is found that country bred men make the most efficient and obedient car employes. Colored men are employed chiefly upon track construction and repairs, and are found to be reasonably skillful and efficient. It is gratifying to note that so-called unskilled labor, both white and colored, shows a marked improvement over former years, and that what little education the men have gotten in school and the mechanical trades, has not spoiled them as workers, as some assert, and as many shallow thinkers are ready to believe. Especially is the improvement in the native white laborer, both as to skill and industry, most encouraging. There is abundant proof that the Southern workers are fast becoming the equals of the Eastern and Northern laborers, and are readily adapting themselves to the changed condition of affairs.

The Fifty Thousand Dollar Prize offered by the Metropolitan Traction Company, of New York, for a "working system of motive power for street railway cars, demonstrated to be superior or equal to the overhead trolley" will, no doubt, result in bringing to the front many obscure inventions and schemes of would-be inventors, on which the State Railroad Commissioners will have an opportunity to sit in judgment, provided the Legislature grants them the permission to do so, and it will stimulate many others to engage in this line of investiga-

tion. But, that it will result in producing, at present, any new mechanical device or system, or in making application of old devices that shall be entirely free from all the objectionable features that now accompany electric or cable traction, we have not the slightest expectation. In the first place, it has been known for years that not only $50,000, but $1,000,000 or more awaited the successful inventor in this direction, so that if money could bring the result, it would long since have been accomplished. We are accustomed to say that nothing is impossible in the line of engineering feats. Give an engineer a banker's order and he will accomplish wonderful results. He will bridge great rivers, scale mountains, and talk under the ocean. He will devise, and has already produced, wonderful systems of transportation by means of which large numbers of people, under every possible condition, are being transported cheaply, safely and quickly to and from their homes, but this has been accomplished slowly by painful effort. The recent developments in this direction mark an epoch in human history worthy of all admiration; but while all these methods are good, none of them are without some objectionable features, and it is not to be expected that these features can at once be eliminated. At the same time the Metropolitan Traction Company is to be commended for its offer, and we trust that the Legislature, which now has the matter of deciding whether the Railroad Commissioners can act as judges, will determine in the affirmative.

Faulty Discipline, in our opinion, is more directly responsible for the recent three or four appalling street car accidents than the failure of safety appliances. Nearly all the roads upon which the recent unfortunate accidents have occurred, were covered on our tour of observation during last year, and in each instance we now recall that a laxity of discipline was noted and recorded. We do not mean that there were no rules provided for the guidance of the employes, but there was rather a neglect in enforcing the rules. Minor offences were overlooked, and there was no systematic inspection of the employes at times when they did not know that they were being watched. Recklessness upon their part followed, until it culminated in the calamities recorded. When riding on one line we remember to have been frightened as never before, from descending a long steep grade at a dangerous speed, and afterwards took pains to inform the superintendent that his men were given to reckless running when he was not present, and now that an accident has occurred we are not surprised, and only wonder why it had not occurred before. In some cases defects of discipline come about from the inability of the superintendent or manager to carefully watch his men, owing to a multitude of other duties that are imposed upon him. In other cases it is indifference. We now recall one or two cases where the superintendent's office is located alongside or above a liquor saloon, which the car men frequented without any protest on the part of the company's officers. Again, minor offences, like smoking while on duty, are overlooked, until the men learn that they can break the rules without fear of being caught, and so form a contempt for all law. Careful and frequent inspection at odd times and when the men least expect it, with a *certain* penalty for every violated rule, whether it results in harm or not, is the secret of good discipline. The worst evil that can possibly befall a street railway company is an attempt to apply a great deal of regulation to every department without providing an agency strong enough to enforce such regulation everywhere. In some cases the superintendent or manager is handicapped because he is not properly supported by his superiors, or because he has learned to become too familiar with his men; the latter condition is often a drawback to good discipline because of the fear of offending some of his friends. This condition of affairs should never arise. As an aid to good discipline, the superintendent should have an office by himself, with not even a clerk present, where he can meet his employes or others in private, and where he can administer reproof which is heard by the offending party only, and where he is not obliged to meet people who call to see his associates or other persons connected with the office. He should have regular office hours for the transaction of a certain class of business, and be at liberty at all other times for outside work, whatever it may be.

The Massachusetts Board of Railroad Commissioners deservedly stands in the front rank of those bodies appointed by the governments of our different states to exercise a supervision over the railroads within their borders. Its reports have always been marked with a painstaking care to secure reliable returns from the transportation companies, and its recommendations, based upon a careful study of existing conditions, have usually been of great value in improving railway methods and service. In no state outside of New York do the reports of the Railroad Commissioners deserve such careful attention or carry such great weight, and in no state, perhaps, have the transportation systems reached a higher stage of development or given better service. Special attention has always been paid in the state to street railways, and the Commissioners' report this year is of especial interest, inasmuch as some very striking comparisons are drawn between the financial results secured in that state by the electric system and by the operation of street lines by horse power. While showing that the net earnings per mile are 57 per cent. greater, the reported cost and capitalization per mile were 60 and 75 per cent. greater respectively, "leaving the odds in favor of the horse system." And the Commissioners in conclusion state that "taking everything into account there has been thus far no demonstration of the superior net earning capacity of the electric as compared with the horse system, but rather the reverse. It can and should be said without hesitation or qualification, that the electric system has not shown or indicated any such margin of profit as to justify the expectation of more than ordinary returns on money legitimately invested in it. The idea, which seems to have obtained some currency, that the electric railway system is a bonanza of rare and inexhaustible wealth, is clearly a delusion, and has doubtless proved to some a snare." In another part of their report, the Commissioners call attention to the fact that, as the electric roads are, for the most part, newly built, the necessary repairs and renewals for the first few years are comparatively slight, so that the operating expenses appear in even a more favorable light in the report than they otherwise would.

These, and other opinions of a like nature expressed in the report, have naturally attracted wide attention, and, where not understood, have created considerable surprise, if not alarm, among a considerable number of electric railway investors. Some newspapers have seized the opportunity to declare that the electric railway is a finan-

cial failure, giving as grounds for their statement the opinions quoted, while others, with an equal bias on the other side, impugn the reliability of the conclusions. But let us carefully consider the facts as given. Most of them in themselves are distinctly favorable to the electric system. The operating expenses have averaged during the last year less than 70 per cent. of the gross receipts, a figure about equal to the well managed steam railways of the State, and considerably less than formerly with horse power. The increase in net earnings is from .96 cents in 1888, the last year that horses were exclusively used, to 1.56 cents in 1893. With this decrease in operating expenses there has been an increase in traffic amounting, as already mentioned, to an average of 57 per cent. as the result of the employment of electricity. The only question in the minds of the Commissioners was whether this increase in receipts and greater earning power was sufficient to counterbalance the added investment incurred.

Assuming that the statistics for each system employed are strictly accurate, and that the method of computation for each was the same, it must be remembered that many of the electric railway companies in Massachusetts were the earliest in the field, and equipped their lines when the cost of electric apparatus was high, and when many of the economical devices now in use were not in existence. The improvements made in electric railway practice have been largely the results of experiments made by these companies at great expense, but through which every other railway company has been benefited. The showing made by a company now, using the latest appliances, would undoubtedly be much more favorable, and would probably under all ordinary conditions show a decided saving in favor of electricity on the capital invested. No other conclusion is admissible. At the same time this report is most timely, and should go far in disabusing the popular mind of the belief that an immense saving is made by a street railway company in changing its motive power from horse to electricity. If such a change is made and a city in consequence obtains cleaner streets, more comfortable and better cars, higher speed and in every way better service, the railway company has done all that it should do. It ought not to make any greater payments to the city's treasury, either in the form of taxes or as car licenses, than when operating as a horse railway. In fact the benefit to the city in most cases is considerably greater than to the street railway company, so that the former can better afford to pay a bonus to the railway company for making the change, than to exact, as is often attempted, payments in some form for the right to change the motive power.

* * * * *

Two other striking comparisons made by the Massachusetts Board in its annual report were in regard to the abnormal increase in capitalization in comparison to mileage, and to the decrease of the surplus of the companies. The capitalization, by which is included capital stock and bonded debt, has, in the aggregate, increased much more rapidly than the mileage. The commission recommends limiting the issue of bonds of street railway companies to the amount of paid up capital stock. Steam railroad corporations have been for many years subjected to such limitation by the general law of the state. The surplus of the companies has been rapidly decreasing, according to the commissioners, and in nine years has fallen from 13.44 per cent. of the capital stock to 2.9 per cent. of the stock. A conservative policy in regard to expenditures, and the setting apart each year of some substantial portion of the earnings as a fund for future contingencies is wisely recommended by the commission. At the same time, we do not see in this reduction of the surplus of the companies such a very alarming condition as some have assumed. The past year, which was one of great financial depression, found many street railway companies with lines but partially equipped and in an unfinished condition. It was absolutely necessary to complete these to care for the traffic; at the same time, the market for bonds was cut off. The surplus was the source naturally selected from which to make payments, and it was certainly better to draw from this than to make further issues of bonds or stock at a ruinous rate.

Convention Notes.

A meeting of the street railway and supply men of Atlanta was held on February 5, at the office of the Atlanta Consolidated Street Railway Company, in the Equitable Building, for the purpose of organizing and appointing local committees preliminary to the annual convention in Atlanta, October 17-19. Joel Hurt presided at the meeting, and the following committees were appointed:

Hotels.—Wm. W. Kingston; W. M. Kelley; S. W. Trawick.

Exhibits.—L. R. Shellenberger; N. W. L. Brown; W. M. Kelley; D. R. Bullen and H. I. Bettis.

Entertainment.—R. J. Lowry; J. Carroll Payne; T. K. Glenn; C. H. Wilcox; Wm. W. Kingston; Henry Inman and J. W. English, Jr.

Transportation.—H. I. Bettis; W. M. Kelley; C. H. Wilcox.

Banquet.—H. E. W. Palmer; J. Carroll Payne; E. Woodruff; R. J. Lowry; Henry Jackson and T. B. Felder, Jr.

Excursion.—W. M. Kelley; E. Woodruff; H. N. Hurt.

Finance.—E. Woodruff; R. J. Lowry; T. B. Felder; J. W. English, Jr.; W. T. Sanders.

It was resolved that the local representatives send a circular letter to the street railway men of all the principal Southern cities, urging them to be present at the convention, whether members of the Association or not, to welcome the delegates who are expected to be present from all parts of the country.

The committee on entertainment was instructed to communicate with a number of the representative ladies of Atlanta, and secure their co-operation in entertaining the visiting ladies who will accompany their husbands on their visit to Atlanta. A number of novel plans were suggested for providing entertainments for the delegates and ladies while in the city, and from the enthusiasm manifested on the part of the committee, and the energy with which they have set to work to make the necessary arrangements, it may be expected that the Atlanta convention will be one of the best attended and most enjoyable yet held.

It is hoped that the representatives of Southern roads will feel the importance of being present, and that all will recognize the importance of becoming members of the Association.

It is proposed in the near future to construct an electric tramway at Dublin, Ireland, from the terminus of the United Tramway Company, at Dollymount on the north side, to Howth and on the south side from the Clonskeagh terminus to Dondrum and Windy Arbour. Parliamentary powers have already been secured for the line, and it is proposed to commence the construction immediately. The manager of the Southern Tramways Company, J. Clifton Robinson, C. E., is well known in the United States, and it is to his efforts that the success of the work is largely due.

EDITORIAL CORRESPONDENCE.

CHARLESTON, SAVANNAH, AUGUSTA, CHATTANOOGA, ATLANTA—PART II.

Charleston, S. C.

Were one about to write history, he would find in Charleston and its vicinity, numerous spots prolific in historic suggestions, that would serve as links in the chain which binds the present with the past. This is the spot where the first scenes of our civil war were laid. Fort Sumter, now partially in ruins, still guards the entrance to the harbor, and to the left, on Sullivan's Island, is old Fort Moultrie, whose history takes us back to colonial times, and recalls the heroic service of Sergeant Jasper in holding aloft the flag on his gun swab, in the battle of June 28, 1776. Rambling through the enclosure of the old fort, we come across the grave (still carefully fenced and preserved) of Osceola, the Seminole chief, who was incarcerated here after the close of the Seminole war in 1836. Still nearer to the city, on the left, is Castle Pinkney, and on the right Morris Island, from which Gilmore's guns sent their missiles of destruction into the beleaguered city. The city itself bears but a few marks of the prolonged bombardment, to which it was subjected during the late unpleasantness, but it does bear some few marks of the terrible earthquake of 1886, and still more

FIGS. 1 AND 2.—SOUTH BATTERY PARK AND EAST BATTERY, CHARLESTON HARBOR—CHARLESTON, S. C

the devastation wrought by the cyclone and tidal wave on August 27, last.

But we are not to deal with history, nor with the flood, nor plagues of which Charleston has had her share. A more pleasant service invites us, and we are to write about Charleston as we find it to-day. We are told that the city has changed but little in physical appearance since the war. There is an old-time look about it, which comes from the quaint architecture employed, and the former practice of placing the houses directly upon the street line, or closing in the grounds with high brick walls. The most attractive features of the city are the East and South Batteries, which bound the point of the peninsula upon which the city is located. These consist of massive walls with wide pavements of stone flagging, which, upon the south, enclose White Point Gardens which consist of a beautiful grove of live oaks, interspersed with numerous monuments. These include the Fort Moultrie Monument, erected in memory of the defenders of this point in 1776. This is a granite shaft, supporting a bronze, life size figure of Sergeant Jasper, holding up the flag, and has bronze plates containing a brief account of the action. Another is erected to the memory of Gilmore Simms, the historian. There is also a circular shaft, about twenty feet high, composed of lumps of phosphate rock from the various phosphate deposits, which are being worked about thirty miles from the city. There are also other interesting monuments about the city, the principal one of which is known as the Calhoun Monument, near the citadel on Marion Square, and another which is known as the Washington Light Infantry Monument, in the yard of the City Hall. The Battery walls, above noted, make a delightful resort, to which large numbers of the people come of a summer's evening to enjoy the refreshing sea breezes, which never fail to come and relieve the oppressive heat of a summer's day. Along the Battery fronts are some of the most beautiful homes of the city, especially those of the old-time residents. The East Battery (Fig. 2) was entirely destroyed by the August cyclone, but it has recently been rebuilt by the city in a most substantial manner, and restored to its old-time beauty.

STREET RAILWAYS.

The street railways of the city embrace a trackage of about thirty miles out of a total of eighty miles of streets, and are controlled and operated by two companies, both of which employ animal power. There is also a short line on Sullivan's Island, but this is not embraced in the city mileage. Negotiations have for some time been pending with outside capitalists, looking to the consolidation of the two companies with a view to operating these lines by electric power, but this deal is off, we understand, and there is little probability that the present management will undertake an electric system, although there is a desire on the part of the people for mechanical traction. No opposition would be offered against the trolley system. While mechanical traction is very desirable from the standpoint of the patrons, the managers of the Charleston City Railway Company, at least, are of the opinion that there is more profit to be had from the present system.

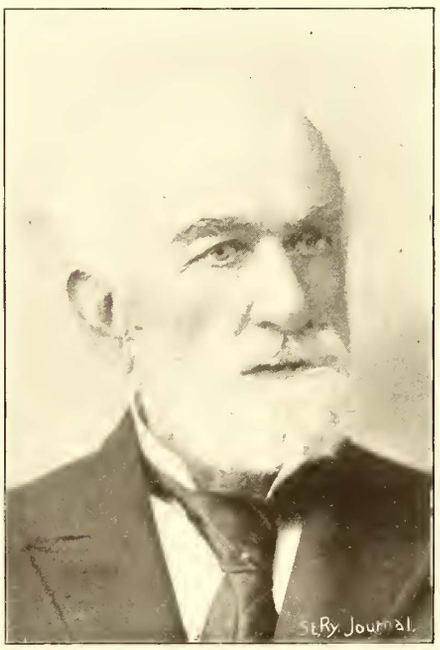
The Charleston City Railway Company,

which now operates thirteen miles of track, began operation in 1865, and has continued under the same management during the entire period of twenty-nine years, John S. Riggs having held the presidency from the first. Frank F. Whilden is secretary and treasurer, and J. H. Mohlenhoff is superintendent. The company has done a prosperous business from the first, never having missed a dividend of from 6 per cent. to 8 per cent. during all the years of its existence. The capital is all held in the city, and there are among the directors four bank presidents, the mayor of the city; also an eminent lawyer and a leading private banker and broker. In the matter of accidents the company has been particularly fortunate, having paid less than $5,000 accident charges since it began operations, and it has paid in solicitors' fees less than $1,000 during the time. The tracks run through the most desirable parts of the city, passing the principal churches, hotels and public buildings.

The company owns forty cars, about half and half open and closed, all of which were built by the John Stephenson Company, of New York. The president, Mr. Riggs, having been an intimate friend of the late John

Stephenson, has always been partial to his make of cars. The average number of cars operated daily is twenty-four, and they are run on a four and five minute headway. These are mostly one horse, fare box cars. White men only are employed as drivers, and their cars are run only until eleven o'clock at night, except on one line, where a recent ordinance requires that the cars run until 12:30 o'clock. The fare is five cents, and twenty-five tickets are sold for $1. The tickets are printed in different ways; some in coupon books, and others are simply card tickets Transfers are given to connecting lines. The colored people ride quite as much as the white people in proportion to their numbers, and are always liberal patrons of the street cars when they can get a nickel to ride with.

The original track construction of the line consisted of the old Crescent rail, fastened to stringers by means of screws and countersunk holes. About ten years ago a forty pound, center bearing rail was substituted. The soil in and about Charleston is low, level and very sandy; but little trouble, however, is experienced in keeping up



JOHN S. RIGGS,

PRESIDENT CHARLESTON CITY RAILWAY COMPANY.

the rail joints. The principal streets upon which the street cars run are paved with granite rocks or cobble, but upon others, in the suburbs, the animals wade through the sand, and as this is constantly accumulating upon the rails, the traction is exceedingly hard at times. The horses employed upon the Charleston line are among the finest we have ever seen driven to street cars, and are generally kept in excellent condition. The horses weigh from 1,100 to 1,200 lbs., and cost $140 to $160 a head. A few mules are employed, and these cost about $40 a head more than the horses; but horses are preferred for street car service, as they are generally quicker, and do not require so much persuasion from the driver, giving him more time to see that the fares are paid.

The stables at which the 150 animals of the company are housed consist of low, one story buildings, with ample ventilation, but little protection from the cold. Stalls are provided for part of the animals, but most of them are allowed to run loose in pens in lots of fifty; the pens are 100 × 23 ft. It is found that the animals do much better when allowed to run loose in the pens, than when confined in stalls. All vicious and unruly animals are sorted out and provided with stalls. The pens are provided with fodder, manger and grain racks on one side, and upon the opposite side is a water trough, to which the animals have access at all times. Sawdust is employed for bedding, and the pens are cleaned once a week. The feed consists of long prairie and North River hay which costs from $12 to $16 per ton delivered in bales. The daily ration consists of sixteen pounds of hay and fourteen quarts of grain, corn and oats, ground half and half. The grain is ground in the stables by horse power. The animals are driven about fourteen miles a day, and their average life is about five years. There is one mule, however, still in service, which has been at work twenty-five years, and it is still in good condition.

A good deal of traffic upon the pleasant days consists of colored nurses, accompanied by young children, and in the cars is posted the following notice relative to the fares: "Notice: When two seats are occupied upon these cars, two fares must be paid. Children three years old and under, ride free."

The Enterprise Railroad Company,

which is now operated under the management of T. W. Passailaigue, president, and P. J. Balaguer, secretary and treasurer, controls about fourteen miles of track. The line began operations in 1874, and was built and is owned by Northern capitalists. It was originally projected as a freight line, and in the business portion of the city runs from the Battery along the river front, connecting with the principal steamer wharves and railway depots. The gauge is five feet, to correspond with the gauge of the steam lines, so that steam cars could be run over the track. One branch crosses the city to the west near the center, and one extends nearly five miles into the country to the north, past numerous negro settlements, and through the principal truck farms, and out to the phosphate mills which are located at intervals along the Ashley River. There is also a branch running to the entrance of Magnolia Cemetery which is a very attractive place, with numerous drives shaded by ancient, moss draped, live oaks, and there are also many ornamental shrubs, including japonicas which during January were in full bloom.

The line is operated with one horse, fare box cars, with white men for drivers; but at certain hours, on the line running to the phosphate mills, two-horse cars are run to convey the crowds of workmen, morning and night, to and from their work, and these are operated by white conductors and colored drivers.

The regular fare is five cents, or twenty-five tickets for $1, but on a portion of line running to the mills, two tickets are sold to laborers for five cents. At certain hours these cars are crowded, and as the colored people look so nearly alike, the conductors often have difficulty in distinguishing who has paid fare. Checks were at one time issued, but the passengers would exchange with one another, so, as a final resort, the conductors have devised a plan of putting bits of cotton or lint upon the clothing of the passengers from whom the fare has been collected, thus distinguishing them from new comers. On this car line, a car load of phosphate hands, fresh from the mills, is about 50 per cent more odorous than a load composed of employes from the slaughter houses in Chicago and Omaha. We noted that some of the drivers were armed with heavy revolvers, as a defense while driving through some of the woody sections of the route, and also as persuaders, when a drunken negro refuses to pay his fare, as is sometimes the case. The business, it is stated, has increased about 70 per cent since the reduction of the fare, with a large increase of net receipts. Not only the phosphate hands, but the laborers on the truck farms live in the city and patronize the street cars liberally, although the wages of the latter class are only from twenty-five to fifty cents per day. There are at present vast numbers of idle colored people in Charleston, but when employed, they are liberal patrons of the street cars. About 40,000 miles per month are run on the lines of the Enterprise Company, and at an exceedingly low cost per car a mile. The animals make about eighteen miles a day. Mules are mostly driven double and horses single.

Prairie hay is fed long, and the daily rations per animal are about twenty pounds of hay, and from fifteen to eighteen quarts of grain, consisting of corn and oats, which is ground by horse power in the stables.

The pay of white drivers and conductors is $10 a week, or $1.43 per day for thirteen and a half hours'

work; while colored drivers get fifty-seven cents a day for twelve hours' work.

The city ordinance requires the company to keep the pavements repaired between the tracks and three feet outside. Granite block paving or cobble stones are employed, and paving costs the company from twenty-five to thirty cents a square yard, the material, except sand and gravel, being furnished by the city.

The offices and stables of the company are located at the corner of Shepherd and Meeting Streets; the latter being the famous shell road for which Charleston was once noted; but it is not kept up of late years as well as formerly. The stables and car sheds are plain, one story buildings, and stalls are provided for the animals. The stables are kept remarkably clean and there is an air of thrift about the whole establishment. The cars are kept in good repair, being painted once a year, and varnished twice. The salt air of the region is said to be very destructive to paint and varnish, but, by the use of good material, the rolling stock is made very presentable. The paints employed are purchased, for the most part, from Sherwin & Williams, and the varnish from Valentine.

Middle Street Sullivan's Island Railway Company.

This is a line of two and a half miles in length on Sullivan's Island, Charleston Harbor, which runs from the steamboat landing along the line of the summer cottages, where from 3,000 to 4,000 of the Charleston citizens usually pass the summer months. Only one car is run at present, and this makes the trip on the arrival of each steamer. The tracks were buried about four feet deep under the sand by the August cyclone, but this has been shoveled off, and the cars run through a trench of sand three or four feet in depth. The line has hitherto been a paying one, and will, doubtless, see better days again. The president is B. Callaghan, and the treasurer Frank F. Whilden, who is also treasurer of the Charleston City Railway Company. B. Buckley is superintendent.

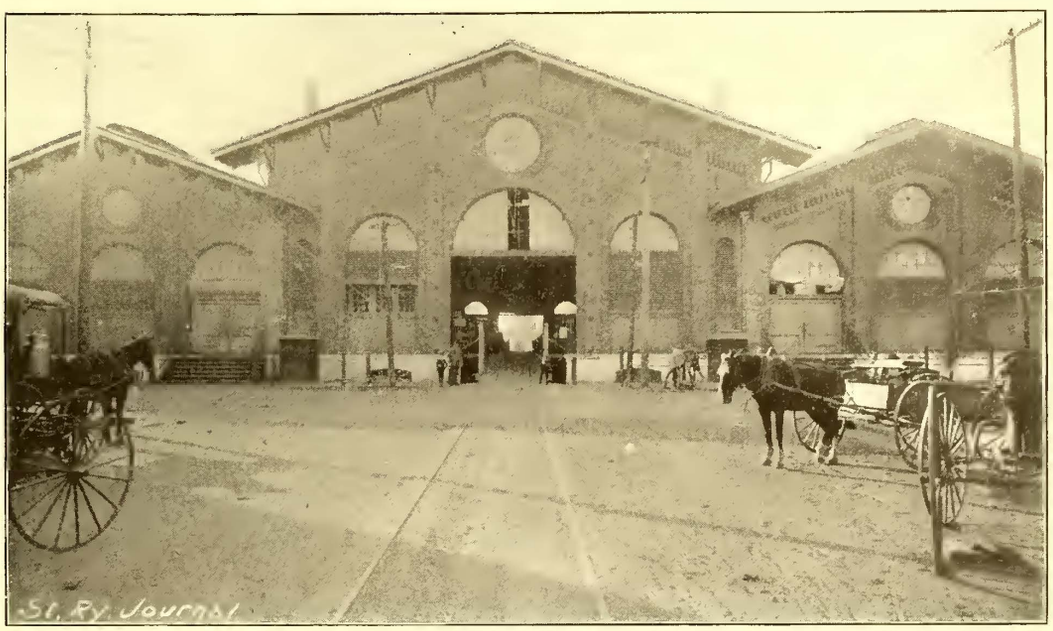


FIG. 3.—LINE OF ELECTRIC RAILWAY PASSING THROUGH MARKET HOUSE—SAVANNAH, GA.

THE FUTURE OF THE CITY.

It has been said by people who have visited Charleston, that the place is slow in a business sense, and an undesirable location in which to make investments. This is not fair; for, considering the calamities that have overtaken the city, it has held its own remarkably well, and in our opinion, a prosperous future awaits the place. It is a desirable residence city, and has a great many wealthy people, and although they may be classed as conservative, they will look to it that the city has a substantial growth.

The banking interests are particularly flourishing, and during the money stringency which has affected nearly every section of the country, the Charleston banks have held their own, and there is not a failure reported. The business outlook, especially since the harbor improvements, is very encouraging. These improvements consist of a system of jetties which have been constructed by the government, and which have already deepened the channel on the bar at the entrance of the harbor, so that now there is twenty-two feet of water on the bar at extreme high tide, and twenty feet at medium high water, with fifteen feet at low water, where formerly the depth was from eight to ten feet, and it is confidently expected that the depth will be yet materially increased. As it is, there is now a straight course from the open sea to the anchorage ground inside the harbor, and vessels can enter by night as well as by day, by bringing the light of Fort Sumter, which is near the middle of the harbor, on a line with a temporary light which has been placed in the steeple of St. Philips' Church, one of the principal landmarks in the city.

The principal exports from Charleston are cotton, naval stores, lumber, phosphates and small fruits and vegetables.

In our opinion, nothing would serve to galvanize Charleston's business interests into new life more quickly than the adoption of electric power for propelling the street cars. The investment would not, doubtless, bring at once so large a return as the horse cars are now doing, but it would give the city a name abroad, and attract capital and enterprise as no other feature can; and, even if the lines are not sold, it is hoped that the present owners will yield to the pressing demand of the citizens, and adopt the modern power.

Savannah, Ga.

Savannah is a city of about 60,000 inhabitants, situated near the mouth of the Savannah River. It is an important seaport and shipping point for the products of this region, which consist chiefly of cotton and naval stores (spirits of turpentine and rosin).

Like Charleston, the surface is low, flat and sandy, but it is a beautiful city, regularly laid out, and has numerous small parks and squares located in the center of the streets, which divide and pass on either side. There are many modern houses and business blocks, and the city has a more modern appearance than most Southern coast cities. It might be styled the Monumental City, for in its various parks are located monuments erected to the memory of heroes and prominent statesmen. Among these are Jasper Monument on Madison Square, the Pulaski Monument on Monterey Square, the Green Monument, Gordon Monument and the Confederate Monument of the plaza of Forsyth Park.

The most attractive features in and about the city are the Forsyth Park, near the center of the city, which covers a large tract, most of which is shaded by an original growth of pines and oaks, with here and there a palmetto, and which is also adorned with fountains and ornamental structures. The beauty of this park is only surpassed by that of Bonaventure, a name given to the principal cemetery, just outside the city. Here are extensive avenues, shaded by rows of live oaks, with the limbs draped in festoons of the soft, gray moss for which this region is so famous. In foggy weather, a condensation drips from the pendant moss, as if the very trees were

weeping for the dead which lie buried all about. Numerous flowering and ornamental shrubs add beauty to the location, making a weird but attractive place.

The two principal hotels of the city are the DeSoto and the Pulaski House. The former is a modern structure, and is the winter home of a large number of Northern tourists, who seek to escape the rigors of a Northern climate.

STREET RAILWAYS.

The street car lines embrace forty-two miles, and they are all operated by electric power, with the exception of a short dummy line. Two companies, at present, control the street railway system. The City & Suburban Company and the Savannah, Thunderbolt & Isle of Hope, are, virtually, under one management, J. H. Johnston being president of the former, treasurer of the latter, and general manager of both. The former embraces fourteen miles of electric track and five miles of steam dummy; the other eight miles of electric track, and both are operated from the same power station, which is located at the Bolton Street junction. From this station a line also runs to Thunderbolt, a suburban settlement on the Wilmington River. The power station is a high, one story frame building, with corrugated iron covering. There is one smokestack, about 100 ft. in height, which rests upon a brick base into which the flues from the boilers lead. The power equipment consists of two 325 H. P. Cooper engines, each belted direct to a 400 H. P., M. P. Thomson-Houston generator, the shafts being forty-five feet from the engine shaft. The flywheels are twenty-five feet in diameter, with forty-one and a half inches face, and weighing 40,000 lbs. The belting employed was manufactured by the Southern Belting Company, of Atlanta. The water pumps are driven by belts direct from the engine shaft, through a train of reducing gears. The steam equipment consists of two Babcock & Wilcox water tube boilers, and a Wainwright feedwater heater. Tennessee and Alabama soft coal is employed as fuel, and is delivered by steam cars direct to the furnace room. It requires about four and a half tons a day to operate the twenty-two cars.

Some of the cars were built by the St. Louis Car Company, and others by the Ellis Car Company of Amesbury, Mass., and a few are home made. Trucks manufactured by the Baltimore Car Wheel Company, the J. G. Brill Company and the St. Louis Car Company are employed, and the motors are all of the Thomson-Houston type, W. P., 13, 7 and 25 H. P. Most of the cars have only a single equipment. Wheels are purchased, for the most part, from the Missouri Car Wheel Company. The prevalence of sand in the streets and on the tracks, tends to cut out the wheels rapidly.

Motormen are paid $1.50 a day and fifteen cents an hour for overtime.

On the line to Thunderbolt, a flat freight car is towed twice a day, carrying merchandise and other freight, returning quite an income to the company. The lines of the company are mostly single track with turnouts, and we noted that a number of the turnouts were located at the street crossings. One portion of the line, constructed with flat rail and stringers, is not standing up well under the traffic, and must, necessarily, soon be rebuilt. Most of the streets, through which the line in the city runs, are paved, but some are still unpaved, and on these, the sand is very troublesome.

Electric Railway Company.

The officers of this company are: J. S. Collins, president, T. G. Reid, treasurer, and J. W. McFarland, superintendent.

The lines operated by the company embrace twenty-five miles of track, and consist of both double and single track; most of that portion in the city being paved, while the suburban sections are along dirt streets. The lines are operated in two belts, with a line to Thunderbolt, and on some of the streets the track runs on a reservation in the middle of the street, while one line passes directly through the market house, supported on an iron bridge built on a level with the principal floor, which is approached in both directions, over a short, steep grade. There are numerous curves in the line where the streets divide to pass the parks above mentioned. In the paved portion, the construction consists of T rails placed on chairs. The average number of cars run in winter is twenty-one and in summer thirty. The cars were manufactured by the J. G. Brill Company, and are mounted on Brill and Dorner & Dutton trucks, and are equipped with Thomson-Houston, Edison and Westinghouse motors, eight equipments of the latter type having been recently purchased. Wheels are purchased, for the most part, from Whitney of Philadelphia, and some from the Missouri Wheel & Foundry Company of St. Louis.

The company is required to pay the city a license of $30 per year on each car owned, including the open and closed cars, whether operated or not. The street authorities attach a metal badge to each car, which, on the closed cars is square, and round for the open cars, upon which the date of the license is stamped.

A payment of $300 per annum is required from the street railway company, as a bonus for the privilege of doing business, and a real estate tax is imposed both by the city, state and county.

The rate of fare is five cents, and transfers are issued only at the main office. The pay of conductors and motormen is twelve and a half cents an hour.

The traffic during the last year increased more than 20 per cent. above the previous year, and the prospects of the company seem to be encouraging. The power station of the company is equipped with three Armington-Sims engines, and Edison and Westinghouse generators. The boilers are of the horizontal return flue type, and two of the four are of the Phœnix type, and two were made by E. P. Hampson & Company, of New York. The fuel consists of Alabama coal, costing $3.15 per ton, delivered, and it is hauled half a mile on wagons, requiring about eight tons a day for the twenty three cars. That portion of the track equipped with stringer rails is said to consume a much larger amount of current than the T rail construction. It costs about $10 per car per day for operating expenses. The Electric Railway Company is a consolidation of two other lines. The original Savannah Street Railway began operations as an electric road in 1889, and the other line in 1891.

Augusta, Ga.

This appears to be a New England manufacturing city transported to Dixie. It has many Northern characteristics, besides its manufactories, which consist principally of cotton mills, although there are a number of other industries. There are thirteen large cotton factories operating 160,000 spindles, and employ about 5,000 operatives, and consume yearly about 100,000 bales of cotton. The thirteen mills, with one exception, are operated by water power, and it is the abundant water power, together with ample shipping facilities, that renders this an important manufacturing center, there being eight railways and one steamboat line, which center in Augusta.

The city has a population of about 40,000, and it is situated upon the Savannah River, at the head of navigation, 250 miles from the river mouth. The city extends along the river bank a distance of about four miles, and is regularly laid out with broad streets at right angles to each other. The main thoroughfare is Broad Street, which is 168 ft. in width and nearly four miles in length. Green Street, which is parallel to Broad Street, two squares south, is 168 ft. wide, and is a beautiful residence street, being divided into two broad roadways with a park in the center, having a row of magnificent oaks and elms on either side, while there are two other rows, one on each side of the street boundary. It is claimed for these *boulevards* that they are the handsomest main streets to be found in any city in the country. The city abounds in fine streets, while the suburbs are admirably located and said to be very healthful. There is every indication of a substantial growth in and about the city, and no doubt Augusta will yet take rank with many of the large cities in the country.

The Augusta Railway Company.

This company controls the only street railway system in the city, and is known as the Jarvis-Conklin Syndicate. The same persons control the Augusta Electric Light & Motor Company, and light the city and furnish lights to private consumers, as well as power to a large number of stationary motors. D. B. Dyer, formerly of Kansas City, well known throughout the West as a United States Indian Agent, and first Mayor of Guthrie, Oklahoma, is president of both companies, and also has charge of the real estate interests of the syndicate, which has invested over $1,000,000 in the city and suburbs.

Mr. Dyer has resided in Augusta for about four years, and has become prominently identified with a number of the city's industries, and is regarded as one of her most enterprising citizens. He is also president of the Port Royal & Western Carolina Railway, and is interested in the development of Port Royal as an export city, which is claimed to have one of the finest harbors on the Atlantic coast, the channel being sufficiently deep to admit of the largest sea-going vessels. The street railway system embraces twenty-five miles of track, and the cars are operated with water power. Associated with Mr. Dyer in the operating of the street railway system are the following persons, who, with a number of the employes, are from Kansas City: C. B. Reavis, secretary; T. A. Roberts, superintendent, and W. E. Moore, electrician.

The track construction is very substantial, and consists mostly of T rail spiked to the ties. The streets are

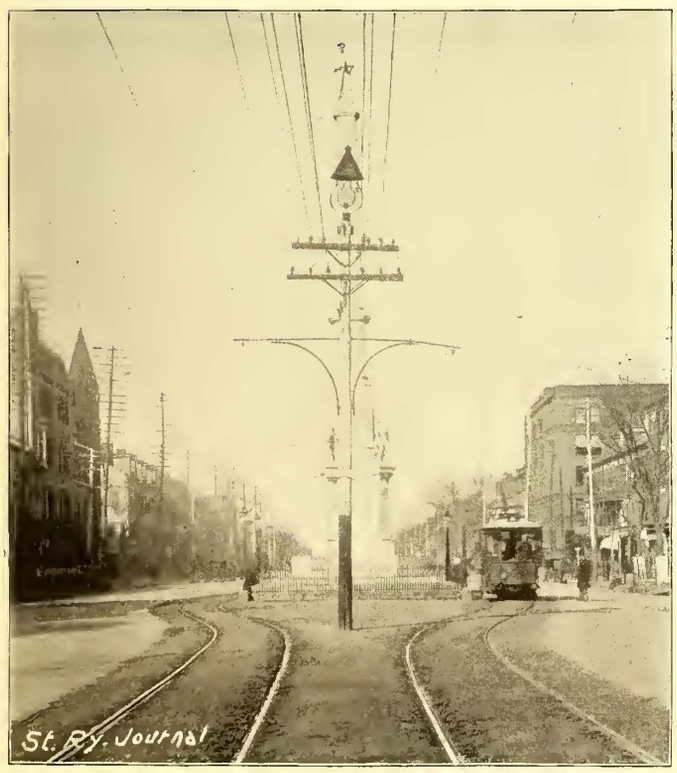


FIG. 4.—CONFEDERATE MONUMENT, CORNER BROAD AND JACKSON STREETS, SHOWING BRICK PAVEMENT BETWEEN TRACKS—AUGUSTA, GA.

generally paved, asphalt being principally used. There is also considerable Belgian block paving and macadam, and also a cement rock called chert, which is laid on a foundation of broken stone, and which develops cementing qualities after being exposed to traffic. Broad Street is paved with asphalt, but between the tracks and rails and three feet outside, a brick paving is employed. This construction facilitates track repairs, for bricks can readily be removed and replaced. Above the ties there is but one tier of bricks, which is set edgeways on a thin layer of sand, the sand foundation being thoroughly tamped. At the street crossings the rails are placed on chairs, and here two tiers of bricks are employed. At one

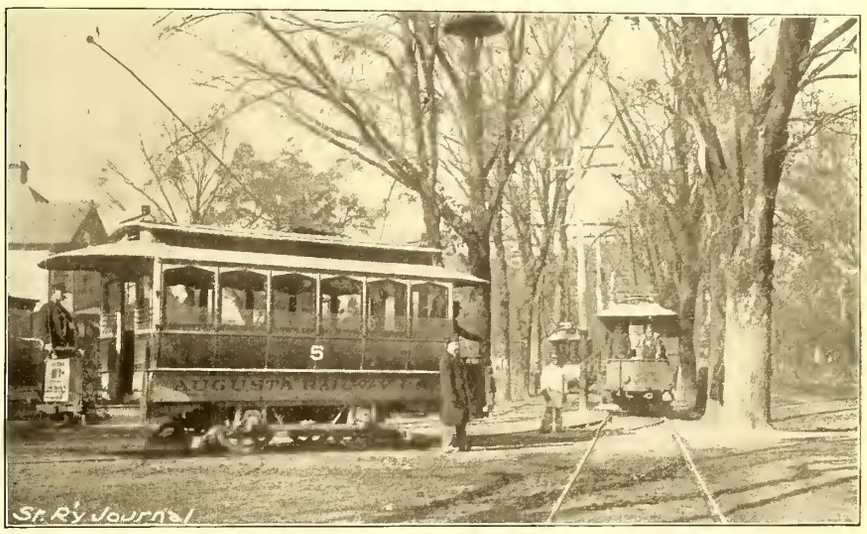


FIG 5.—CURVE AT CORNER OF LINCOLN AND BROAD STREETS—AUGUSTA, GA.

crossing, however, there is a concrete foundation with one tier of brick only, set edgeways. The brick paving is giving excellent satisfaction after a year and a half of service. The material is an excellent quality of hard burned brick (not vitrified), and the paving is laid by the brick manufacturers and warranted for five years, at a cost to the company of sixty-five cents a square yard.

The company owns forty-six cars, and the average number operated in the winter is eighteen, but in summer a larger number. The rolling stock is of Brill and Stephenson manufacture, and the electrical equipments consist principally of the Edison and Thomson-Houston motors, but there is one equipment of a six pole motor, which was designed and built by W. E. Moore, electrician of the company. This machine is illustrated and described in another connection in this issue, and is said to be giving excellent satisfaction.

The power station and car sheds are all of brick, and are separated by fireproof walls and doors. These are located just west of the city, on the line of the Augusta canal, from which the power is derived. The power house proper covers 84×200 ft.; the car houses 90×120 ft., and the repair shops 50×100 ft.

The station equipment includes both water and steam machinery, the latter being employed only in case of an emergency, or when for any reason the water is turned off for the purpose of making repairs on some of the numerous mill races and flumes. The water wheels are of the Victor horizontal turbine type, and were manufactured by the Stilwell-Bierce Company, of Dayton, O. The total fall is thirty-five feet, and the water is led to the wheel case in a short, nine foot penstock. The main shell contains two wheels, of 350 H. P. each, from which the power is transmitted by belts to a countershaft. There is also a 125 H. P. wheel, having its shaft parallel to those of the other wheels, which is operated in a smaller shell, to which the water is led by a small penstock from the side of the principal shell or case, making a total of 800 H. P.

The countershaft is 150 ft. long, and mounted ten feet above the floor on brick pedestals, from which the generator belts lead down and back past the water wheel shaft of the generators. The shaft is provided with clutches, and there are three or four balance wheels which are nine feet in diameter, and weigh 10,000 lbs. each.

The water wheels are governed by hand power, no satisfactory governor having yet been devised. The attendant stands at the valve wheel constantly, and opens or closes the valve according to the indications of a voltmeter and speed recorder which is placed in a convenient position. The street railway company pays the city for the use of the water, $5.50 per horse power per year.

The steam equipment of the station consists of three Babcock & Wilcox boilers, of 250 H. P. each, and an 800 H. P. Corliss engine which is belted to the same countershaft as the water wheels. The station is equipped with both lighting and railway generators; the latter consist of three Edison 100 K. W. and one Thomson-Houston generator of the same capacity. The station furnishes power for 300 arc and 1,800 incandescent lights, besides power for a number of stationary motors.

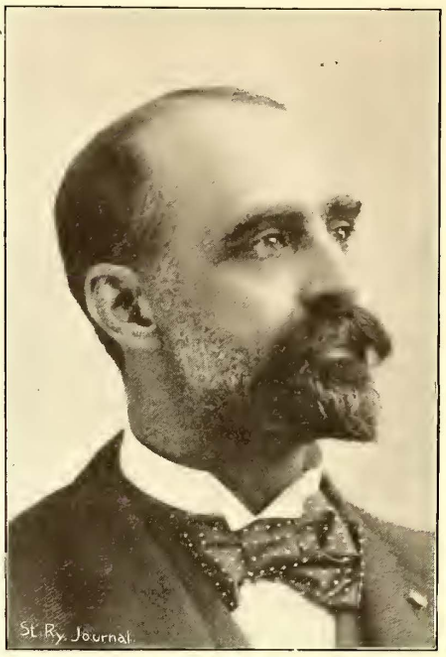
SOURCE OF POWER.

The canal from which the water supply for Augusta industries is derived, belongs to the city and cost $2,000,000. It is seven miles in length for the first level, and nine miles, including the second and third levels. The water is drawn from the Savannah River above the city, at which point is a dam of masonry and bulkheads and locks, consisting of granite walls laid in cement. The original canal was built by the city in 1845-7, but was enlarged in 1872-6 to its present dimensions, the width at the surface being 150 ft., and having a depth of 11 ft., with an estimated capacity of 14,000 H. P. between the first level and where the water is returned to the river. Of this, 9,200 H. P. is let out by the city to the mills and factories at a uniform rate of $5.50 per horse power per annum—a remarkably low charge. It is estimated that there is within twenty or thirty miles of Augusta available water power of 200,000 H. P., giving encouraging promise of what this city may yet be when the remaining power shall have been developed.

EMPLOYES AND COST OF OPERATION.

The wages of motormen and conductors are twelve and a half cents an hour for new men, but after a certain term of service, they receive fourteen cents per hour. On one or two of the lines, where the traffic is light, boys from fourteen to sixteen years of age are employed as conductors. They receive fifty cents and upwards per day, and are found to be very efficient.

The fare is five cents; no tickets are sold; transfer tickets are issued, however, at three points, and the longest ride is over five miles. No serious trouble has been experienced by any abuse of the transfer privileges by the public or employes. The company is not required to pay a car license, but pays a real estate tax of $2.25 per $100 valuation. One of the principal lines of the railway system runs out to Summerville, a suburb of Augusta, two miles to the west. This village occupies a sandy ridge 300 ft. above the city, which the cars approach over a grade of 8 per cent. This elevation commands a charming view of the city and valley of the Savannah River, which embraces an extensive region in Georgia and South Carolina. At this point is located the United States arsenal, which embraces a large tract, and which was originally located here because of the high, dry climate, rendering it particularly suitable for the storage of arms and ammunition. At the brow of the hill opposite the arsenal, on Summerville Heights is located the beautiful and celebrated hotel, Bon Air, which is surrounded by extensive gardens, shaded by magnificent oaks, pines and elms, as well as the rich evergreens (olives and magnolias) and is in the heart of Summerville, one of the most beautiful, healthy and wealthy villages of the South. The climatic advantages of the section are said to be unsurpassed,



D. B. DYER,
PRESIDENT AUGUSTA RAILWAY COMPANY.

and during the winter months, the hotel is filled with Northern visitors, who prefer the locality to the more enervating resorts upon the Atlantic and Gulf coasts. The average temperature for the winter months, is 54 degs., and the official record shows it to be the driest climate east of the Rocky Mountains.

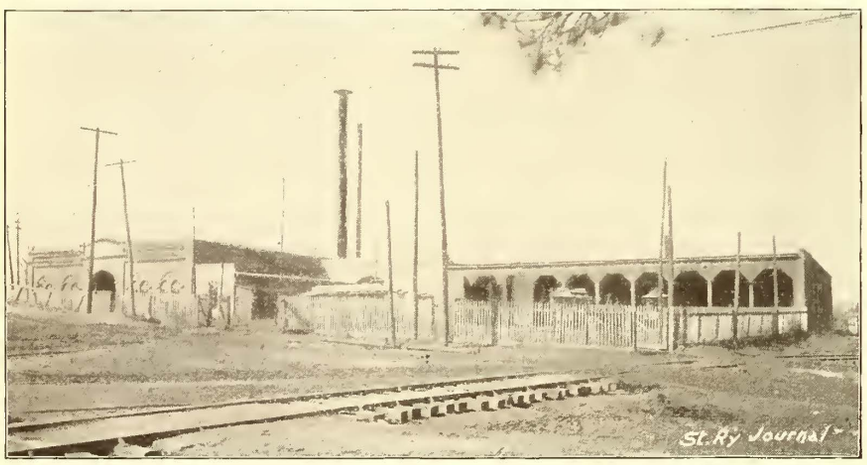


FIG. 6.—POWER STATION AND CAR HOUSE—AUGUSTA RAILWAY CO., AUGUSTA, GA.

Chattanooga, Tenn.

It was noted in our last issue, in connection with the meeting of the executive committee of the American Street Railway Association at Atlanta, that an excursion was decided upon from Atlanta to Chattanooga on the 19th of October, as a fitting close to the convention of the Association, which is to convene at Atlanta on the 17th. This action on the part of the executive committee was taken at the suggestion of the president of the Association, H. C. Payne of Milwaukee, who had made a stopover visit at Chattanooga on his way to Atlanta, and was enthusiastic in his description of the outlook from Lookout Mountain and the historical associations of the locality. Being somewhat enthused ourselves by the president's vivid recitals of Chattanooga's attractions, we resolved to visit the region, so that we might present to our readers a pen picture of the city and its surroundings, as an additional inducement for street railway men and others to be present at the Atlanta convention and join in the excursion.

Chattanooga, which is 138 miles distant from Atlanta, is connected with the latter city by two lines of railway, the principal one of which is the Western & Atlantic route, along the line of which was conducted the campaign of 1863-1864. In fact, it was for the possession of this road that the campaign was planned, and it is said to be the scene of 100 battles. The route from Atlanta is through one of the richest farming regions of North Georgia, and on the way we pass out of the cotton belt to the grain and blue grass regions of the northern counties. In October the trip will be particularly interesting, as the cotton fields will appear at their best, and the process of harvesting and fitting the crop for

market will be a novel sight for the Northern delegates. The trip being in reverse order from that in which the armies moved, the first prominent historical point, after leaving the fortifications of Atlanta, is Kennesaw Mountain, twenty-two miles distant, and Altoona Heights, which have been immortalized by the gospel hymn, "Hold the Fort; for I Am Coming," which was suggested by signal messages that were exchanged during the battle, and the attendent thrilling circumstances. There is still preserved immediately beside the track on the left side in the deep cut through which the train passes, as a mute memorial of this bloody and famous struggle, a lonely grave of a confederate soldier who was buried upon the spot where he fell, and which has been marked by a marble headstone, erected by the railroad company, upon which the following is inscribed: "An unknown hero. He died for the cause he thought was right." For years past, it is said, the track hands of the Western & Atlantic Railway have made it a sacred duty to give this grave especial attention, and to see that it is kept clean of rubbish, and that fresh flowers are regularly placed upon it.

It would require much more space than our columns will admit to describe all historical points and thrilling events of which this trip is prolific, for General Sherman said of it: "Every foot should be sacred ground, because it was once moistened by patriotic blood." So we will pass on to Chattanooga, and upon arrival, board an electric car on the line of the Chattanooga Electric Railway, which takes us out three miles to the foot of Lookout Mountain, where we transfer to the steam cars on the Chattanooga & Lookout Mountain Railway, which is known as the Broad Gauge Line, and of which W. T. Carley is superintendent. The electric car also connects with the Inclined Railway, on which the summit of the mountain may be more quickly reached, but because of the more interesting views to be had of the surrounding valleys, we prefer the Broad Gauge for the ascent, and will return by the Incline.

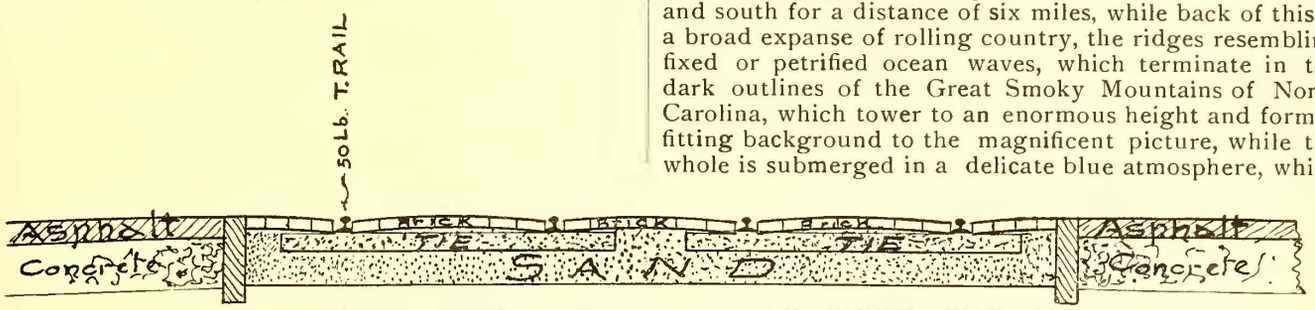


FIG. 7.—SECTION OF BROAD STREET DOUBLE TRACKS—AUGUSTA RAILWAY CO.

The length of the Broad Gauge Line is nine miles, and the ascent is made over a rocky course, and through deep cuts, on a grade averaging 3 per cent. with a maximum of 4 per cent. at certain points. The line passes twice along each side of the mountain and around the point, and twice over Hooker's battlefield, where was fought the celebrated battle "Above the Clouds." In the ascent the train makes one switch back, and at this point the engine switches past, and couples to the other end of the train, and the course is continued along beneath the face of the palisades and past the numerous cottages (summer residences) that are nestled among the trees near the summit, until the terminal is reached in front of Lookout Inn upon the highest point of the mountain, which is 1,700 ft. above the city and 2,300 ft. above the sea level. One cannot speak too extravagantly of the ever shifting scenes of the trip, as through the vista of trees, the beauties of the neighboring valleys, are alternately presented to the eye. It is reserved, however, for a view from the tower of the Lookout Inn, or from Point Lookout, for the most superb and extended prospect and for the full inspiration that comes from the sublimity of the scene. Here the vision reaches into seven states, and surpasses in beauty, it is claimed, the scenery about the White Mountains, or even in some respects the mountains of Colorado. When regard is had to the scenery alone, there is, doubtless, no more interesting and fascinating mountain views in the country, but since it overlooks the theatre of notable campaigns and battle incidents to the opening of the Tennessee, and when the names of the prominent generals are recalled, together with the trials and achievements of the thousands of brave men on either side, who dared to face death for their country, their cause, and their flag, the spot acquires an interest which cannot be surpassed in military story. The perfection with which the different battle fields are defined by the contour of the country adds much to the charm of the scene. Directly beneath, to the north, is the city of Chattanooga partially enfolded by a bend in the river, which is here three-quarters of a mile in width, with its suburbs extending out and nestling along the slopes of the neighboring ridges. Just below the city, the Tennessee River beats against the foot of Lookout Mountain and makes a remarkable turn upon itself, known as the Moccasin Bend, from the resemblance of the enclosed peninsula to an Indian moccasin. At the ankle, the distance across is only about one mile, but the shore line is nine miles. Further north the river shines out through the deep gaps in the mountains and is seen at intervals for about forty miles.

To the east and close at hand, the valley is bordered by the long line of Missionary or Mission Ridge, on which was some of the most stubborn fighting during the battle of Chattanooga. The ridge extends in a direction north and south for a distance of six miles, while back of this is a broad expanse of rolling country, the ridges resembling fixed or petrified ocean waves, which terminate in the dark outlines of the Great Smoky Mountains of North Carolina, which tower to an enormous height and form a fitting background to the magnificent picture, while the whole is submerged in a delicate blue atmosphere, which gives a placid beauty to the scene, making it, as above noted, unsurpassed by any other region.

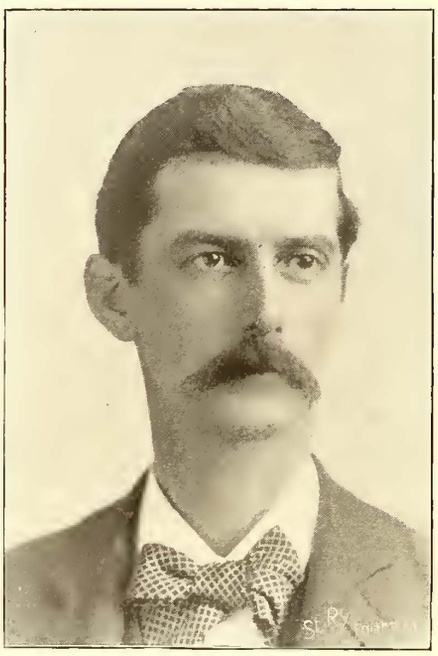
To the south the serrated peaks of the Lookout range, which extends for eighty-five miles, intercept the vision, while in the west are the neighboring Racoon Mountains, with their palisades, smaller but not unlike in appearance to those along the Hudson. Beyond are the Sand Mountains, and back of all the Cumberland Plateau, which leads the eye into the states of Virginia and Kentucky, which, together with Tennesee, Alabama, Georgia, North Carolina and South Carolina, make the seven states which can be seen from the mountain.

Besides the beautiful outlook, there is a great variety of scenery and many interesting points upon the mountain itself. The geological formation is very curious, the base of the mountain being a limestone and the top a light sandstone, some of the boulders being worn into curious and fantastic shapes. There is a natural bridge; the Old Man of the Mountain; the Garden of the Gods, and in addition a beautiful lake and waterfall, to which the visitor is shown. The prospect from Sunset Rock, where the bluff falls off precipitously for more than 300 ft. on the west of the mountain, is one of the most picturesque and marvelous of the location, and includes the Wauhatchia Valley and Grim's Gap, through which the Federal troops advanced for their assault on the heights.

Quite in keeping with the unsurpassed scenic beauty of the place is Lookout Inn, one of the largest and handsomest hotels east of the Rocky Mountains. It is a modern structure with accommodations for about 500 guests, and is equipped in the highest style of hotel art, and with exquisite interior decorations. It faces the east on the highest point of the plateau, and is 365 ft. front. The material of the first story is sandstone, which was quarried upon the mountain, while the other three stories are of wood, with shingle outside finish. The main tower is served by an elevator, and from this elevation the finest view is had. The inn is both a summer and winter hotel,

and is a great resort for Southerners in the summer and for Northerners in the winter. It is worth a visit to the regions to enjoy the entertainment furnished by the hotel, and a night spent here will by no means be the least of the attractions that will help to make up an enjoyable excursion.

Just in front of the inn, across the railway tracks, is a large building known as the War Museum, in which is found a very large and interesting collection of war relics, which have been gathered from the neighboring battlefield. From the hotel it is only a short walk to Point Lookout, beneath which is the Lookout House, reached by a series of steps down the bluff, but those who prefer can take the cars on the Narrow Gauge road, which comes up to the hotel, over a third rail, on the Broad Gauge line, and which runs around the summit of the mountain a distance of three miles to the right and terminates at Lookout Point Hotel, where connection is made with the cars of the inclined railway upon which the trips are made every twenty minutes. The incline is three-quarters of a mile in length, and is operated by a cable over an average grade of 22½ per cent., the steepest points being 33 per cent. This is one of the few inclines in the country where the cars operate around a curve, the upper portion of the line making a long curve to the right in order to reach the hotel and avoid the bluffs which border the summit on three sides. The incline is a three rail line, three foot gauge, and is operated by the Incline & Narrow Gauge Railway Company, which includes the Narrow Gauge line above mentioned, and of which T. M. Derickson is superintendent. The incline is operated by an endless cable, to which the two cars are permanently attached, and the ropes are carried around curves on sheaves tilted to an angle of about 45 degs. The power station is located at the foot of the mountain, and the rope is driven by a pair of winding drums which are both driven by an intermediate gear, but one drum is set at quite an elevation above the other, so that the ropes lead in an ascending angle to the tension sheaves in rear and above the line of the winders. The power is furnished by a duplicate engine, each piston being coupled to the end of the shaft, and which is controlled from the engineer's office in front of the building by the throttle which is connected with a rod and hand wheel. From the power house a shuttle electric car connects with the cars on the line of the Chattanooga Electric Railway, over which the return trip is made to the city.



W. T. ADAMS,
PRESIDENT CHATTANOOGA ELECTRIC RAILWAY COMPANY.

A second incline is now building some distance to the south of the one described, upon which the grading has already been done, and which will extend in a direct line to the top of the mountain near Lookout Inn, the face of the bluff having been blasted away to provide an approach to the summit.

THE CITY.

The name of Chattanooga is an Indian term, meaning hawk's nest, and was derived from the cove, or bend in the river, in which the place is located, and which looks like a huge nest, when viewed from the top of Lookout Mountain, which, in turn, is said to have derived its name from an expression of the pioneer boatmen, who, in descending the river, cautioned each other, when nearing this point, to "look out" for the Indians who were wont to lay in ambush at this point. The city proper contains a population of about 45,000. Including the suburbs, there is a population to which the street railways cater, of about 60,000. It is known as the Key City, being located at the only gap in the mountain barriers through which railroad communication can be had between the Central Southern states and the Central Northwest, making it as important a strategic point in its relation to commerce, as it was in time of war. Ten railroads center here, and the river has recently been improved, so that there is an unobstructed waterway to the Gulf through the transportation lines of the Mississippi system. Besides its transportation facilities, the city has other principal advantages for making it an important manufacturing center. The first of these is its proximity to the three principal factors that enter into manufacturing industries—iron, wood, and textile fabrics, being located almost in the center of the greatest iron producing section of the country, in the very heart of a well wooded section, and immediately upon the northern border of the great cotton belt, while it is also near to one of the best wool producing sections. The other advantages are an abundance of skilled labor, cheap living, and a climate that is said to be unsurpassed upon the continent.

The above are some of the commercial advantages, which, added to its historical associations and grand scenery, give great promise of its future growth.

STREET RAILWAYS.

The lines electrically equipped embrace about fifty miles of track, and there are forty-four miles of dummy line, besides the Lookout Mountain roads above described.

The Chattanooga Electric Railway Company,

controls forty miles of electric equipment, and operates its lines in four branches, which traverse the most desirable streets of the city, and extend to the principal suburbs, while there are a number of extensions projected and partly built. One of the principal lines runs out to Lookout Mountain and another out and along Mission Ridge. The ridge, as stated above, runs in a north and south direction for a distance of about six miles, and has an average altitude of 400 ft. above the city. This line, next to that of Lookout, possesses the greatest interest. The distance from the city to the foot of the ridge is about three miles, and the cars run on a fifteen minute headway, and upon the way pass near the celebrated Orchard Knob, on which General Grant took position, and from which he directed the movements of the troops in the principal battle. At the foot of the ridge is a transfer station, and from this the ridge cars leave once an hour and take a zig-zag course along the slope, making one switch back over a track constructed of light T rails. Upon reaching the summit, a grand outlook is presented, second only to that to be had from Lookout Mountain; in fact, the eastern view from the ridge is regarded by some as the most interesting, as one is brought much nearer to the hills and mountains in this direction, which rise range on range until they terminate in the faint blue outlines of the Smoky Mountains, ninety miles away. The line continues south near the brow of the ridge, crossing from side to side, so that the scenery is varied at every point, while every section is rich in historical association. The ridge is dotted all over with fine homes, and is said to be a most healthful and desirable location.

The Government has erected two steel observation towers upon the ridge, from which the positions held by the contending armies are easily outlined. One of these is located near the northern terminus of the ridge, and is known as "Sherman Heights," and the other further south on Bragg Hill, and near which the cars pass. Outlines of the old fortifications and rifle pits are yet to be seen, and in places the older trees still bear marks of the conflict that raged about them.

The Government is also constructing a *boulevard*, fifty feet in width, with macadam paving, along the brow of the ridge, throughout its entire length, which also extends south seven miles, and connects with the Chicamauga and Chattanooga National Military Park, which is to be dedicated in September next.

Two of the lines of this system also pass near the gateways of the National Cemetery, where are buried over 13,000 Union soldiers. The cemetery grounds are extensive, and are enclosed with a neat stone wall, upon the inside face of which English ivy is carefully trained. The main gateway is a high granite arch with pillars, and presents an imposing appearance. Besides the ordinary headstones, upon which the soldiers' names are inscribed, and the plain marble posts which mark the unknown, there are a few fine monuments erected to the memory of some of the prominent officers and others, the most interesting of which is a monument to the memory of the Andrews' raiders, which consists of a large granite block capped by a bronze locomotive, which is an exact pattern of the "General" with which the celebrated locomotive race was made on the lines of the Western & Atlantic Railway.

POWER STATION.

Returning to the city, we visit the power station, from which the lines are operated, and which consists of a brick building located near the corner of Broad and Seventh Streets, directly opposite the Richardson Block, in which the officers of the operating company are located. On the Broad Street side there is an L, which is employed as a car barn, which is provided with pits and a shop for car repairs. The iron repair shop is located upon the second floor of the station, and here also is a store room for supplies, which is fenced off by a wire screen.

The power equipment consists of four tubular boilers, two of which were made by the Taylor Manufacturing Company, of Carbondale, Pa., and two by Casey & Hedges, of Chattanooga. Run-of-mine coal is employed as fuel and costs delivered about $1.65 per ton, being hauled by wagons about three-quarters of a mile. It requires about eight tons a day to operate the twenty cars, which is the average number employed at this season. There are four high speed engines, which are belted direct to five Edison generators. One of the engines is of the Armington & Sims make, and is of 250 H. P. and is run at 240 revolutions. The other three are of the Beck type, manufactured by the Taylor Manufacturing Company; one is of 150 H. P. capacity and the other two, 125 H. P. each. The two iron smokestacks lead through the second story, and are enclosed between the floors in a casing of wood, part of which is iron lined. The object of the casing is to protect the machine shops from the radiated heat. It would seem, however, to be a good arrangement for starting a first class fire. The engine room is kept in an exceptionally neat condition, reflecting favorably on the engineer in charge.

The cars are of the Brill and Stephenson make, and some of them were purchased from the Fourth Avenue (New York) line, where they were employed in the storage battery experiments that were made some years since. Some of the long cars have been made by splicing together two of the old horse car bodies. The motor equipment consists of Thomson-Houston, Detroit and Edison machines.

TRACK CONSTRUCTION.

In the paved streets a girder rail is employed which is supported on chairs, but in the suburbs the lines are built with light T rails spiked directly to the ties, while a good portion of the roadbed is ballasted with broken stones. The principal streets of the city are paved, and the material employed consists of granite blocks, asphalt and vitrified brick. Upon Market Street, which is the principal business thoroughfare, the pavement is of asphalt, with granite blocks between the rails and tracks, this construction being employed to give more ready access to the track foundations for repairs.

The rate of fare is five cents, with twenty two tickets for $1, except on the line to Mission Ridge, upon which a second fare is collected, except from residents along the line.

The Chattanooga Electric Railway Company has been lately re-organized with a change of management: W. T. Adams is president; E. Watkins, vice-president. Chas. G. Gostafson, superintendent; Wm. S. McCall, auditor, and Wm. H. Roots, secretary. Mr. McCall has been in the employ of the company in various capacities since its organization.

The Chattanooga & North Side Street Railway Company.

This company operates nine miles of track, including three owned by the North Chattanooga Street Car Company, from which it is leased. The president of the company is S. R. Reid, who is also proprietor of the Reid House, the principal hotel of the city, and W. C. Teas is the acting superintendent, who also has charge of the hotel lighting plant. Both lines are owned by real estate syndicates, and were built to develop suburban property. The stockholders of the latter company are mostly English people.

FIG 8—LOOKOUT INN—CHATTANOOGA, TENN.

The cars of both lines run over the same tracks in the city, and start from Ninth Street on Broad, turning east, and then north past the Court House, and continue due north over the Tennessee River, which is crossed with a fine steel truss bridge, supported on granite piers. The bridge is half a mile in length, and the floor is 107 ft. above the water. After crossing the bridge the lines divide, and one route continues northeast and circles around the woody hills and numerous pretty homes which already line the route, and again approaches the river and terminates at River View, a most delightful location, where is located a dancing pavilion and other buildings for the accommodation of picnic parties.

The line of the operating company continues near due north from the bridge for about two miles, passing through Hill City, where the car station is located, and beyond which it continues in a southerly direction through the woods just under the heights upon which Fort Wilder was located, and where the rifle pits are still visible. The extension beyond the power house is operated only in summer.

The station is a small wooden structure quite removed from any other building, and in a wild, romantic spot.

The equipment consists of two Armington & Sims 150 H. P. engines and two Thomson-Houston D. 62 generators. The engines, although they have been running nearly three years, have had no outlay for repairs, except the replacing of a broken valve. In the summer time both engines are required; at this season only one is run at a time, the change being made from one to the other each day.

There are two tubular boilers of 150 H. P. each, manufactured by Walsh & Weidner, of Chattanooga. Steam lump coal, $1.75 per ton, is employed for fuel. This is hauled from a landing on the river, where it is delivered in barges. It requires, on an average, three and a half tons a day for the four cars that are being run.

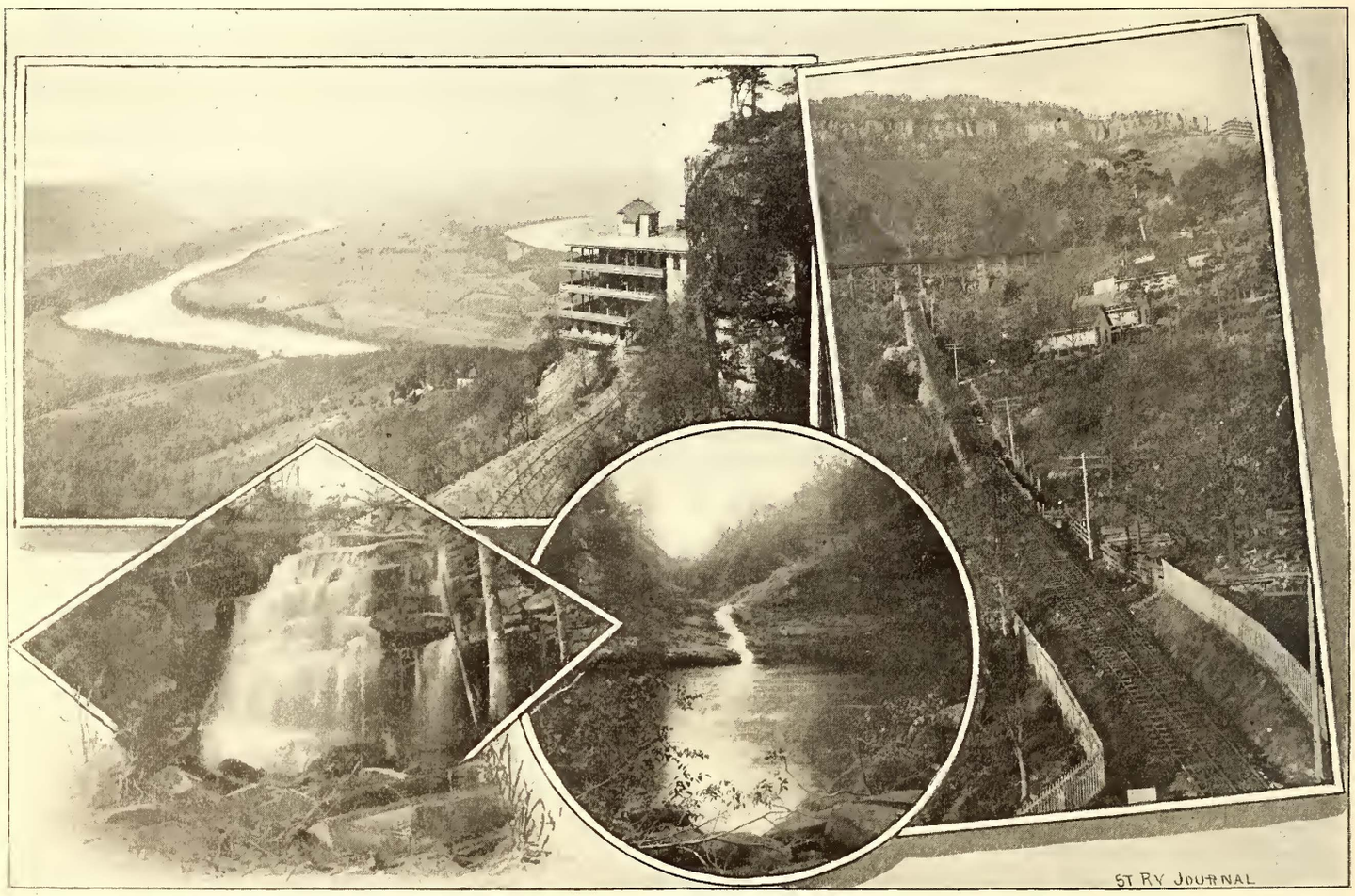


FIG. 9.—VIEWS ABOUT LOOKOUT MOUNTAIN—CHATTANOOGA, TENN

In summer a larger number are employed. The cars and trucks are all of Stephenson make, and are equipped with Thomson-Houston S. R. G. and Edison No 6 motors. This is the only line in the city on which the cars are heated, and for this both the Standard and Lewis & Fowler stoves are employed. One conductor collects the fare upon two cars, changing as the cars pass each other on the bridge. Inspectors are employed in the city, and in case of heavy travel, they act as conductors. The wages of motormen are thirteen and a half cents per hour; some of the men long in service receive fifteen cents an hour.

Conductors receive from twelve and a half cents to thirteen and a half cents an hour. Should the district through which the cars run build up as is anticipated, a prosperous future awaits the enterprise. The same is true of the other city lines and the lines upon Lookout Mountain.

We think, however, that it would be for the interest of the latter lines to provide more tasteful and inviting cars, as tourists will doubtless come in greater numbers each year, and will form more favorable impressions of the locality if the car equipment is in keeping with the hotel and other accommodations.

Atlanta, Ga.—Part II.

It is hard to realize that this city, now so large, so beautiful and so prosperous, has entirely grown up within the last twenty-nine years, or since November, 1865, when General Sherman's army left it, a scene of charred and desolate ruin, to begin the memorable march to the sea. No city during the war was so nearly annihilated, for what was not consumed by fire was blown up or torn down, or otherwise destroyed; besides, all its white citizens had been ordered away following its surrender in September. In 1861 the population was about 13,000, but the city having afterwards been made a military headquarters and supply depot for the Confederate Government, the population was swelled to a much higher figure by the influx of soldiers, and laborers in the arms and ordnance factories, and by the disabled in the hospitals, all of whom were afterwards expelled from their homes by the order noted above.

Time, however, has wrought a marvelous change, and here the Blue and the Gray, with their sentiments modified by generous and kindly memories, have together restored the city to all that warfare wasted, and tenfold more than was consumed, and established upon the very scene of conflict a monument of enduring peace to be far more renowned than one of war. The Atlanta of to-day was briefly described in our last issue, so it only remains to note a few of its salient features and complete the description of its street railway system. The elevation on which the city is located is higher, with one exception, than any other thickly settled portion of the country east of the Rocky Mountains, the height being 1,050 ft. above ocean level, the exception being Denver, which is about one mile above. Geograpically it is situated near the center of the great Southern quadrilateral, which embraces ten states with unsurpassed natural resources, with every part of which it is in direct communication with its eleven railway lines.

Its elevation makes it absolutely exempt from malarial influences and epidemics, so that it has become a veritable "city of refuge" for the people of the coast cities during yellow fever epidemics. Here infectious diseases find nothing to feed upon, and infected patients brought here fail to produce a second case.

Chiefly on account of its healthfulness the region was selected for the location of Fort McPherson, the second finest army post in the United States. The camp is situated west of the city limits and five miles from the center of the city, and contains 236 acres, being a level and well shaded tract. The barracks and officers' quarters are of brick, the latter being large and tasty in design and finish. At present the garrison consists of five companies of artillery and one of infantry, the latter being composed of Indians; in all about 350 men. In summer the number is largely increased by the transfer of many of the artillery companies from the coast defences to the reservation in order to avoid exposure to yellow fever and cholera.

The camp is a popular resort for Atlanta's citizens, who visit it in large numbers on pleasant evenings to witness the dress parades and listen to the music which is provided by a brass band attached to the post. The camp, or barracks, as it is locally known, is reached by steam cars, which run trains every hour, and by the main line of the Atlanta Traction Company's system.

WATER WORKS.

The water works system of Atlanta, which has recently been completed at a cost of $750,000 is said not to be surpassed by that of any city in the country. The Holley system is employed, and consists of two pumping stations, a storage reservoir, filters, and the necessary mains and hydrants. The first station is a fine brick building of ample dimensions located beneath a high bluff near the bank of the Chattahoochee River, about seven miles from the city, and which is protected from high water by a semi-circular embankment about twenty feet high. A forty-eight inch supply pipe extends for some distance along the bank and to the middle of the river through which the water flows into a deep oval well near the station from which it is pumped and forced a distance of four miles to the reservoir, which has an elevation of 250 ft. above the river, and a storage capacity of 198,000,000 gals. The equipment of the river station consists of two Holley duplex, compound engines with Gaskill pumps, each having a capacity of 10,000,000 gals. per day (twenty-four hours). The two high pressure cylinders of each pump are thirty inches in diameter, and the low pressure fifty inches, with a forty-two inch stroke, the high pressure cylinders being directly above the low pressure. The four pistons are connected with a short walking beam which actuates a large flywheel placed between the pumps and cylinders, while the pistons of the pumps are extensions of the low pressure pistons. A pair of air chambers completes the equipment. The combination forms one of the most massive and interesting machines to be found in any similar station. The steam is generated in nine 100 H. P., tubular boilers manufactured at the Atlanta Machine Works. A high brick smokestack completes the principal equipment.

JOEL HURT,

PRESIDENT ATLANTA CONSOLIDATED STREET RAILWAY.

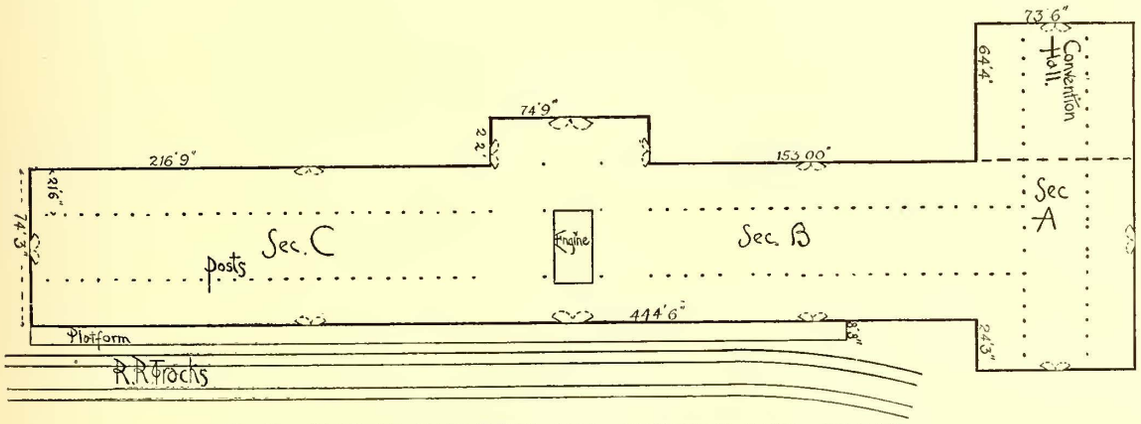


FIG. 10.—PLAN OF MACHINERY HALL—PIEDMONT PARK, ATLANTA.

FIG. 11.—MACHINERY HALL—PIEDMONT PARK, ATLANTA, WHERE THE NEXT CONVENTION WILL BE HELD.

Station No. 2 is a similar building and is located at Hemphill on the northern boundary of the city, near the reservoir and about three miles from the center of the city, both stations being reached from the city, over a wide boulevard recently constructed by the county. Station No. 2 is equipped similar to the river station, except that the pumps have a capacity of 12,000,000 gals. per day and are run continuously, keeping a sufficient pressure upon the mains for ordinary purposes, but which, in case of a fire alarm, can be greatly increased with sufficient force to throw the water over the highest buildings.

The river water, being very muddy, is filtered at the reservoirs before it is delivered to the mains; it is, however, considered very pure and heathful. The city has also a very excellent sewer system.

HOMES AND PARK SOCIETIES.

Peachtree is the finest residence street and is bordered by as many and as fine homes as can be found in a single street of most any other city in the country, while there are many elegant residences located in other sections. On a pleasant afternoon there may be seen on the streets a large number of fine turnouts, and many other evidences of wealth and prosperity. The public parks embrace about 1,500 acres, the principal one of which is Grant Park situated on the southeastern boundary of the city and contains 140 acres. The tract is well shaded and has been well improved, making it a most attractive resort. The city has recently purchased the celebrated painting of the Battle of Atlanta, and placed it in a commodious building in the park. There is also a well assorted "Zoo."

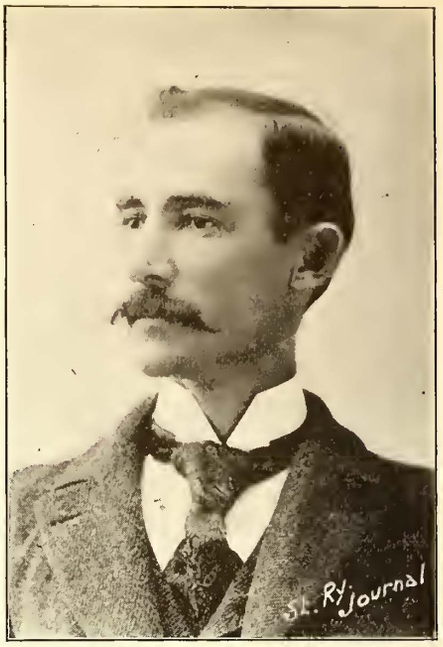
FIG. 12.—ENTRANCE TO PIEDMONT PARK, WHERE THE NEXT CONVENTION IS TO BE HELD.

There are sixty-six churches and missions, and a number of fine school buildings.

There are two social clubs—one known as the Capitol City Club, and the other the Commercial Club. The former has a large membership and occupies a very elegant and handsomely furnished house on the corner of Peachtree and Ellis Streets, which is illustrated in Fig. 13, this view being taken on the line of the Atlanta Consolidated Street Railway, and near where the lines of the Traction Company cross.

The city supports two daily papers, the principal one being the *Atlanta Constitution*, which was made famous by the labors of the late Henry W. Grady, whose monument was illustrated in our last issue. The paper now occupies a large, elegant building on Alabama and Forsyth Streets.

The Atlanta *Journal*, known as the greatest afternoon paper in the South, issues four editions daily, except Sundays, and has every evidence of prosperity. There is also a publishing company which prints patent outsides for about 400 country papers.



H. N. HURT,
SUPERINTENDENT ATLANTA CONSOLIDATED STREET RAILWAY COMPANY.

STATE CAPITOL.

The edifice is one of the most imposing in the city, the material being limestone, Georgia granite and marble. The east and west face is 325 ft.; the north and south 172 ft., and the height to the top of the figure of Liberty is 257 ft. It is worthy of record that it was built within the appropriation of $1,000,000.

The Union Passenger Depot is located in the immediate center of the city, and is easy of access from all parts of the city by the street cars. It is proposed, however, to move it away, on account of the confusion and annoyance caused to the near residents. The principal business streets are south of the depot, but the hotels and best residence portion are north and northeast, as is also the Exposition ground, where the meetings of the Association are to be held.

HOTELS.

These were quite fully described in our last issue, but the illustration of the Kimball House is given on the next page. This is a fine fireproof building, and is noted for its grand dimensions, and for the central arcade which is 60 × 100 ft., open to the skylight, with wide balconies upon each floor.

MANUFACTORIES.

Atlanta is an important manufacturing city, there being, it is claimed, 300 manufacturing concerns in its near vicinity, and embracing nearly every important commodity. There are three large cotton factories; extensive manufactories of agricultural instruments; cottonseed oil machinery and cotton gins; also cottonseed oil mills, and establishments for the manufacture of chemicals employed in making commercial fertilizers. There is also an extensive manufactory of leather belting styled the Southern Belting Company. Added to these are the granite industries described in our last issue. The city being the trade center of the

South Atlantic States, here are located the headquarters and agencies of numerous Northern manufacturing concerns. These include the principal Southern depot of supplies of the General Electric Company, which occupies a large four-story brick building at the corner of Marietta Street and Jones Avenue, while the offices for the Southern territory are in the Equitable Building. The present office force is as follows: A. F. Giles, resident manager, who has been recently appointed to succeed H. E. W. Palmer, resigned. D. R. Bullen is chief of the supply department. S. W. Trawick and F. W. Wilcox are traveling salesmen; Frank Lederle is engineer; F. A. Hills has charge of the railway department, and G. L. Thompson, the isolated lighting and motor departments.

The headquarters of the Johnson Company, of Johnstown, Pa., manufacturers of the Johnson girder rail are also in the Equitable Building, Wm. W. Kingston being the principal representative, with L. R. Shellenberger as engineer.

The Carnegie Steel Company is represented by Walter M. Kelley, with headquarters in the Gould Building.

C. H. Willcox represents the Lane & Bodley Engine Works, of Cincinnati, and the Harrison Safety Boiler Works, of Philadelphia.

The Siemens & Halske Company, of America, also has a branch office in the Equitable Building, and is represented by H. I. Bettis.

The Stilwell-Bierce & Smith-Vaile Company, manufacturers of Victor turbines, is represented in Atlanta by J. W. Taylor.

The following are also local manufacturers, or deal in street railway supplies to a considerable extent: Brown & King Supply Company; Chas. A. Conklin Manufacturing Company, and the Standard Oil Company.

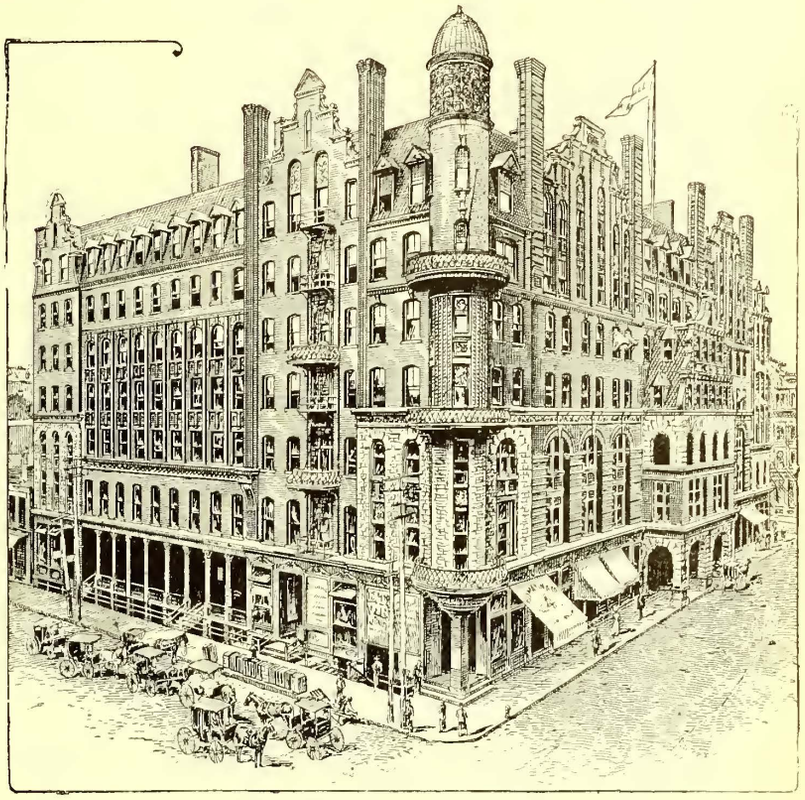


FIG. 12.—KIMBALL HOUSE.

STREET RAILWAYS.

The financial affairs of the Atlanta Consolidated Street Railway Company have recently been satisfactorily adjusted, following the refusal of Judge Pardee to appoint a receiver for the line, application for which by one of the bondholders, was mentioned in our last issue. The station and rolling stock will now be largely increased, a shorter headway adopted, and the service generally improved.

It was noted last month in connection with the operating affairs of this company that it was manufacturing its own car wheels at a cost of about $3.00 each. This should be qualified by the statement that the scrap employed in the manufacture of wheels was not charged up in the estimate. It should also be remembered that coke and pig iron are remarkably cheap in this locality, the former costing only about $3.40 a ton and the latter about $17.00. It is not possible, in our opinion, for street railway companies, as a general thing, to make wheels that

FIG. 13.—PEACHTREE STREET, LOOKING NORTH FROM ELLIS STREET—ATLANTA, GA.

are as durable or as cheap as those bought from the wheel manufacturers.

The company now proposes to try the experiment of making its own cars, the wood work for which will be procured ready for setting up from the local planing mills, and will be put together in the company's shops. It is proposed to build a number of open cars entirely of Georgia pine lumber.

In connection with street construction, it is interesting to note that no grade crossings of steam lines are allowed in the city. The lines of the Consolidated Company cross the steam lines on seven bridges and pass under at two points.

FIG. 14.—OLD CAPITOL BUILDING—ATLANTA, GA.

Atlanta Traction Company.

This company was formed last year by the consolidation of two systems, one having the same name and the other known as the Atlanta Street Railway.

The present officers are: T. B. Felder, president; E. T. Shubrick, vice-president; J. T. Voss, superintendent.

The system embraces about twenty miles of track, and the principal line extends from Camp McPherson, five miles southwest of the city, through the center of the city, passing the postoffice, and within one block of the corner at which all the lines of the Atlanta Consolidated Company meet; thence out to Decatur, a flourishing town to the east. There are also branches to East Lake and Grant's Park. Already the road has developed the territory through which it passes, new houses having gone up all the way from Atlanta to the terminals. The line passes over an undulating surface, and some of the grades are quite steep. From a hill upon the line, near the East Tennessee shops, a commanding view is had of the city and surrounding country, and this is said to be the best point from which to overlook the situation. The track is composed mostly of a forty pound T rail, and is a single track line, with switchback turnouts, and the system is operated from two power stations, one located in the southwestern part of the city, between it and Camp McPherson, and the other on Irwin Street, on the Decatur branch. The boiler equipment of the first station consists of three 125 H. P., drop tubular or vertical boilers, manufactured by McGlaughlin of Boston, in which slack coal, costing $1.90 a ton, is employed as fuel. There are two Russell high speed, automatic engines of 260 and 125 H. P. respectively. The engines are belted direct to the generators, which consist of one Edison of 100 K. W. capacity, and two M. P. Eddy generators of the same capacity. The M. P. generators have recently been

substituted in place of two Eddy bipolar machines. Adjoining the power station are the car barns, the pits, the machine shops and armature winding room. A stationary motor provides power for repair shop machinery.

The rolling stock consists of cars manufactured by J. G. Brill and the American Car Company, which are mounted on Brill, McGuire and Robinson (Altoona) trucks, and are equipped with Detroit, Westinghouse and Edison motors, there being eight of the Detroit type. The cars are at present run under a twenty minutes headway, and the average number a day operated is fourteen. The fare is five cents each way from the center of the city.

FIG. 15.—UNION DEPOT—ATLANTA, GA.

The terminal points are popular as places of residence or resort, and with a new equipment of rolling stock and motors, which is proposed, no doubt in time the line will do a thriving business. One branch of the system has been running since March, 1891.

Collins Park & Belt Railroad Company.

This line was originally planned for the development of property lying west of the city, along the banks of the Chattahoochee River. It is a single track with switchback turnouts, and starts from the center of the city, near the post office, and as originally built, extends fifteen miles, but owing to the expense of tunneling and embankments for passing under the Western & Atlantic Railway, it has not been opened further than this point, and now terminates at Bolton, about nine miles from the city, the remainder of the line being idle. The laws of the state, relating to grade crossings have recently been modified, and permission has been secured to cross the steam line near the depot, in the town of Bolton, when the entire line will be operated. The line is constructed with a fifty-six pound T rail, which was formerly employed on a steam line. This is spiked directly to sawn ties, placed two feet apart, making a very substantial roadbed. The rail joints are bonded and the bonds connected with a very large galvanized return wire. The line is suffering considerably from a collapse of the real estate boom, as first inaugurated, but is still in operation, and with the return of prosperous times will yet, no doubt, meet the anticipations of its projectors. It is at present in the hands of a receiver, J. W. Darr, who is superintendent and manager, and to whom the creditors are greatly indebted for the skill and economy with which the affairs are being managed and the fact that the line has been kept in operation.

A portion of the route is through a woody, wild, romantic region, with many curves and street grades, but which is rapidly building up with new homes. The cars leave the city terminal every half hour and run to the limits six miles distant, but from this point out, trips are made only once an hour.

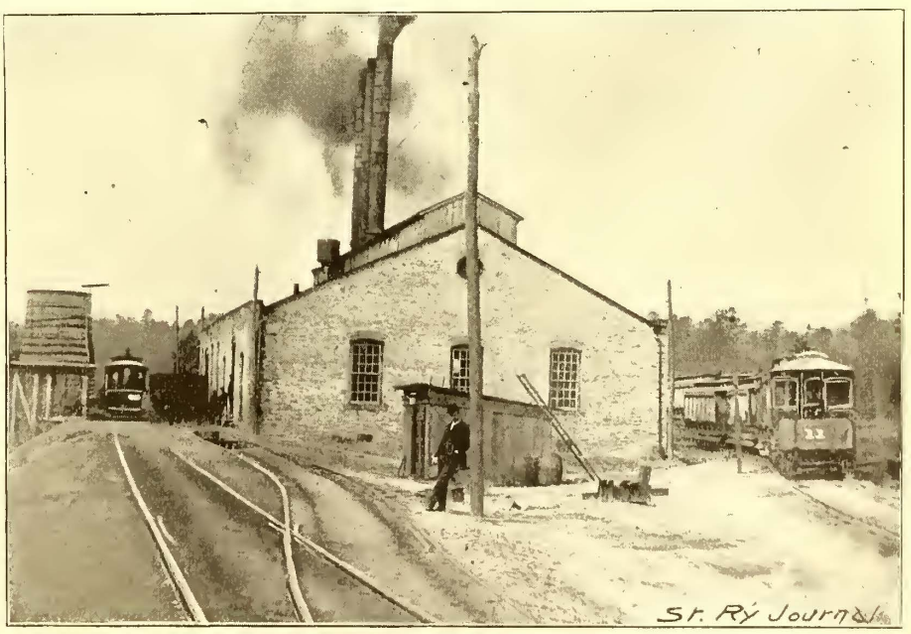


FIG. 16.—POWER HOUSE OF THE COLLINS PARK & BELT LINE RAILROAD CO.—ATLANTA, GA.

The car station is a stone building, located about six miles from the city and stands alone in the woody tract. The equipment consists of two Reynolds-Corliss 180 H. P. engines, each of which drives direct by a twenty-four inch belt a Short generator, one of which is a thirty-six inch, 150 K. W. machine and the other a 225 K. W. The belts were furnished by the Southern Belting Company, of Atlanta. The steam is generated in three tubular boilers of 200 H. P. each, manufactured by E. H. Jones, of Cleveland, O. The station is kept in an exceptionally fine condition.

The fuel consists of Little Warrior coal from Hewitt, Ala., which costs, delivered, $1.90 per ton, being hauled by the company three-quarters of a mile over its own tracks, a siding being provided which leads out to the side of a steam line. Water is obtained from a neighboring stream, which is brought from a considerable distance in an open trough, the trough having been substituted for a two inch iron pipe formerly employed, as the latter was liable to be choked with sand, or to freeze up in cold weather. There is no barn for the storage of the cars, and the outside repairs are done under an open shed.

The rolling stock consists of four sixteen foot, closed cars, and seven eight seat, open cars, all of which are of Brill manufacture. Two of the closed cars were recently purchased from the Atlanta Consolidated Company, and electrically equipped by the superintendent. The cars are mounted on Dorner & Dutton trucks, and are all equipped with twenty horse power, S. R. G. Short motors. The motor equipment was formerly employed on the line at Wilkesbarre, Pa.

The line does a considerable freight business, including the hauling of wood, brick, sand, etc. A funeral car is also operated when occasion requires, as the line passes Hollow Wood Cemetery, a new burying ground located at some distance from the city. The number of employes is twenty-one, and the pay of motormen and conductors is $1.50 for thirteen hours' work. There is no extra list, as the crews are required to lay off one day in each week. Colored trackmen are employed who receive $1 per day.

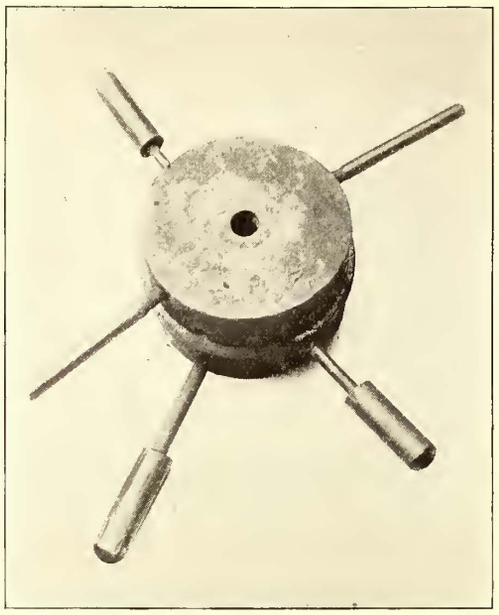


FIG. 18.—TROLLEY MOULD CLOSED.

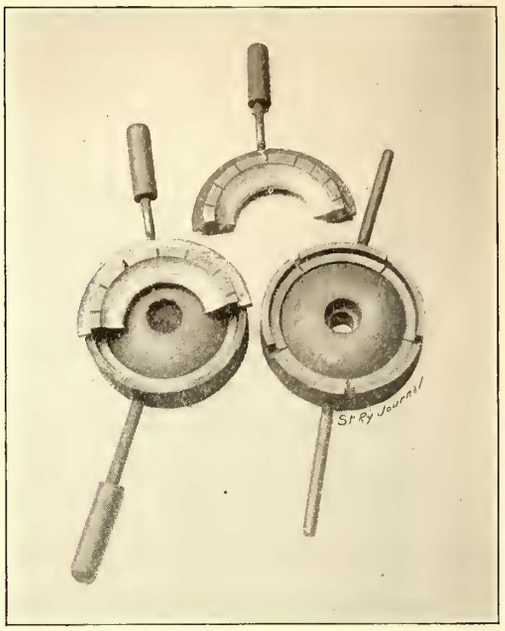


FIG. 19.—TROLLEY MOULD OPEN.

Only a short night run is made, as the last car leaves the city at eight o'clock.

Wanting a machine shop, the ingenuity of the superintendent is greatly taxed for making repairs. If seriously damaged, the motors and armatures are sent to the Steel Motor Company, of Cleveland, O., for repairs, but slight damages are repaired at the station. For turning down commutators, a lathe has been devised, which consists of a frame made from ties, with wood journal caps. The armature is turned by hand power by a crank which is provided with a clamp to embrace the armature shaft. A metal tool rest completes the equipment.

Considerable trouble is experienced in this locality from lightning. To guard against danger from this source, a lightning arrester is provided, which consists of a double set of serrated plates, connected with a switch, can be thrown as soon as the fuses of one set burn out. This is supplemented by a home made arrester consisting of two parallel bars of copper, one above the other, and placed about one foot apart, one of which is connected to the line, the other to the ground. These are joined by a number of small copper wires which are hooked over the upper bar and rest against the side of the lower bar, the wires being covered with a thin coat of shellac to prevent contact, but which is readily pierced by the static discharge. Additional wires are kept at hand to replace the others as fast as they burn out. However, the superintendent prefers to shut down the plant during a storm rather than risk the danger of a burnout.

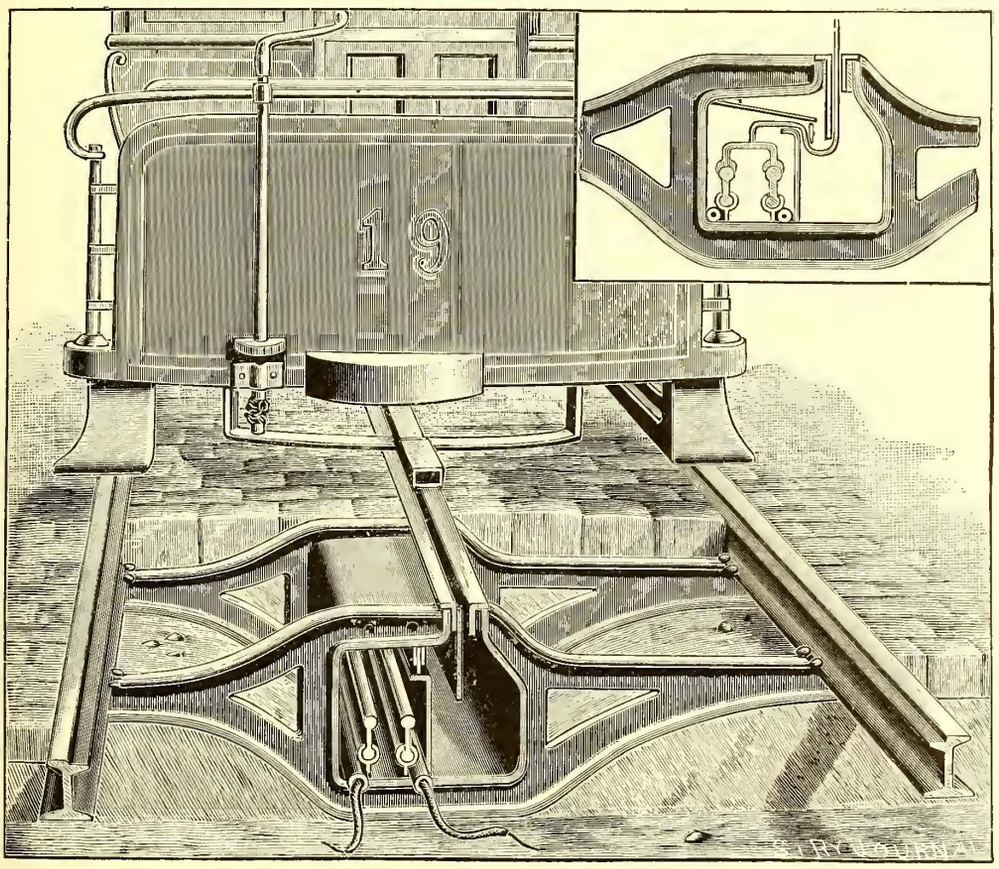
FIG. 17.—NEAR ARROWOOD—COLLINS PARK & BELT RAILROAD, ATLANTA, GA.

PROJECTED LINE.

The Lithia Springs Railway Company, of which Harry Camp is president; B. F. Curtis, vice-president, and Thomas Camp, secretary, has recently begun the construction of a new line, which is intended eventually to extend from near the post office in Atlanta, twenty-two miles, to Lithia Springs, a popular resort west of the Chattanooga River, capital for which is being furnished by Minneapolis parties. The first six miles, which are now building, will extend only to the river, and which it

is expected will be in operation in the early summer. The river will then be bridged and the line extended. A portion of the city section will run for a short distance along the same streets upon which the tracks of the Atlanta Consolidated Company are now laid.

The line is projected for the development of suburban property and for establishing a park at the river, where it is proposed to provide a fleet of electric launches for the accommodation of pleasure seekers. The effort is being made to purchase some of the same boats that were employed upon the Lagoon at the World's Fair. The batteries for operating the launches will be charged from the railway line. The current of the river, for a considerable distance in the neighborhood of the proposed park being comparatively slow, it will make a safe and pleasant sailing course. As this is the only available water of any extent in the neighborhood of Atlanta, it is expected that it will develop into a popular resort. The track is being constructed mostly with T rail, manufactured by the Illinois Steel Company, but in the paved streets of the city a rail of the Johnson girder type will be employed. The type of motor and power equipment are not yet determined upon.



NEW CONDUIT SYSTEM FOR STREET RAILWAYS.

TROLLEY MOULD.

The trolley mould used in the manufacture of trolley wheels by the Atlanta Consolidated Street Railway Company and described in our last issue, is shown on the opposite page. This mould is of iron and in three parts, each of which is provided with handles. The use of iron for moulds has given better results, it is claimed, than sand, as the iron chills the metal somewhat. C. B. F.

A DISASTROUS fire occurred February 2, in Cincinnati, at the Avondale Street Railway car houses.

THE Lake Street Elevated Railway Company, of Chicago, intends to build, before long, a three mile extension to the northwest.

THE Third Avenue Railway Company, of New York, has petitioned for rights on a number of streets in the northwestern part of that city, with privilege to employ electric power.

A Double Compartment Conduit System.

A conduit system for electric railways, which differs radically from any of the many devices for putting the contact wire under the surface of the street, has been invented by H. Petersen, proprietor of the Petersen Electric Works of Milwaukee, Wis. The system has attracted a great deal of attention among expert electricians and street railway men who have examined it, and many favorable opinions have been expressed about it. The inventor intends to install a section of road before long, when the merits of the device can be thoroughly tested and demonstrated. The principal object of the invention has been to make suitable provision for guarding against an accumulation of dirt and moisture within the conduit. The general arrangement of the invention is shown in the accompanying engraving.

As will be seen, the principal feature of the conduit lies in the fact that it is constructed with two longitudinal compartments, one of which is arranged to contain the electrical conductors, and the other to carry off the water that might find its way to the inside of the conduit, this latter compartment being connected at intervals with the sewers. A steel broom attached to the cars is arranged to sweep along any accumulation of dirt in this compartment and deposit it in the sewer.

The second compartment is placed out of the line of the slot. In the upper part of the wall between these two compartments is an opening provided with a device by which it is kept closed when the car is not passing, but so arranged as to be automatically opened by the trolley arm. In the conduit shown in the large engraving the device consists of vertical strips of metal of considerable length jointed and adapted to be raised between guides. By this means no moisture is permitted to get into the compartment containing the conductors, and the slot rail is extended down far enough to prevent any water getting on the closing device. As the conductor compartment is thus to all practical purposes entirely shut off from the interior compartment, and as, consequently, its temperature is the same as the temperature of the wall of the conduit, it is thought no condensation will take place in this compartment. In a very wet climate, if found necessary, a circulation of air may be supplied to this compartment by means of a fan, but there seems to be hardly any reason why this should be required, especially as the passage of the car will provide a considerable current of air. In the upper right hand corner of the cut on this page is shown a slightly different method of keeping the compartments separate. This consists of a flexible cover or flap, which normally rests on the division wall, but is raised on a roller carried on the trolley arm to permit the passage of the latter.

Instead of using wires for conductors, it has been considered more reliable to employ iron or steel contact rails, as shown in the cut. These are divided into sections of about 100 ft. or any other convenient length. Such section is tapped on the two main feeders and provided with switch and safety cutouts placed in manholes, so that if any trouble should occur, one section can be switched off without delaying the traffic on the whole line. These contact rails can be held in position in various ways. The cut shows two brackets supported on two yokes, and held in position by insulating material. The whole compart-

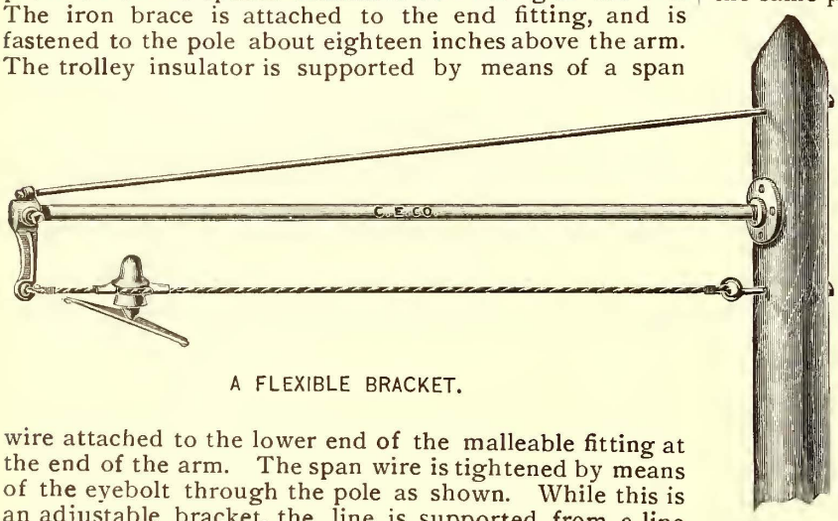
ment is finally coated with waterproof insulating paint. The main feeders are laid in pipes. The depth of the conduit is considerably less than that required for a cable conduit.

The shape of the trolley arm is shown in the small engraving. This arm is provided with two contact shoes, which nearly surround the upper part of the contact rail, so that they cannot jump the conductor. The contact shoes are provided with a swivel arrangement so as to take up any unevenness of the track, and by means of springs keep in proper contact with the conductors. From each contact shoe, wire is laid through the hollow arm and extended up to the motor, and at each end the arm is hermetically sealed. The contact carrier is so arranged that the motorman can from his platform, by moving a lever, lift the contact carrier out of the conduit at the manhole, without delaying the car for more than a minute.

A Flexible Pole Bracket.

The new pole bracket shown herewith is manufactured by the Creaghead Engineering Company, of Cincinnati, and is offered as a device of special merit. It is adjustable, and is a flexible support for the trolley wire.

The horizontal arm is one and a half inch pipe provided with a special malleable iron fitting at the end. The iron brace is attached to the end fitting, and is fastened to the pole about eighteen inches above the arm. The trolley insulator is supported by means of a span wire attached to the lower end of the malleable fitting at the end of the arm. The span wire is tightened by means of the eyebolt through the pole as shown. While this is an adjustable bracket, the line is supported from a line insulator on a flexible span wire. This flexible support eliminates all the troubles peculiar to "stiff bracket" construction.



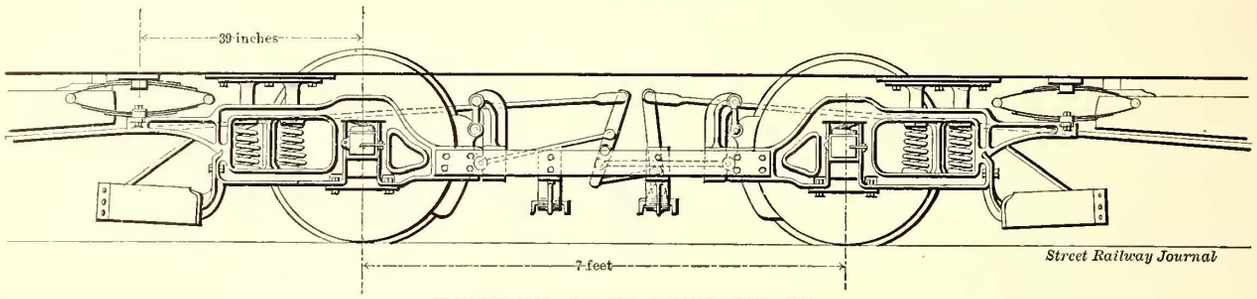
A FLEXIBLE BRACKET.

On high speed suburban roads it is often difficult to get satisfactory results from the ordinary forms of rigid bracket construction. With this flexible support, there is less strain on the insulators, less noise, less "arcing" and less "jumping" of the trolley. This bracket in the form illustrated is made in lengths up to eight and a half feet, and in a modified form up to fifteen feet.

The Liverpool Overhead Railway Company reports for the half-year ending December 31, 1893, as follows: Passengers carried, 2,475,639; number of trains run, 46,429; train mileage, 243,539. They also show a balance available for dividends of over $27,000 on the half-year's business.

St. Louis Car Company's Truck No. 8.

The accompanying cut shows an elevation of the St. Louis Car Company's steel truck, No. 8, which is an improvement on a previous truck somewhat similar in design, placed on the market a little over a year ago, and illustrated and described on page 697 in the November, 1892, issue of the Street Railway Journal. The spring base of the latter, though of the extended type, was not found long enough, and in the new truck the four large steel castings, one at each corner, have been modified so as to give room at each for an elliptic spring. In the old truck the concussion spring over each oil box brought back the disadvantage of oscillation of the car body, to eliminate which the truck was designed, and in truck No. 8 it has been found that the lengthening of the wheel base has done away with this, although the concussion springs are retained. In the old truck the spring base was ten feet nine inches, while in truck No. 8 it is thirteen feet eight inches. The four castings of the truck are riveted together with distance pieces in order to make any desired wheel base. This is a new and advantageous feature which no other truck possesses.



TRUCK NO. 8.—ST. LOUIS CAR CO.

The brake mechanism is very powerful, and as it will be seen, there is direct leverage on the brake shoes. The engraving shows inside brakes, but outside brakes may also be applied. The mechanism of the latter works on the same principle as that of the old truck. The brake hangers are very stout, and are joined to the distance pieces. There are no brake beams, but the brake levers apply the shoes to the wheels through a steel bar running across the truck, to which are joined the small levers. With the outside brake arrangement the brake beams are retained.

The motor hangers are of cast steel, and hung to the distance pieces. It will be noticed that the cast pieces holding the life fenders to the truck are simply bolted to the truck frame. This is a new and excellent departure, for when fenders or the pieces attaching them to the truck are broken, the latter is not disabled entirely or rendered useless, the pieces not forming an integral part of same. It is only necessary to substitute new cast pieces. In the engraving it will be noticed that each of the fenders is further strengthened by a steel rod joining the latter at the apex of the angle and each of the end distance pieces.

The truck is equipped with dustproof and automatic felt oiler journal boxes, which need oiling but once in three months. In order to raise the truck from the wheels, it is necessary only to unscrew the four bolts under the axle boxes, which release small retaining plates. The company expects truck No. 8 to meet with a large and ready sale, on account of the great success had with the truck of which No. 8 is the improved type. Over 500 of the old style trucks have been sold to various street railway companies throughout the United States. A large number is in use in St. Louis alone.

Bristol, England, is about to introduce the overhead system on one of its principal tramway lines. The necessary permission and consents have been secured for the equipment of the line between Old Meeting Street and Kingwood Hill.

A New Fender in St. Louis.

One of the latest fenders to be used in St. Louis is shown herewith. It has been employed on the cars of the Lindell Railway of that city with excellent results. It is adapted to run along the rails on small flangeless wheels,

A NEW FENDER IN ST. LOUIS.

and will thus pick up an individual and carry him along, there being no chance whatever of the fender passing over him. When not in use the fender is carried about ten inches from the ground and easily passes over any ordinary street obstructions. In time of necessity it is lowered by a small hand lever. This lever, however, will be done away with in the future, and a foot button substituted, because it is thought that in time of danger the motorman will find his hands fully occupied in manipulating the brake and power controlling handles.

The fender has on a number of occasions proved its value in saving life. It is the joint invention of Geo. W. Baumhoff and Gus. Hegemann, respectively general manager and master mechanic of the Lindell Railway Company.

AT a meeting of the stockholders of the Lancaster (O.) Street Railroad Company, held at Lancaster last month, it was decided to make an assessment on the stock to discharge the old debt of the company and equip with electric power. The track is already bonded and laid with fifty-two pound girder rails on chairs. All the streets are paved with brick. The officers elected were: Wm. Duffy, president; Dr. G. Mussee, vice-president; C. F. Nestor, secretary, and A. Bauman, treasurer and manager.

THE City Council, of Baltimore, Md., recently passed an ordinance requiring all street railways operating in that city to equip their cars with a proper guard or fender, to prevent, as far as possible, injuries to persons or animals.

THE New Haven (Conn.) Street Railway Company will commence operations, electrically, March 1.

The Ball Engine Company's Direct Connected Engine.

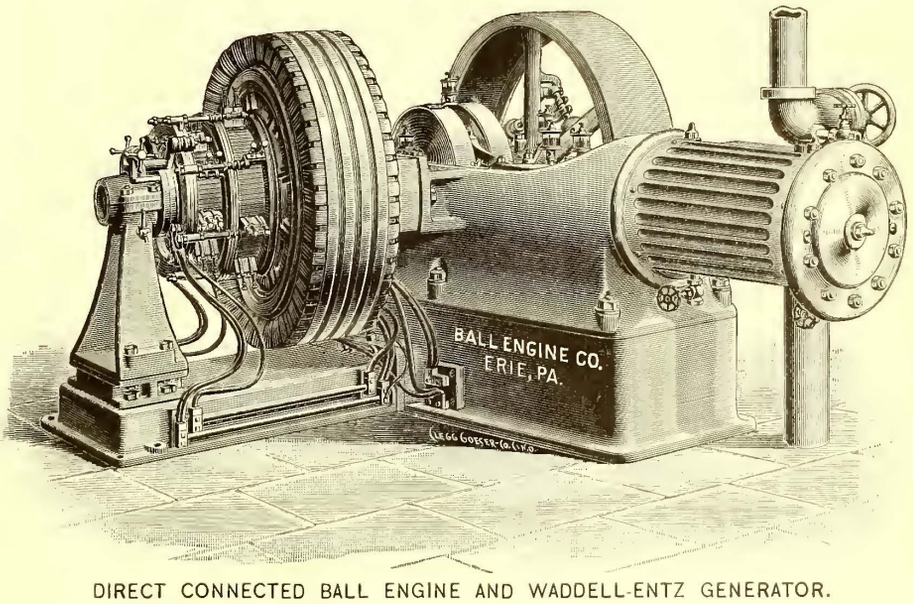
The direct connection of engines and generators has many advocates, and the call for direct connected couples has induced many engine builders to devote their attention to this practice.

This arrangement of engine and dynamo has a twofold advantage. The first of these is the small floor space occupied. This is an important consideration for central stations, hotels and office buildings in large cities where there is a steadily increasing demand for economy in this direction. Another advantage is in the elimination of waste of energy by transmission through belts and countershafting. With the direct connected engine the frictional losses due to outside causes entirely disappear, leaving nothing but the internal friction of the engine to be accounted for.

The Ball Engine Company, of Erie, Pa., has made a number of installations in connection with its various types of dynamos; among late ones, two 200 H. P., cross compound engines, directly connected to Siemens & Halske dynamos in the Lumber Exchange Building, Minneapolis, Minn.; one 125 H. P., simple engine, in connection with a Waddell-Entz dynamo, in the store building of Willoughby, Hill & Company, of Chicago; one eighty horse power engine in connection with the Waddell-Entz dynamo, in the building of Cumner, Craig & Company, of Boston, Mass. The accompanying illustration represents an eighty horse power Ball engine directly connected to a Waddell-Entz dynamo. It shows the armature mounted on the engine crankshaft, which is supported on the end by an outboard bearing resting on an extended sub-base. This is a remarkably compact, durable and efficient arrangement, and has given the greatest satisfaction in practice.

The distinctive features of this well known engine are beauty of design, simplicity and compactness, solidity and strength of frame, large bearings and wearing surfaces, excellence of material and workmanship.

The engine, therefore, is economical and durable, and being well balanced, will run quietly and smoothly under the heaviest and widest varying loads. The regulation is so perfect that, it is said, the engine will not vary more than 1 per cent. in speed.



DIRECT CONNECTED BALL ENGINE AND WADDELL-ENTZ GENERATOR.

THE latest projected electric railway of considerable length is one to connect the city of Washington with Richmond, Va. A bill has been presented to the Virginia legislature to incorporate the Southern Railway & Electric Company which has this in view. Among the incorporators are: A. Pizzini, Jr., T. N. Kendler, G. D. Patch and Hill Montague, all of Richmond.

Practical Notes on Rope Driving.

By M. E.

Introductory.—While economy in the generation and transmission of power is a more or less important factor in nearly all manufacturing concerns, it is doubtful if its influence has ever a more direct bearing on the profit and loss account than in the case of electric light and power plant. In the saw mill, or the flour mill, the cotton or the woolen mill, the cost of generating and transmitting power is of valuable import, but it represents in each case practically a fixed proportion of the cost of the finished product. But in the central station plant, and in one or two other similarly circumstanced concerns—where "force transformation" may be said to represent the "product"—any increase of efficiency in power generation or transmission becomes of supreme importance, affecting, as it does, the profitable operation of the concern nearly in direct proportion. Though of somewhat lesser moment, other points, as first cost, and maintenance, durability, and more frequently the space occupied by the installation, call for thoughtful consideration.

The necessity which so often obtains of restricting within the smallest possible limits the space occupied by the installation, has undoubtedly exercised a very marked influence upon the development of power generating plant in both its electrical and mechanical aspects. Directly connected engines and dynamos have now become common, but beyond the reduction of space and of first cost thus secured, it may reasonably be doubted if any other very material advantages can be claimed for this method of driving. Dispensing with intermediary gearing is not, in electrical work, the unmixed blessing that ardent advocates of direct connection would have us believe—a fact which a severe short circuit not infrequently demonstrates in a very unmistakable manner. Moreover, the interposition of an elastic connection between the engine and the dynamo cannot fail to act beneficially, for other well understood reasons, while the arrangement has the further advantage of allowing the engines and machines to be readily combined in various ways, as repairs or alterations may render necessary. These advantageous features, in conjunction with those of economy of fuel and greater durability of the lower speeded engines, appear to point conclusively to the fact that where the cost of space is not prohibitive, economy in working, durability, and general convenience in operation, call for dynamos indirectly coupled to engines of the most efficient type available.

Upon this assumption the method of driving to be adopted calls for careful consideration, in order that the power transmission may be most efficiently effected. Toothed gearing being obviously inadmissible, there remains available only belt and rope gear, and of this the former was until recently almost exclusively adopted in this country. During the last few years, however, attention has been directed to the method of transmitting power by fibrous ropes, a system largely adopted in England, and to a lesser extent in Europe generally. Concomitantly with this, there has been increasing attention given to the so-called American system of rope power transmission.

In quite a number of central stations in England, rope transmission has been adopted, and although in one or two instances, owing to bad arrangement, only indifferent success has been obtained, the majority of installations have given every satisfaction, the results showing that properly designed rope gear is quite as efficient, mechanically, as belting, while possessing several material advantages over the other method of driving.

Advantages of Rope Driving.—Among the special advantages claimed for ropes over belting for dynamo driving, the following call for special mention:

(1.) The first cost of the ropes is considerably less than that of the equivalent belting.*

(2.) Rope gear is a more nearly positive system of power transmission than belting, and allowance need not therefore be made for slip.

(3.) Rope gear is much more compact than belting at equal power, and consequently narrower (though not necessarily *lighter*) pulleys are required. The latter is often an important consideration in the transmission of large powers, as it reduces the width between the crank-shaft bearings, which with very wide band wheels, frequently becomes a serious inconvenience. Further, with the continuous system of rope driving, the driving and driven shafts may be much closer together than with belting.

(4.) Rope transmission is practically noiseless at all speeds, and the connection being more elastic than with belting, the power is conveyed in a more smooth and equable manner. Contrasted with the noisily flapping and swaying belts sometimes met with, this feature is recognized as a real, though a minor, advantage of the rope driving system.

(5.) The flexibility of this gear renders exact alignment of the connected shafts unnecessary, and thus it is not affected by any slight settling of buildings or foundations.

(6.) The cost of maintenance is, generally speaking, less than that of belting, this being a point, however, largely determined by the care bestowed upon the planning of the installation in the first place.

(7.) The separate rope driving system possesses the very material advantage of securing complete immunity from breakdown, as individual ropes may be readily renewed or old ones taken off, respliced and replaced, without necessitating the shutting down of the entire plant.

(8.) It is claimed that ropes occasion less drag on the shaft necks, and, consequently, entail less frictional loss than belts. This, however, cannot be said to have been conclusively proved.

Among other advantageous features which may be briefly referred to as being of more general interest are: Ropes enable power to be economically distributed to various parts of a building, corners being turned, and shafts at any angle being driven with facility, this being an especial advantage of the continuous system. Vertical drives—practically impossible with belts—can be almost as satisfactorily arranged as ordinary drives, while power can be efficiently transmitted to much greater distances by ropes than by belts.

Historical.—There can be very little doubt that the system of transmitting power by ropes owes its origin to the method adopted by the early inventors of cotton spinning machinery, for driving spindles, "rims," etc. Rope makers, were, however, among some of the earliest users of rope driving. As instancing this, it may be said that at a rope factory at Great Grimsby, Lincolnshire, England, ropes were used from 1830 to 1837 for conveying the power from the engine to the first motion shaft. Some flax spinning mills at the same place were also driven by rope gear about this time. In the rope factory about 100 H. P. was transmitted, and very satisfactory results obtained.* In this case hemp ropes and semi-circular grooves were employed. The wire rope transmission, introduced by the brothers Hirn, at Logelbach, in 1850, again attracted attention to the possibility of transmitting power by ropes, but it was not until about 1858-1860 that James Coombe & Company, of Belfast, Ireland, introduced rope driving for large powers. For some years the system made but little progress, but about 1865, Pearce Brothers, of Dundee, Scotland, took the matter up, and after several mills had been equipped with the new system of power distribution, it found its way to the large textile manufacturing districts of Lancashire and Yorkshire, where it is now almost exclusively adopted. In this country the system has, during the last decade, attracted considerable notice, but it has not been so largely adopted as might have been anticipated.

Materials.—The earliest forms of driving rope consisted of specially prepared leather thongs, twisted together, but these were found liable to untwist and cause

*This is in part due to the fact that while the strength of a leather belt is very greatly diminished at the joint, that of properly spliced rope is not more than 15 per cent. less than the specific strength of the material.

*Proceedings Inst. Mechanical Engineers (Eng.), 1876.

trouble, while their cost also militated against their more extended adoption. It is not surprising to find, therefore, that this material was soon abandoned in favor of hemp, and ropes of this material were afterwards largely employed. A few years later a variety of hemp, known as manilla, was tried with much success, and this material is at the present time used largely in this country. In France and Germany, but more especially in Great Britain, however, manilla is not by any means so generally used, probably owing to the relative poorness of the fibre as compared with that used in this country. The choice of material is, however, largely influenced by the products of the locality. Thus, good hemp and manilla being available in the Dundee and Belfast districts of Great Britain, ropes of these materials are there more generally used, while in the cotton spinning districts of Lancanshire, cotton ropes are almost universally employed. In England generally, however, during the last ten or fifteen years, and in this country for a shorter time, the use of cotton ropes has rapidly extended, and although more costly in the first instance, they have proved to be much better adapted to the purpose. Cotton possesses the marked advantages of strength and durability, while it is more elastic and pliable than hemp or manilla. Moreover, the internal friction caused by the fibres rubbing over each other in bending around pulleys is much less than with hemp or manilla. Ropes made of the latter materials cannot be so tightly twisted as those of cotton, and as the fibres are of a harsh, wiry, unyielding nature, the rope is only brought into a compact form by the partial chafing away of the fibres composing it. To obviate the internal wear of the fibrous ropes, it is now customary to "lay" them in some lubricant which, by reducing the friction, increases the pliability, lessening, therefore, the loss of power due to bending around pulleys, while greatly prolonging the life of the rope. Some makers use plumbago only; others, a mixture of plumbago and tallow, while others, again, prefer to employ only a little wax or French chalk. Some makers of cotton rope coat only the exterior of the strands with lubricant, contending that treating the yarns also, only adds weight to the rope without increasing its effectiveness or prolonging its life.

It should here be remarked that much of the driving rope now sold is largely adulterated with weighting material, white lead being often employed for this purpose. This, as will be readily imagined, soon hardens and stiffens the rope considerably, while it has the double disadvantage of reducing the stress-resisting sectional area of the fibres and of increasing the centrifugal tension, both causes reducing the available strength of the rope.

In the manufacture of hemp and manilla ropes, the fibre, after it has been prepared, is spun into yarn, the direction of twist being in a right hand direction. A number of these yarns, depending on the size of the rope, are then twisted, but in an opposite direction, to form strands. Finally, three or four strands are twisted together in a right hand direction to form the rope. In this way the tendencies of the composite parts of the rope to untwist are to mutually counteract each other.

The manufacture of cotton ropes is a somewhat similar, but rather more complicated, process. Some difference of opinion exists as to the relative value of Egyptian and American cotton, many claiming for the former variety superior strength of fibre. Some makers prefer one, and some the other, but in the writer's opinion there is little to chose between the two. For the best make of rope, the size of yarn technically known as 32's twist is very generally used, but a cheaper variety, made from weft yarn, is also sold, but this is found not to compare favorably with the former as regards durability.

As to the relative merits of manilla and cotton rope for power transmission, much may be said. As previously remarked, hemp or manilla rope is not so extensively used in Europe, but as the manilla obtained in this country is of a much finer description, it is likely that it will continue to be largely used for the purpose. For the particular purpose of dynamo driving, however, the greater pliability of cotton rope would appear to recommend its adoption, more especially as much smaller pulleys may then be used on the dynamos than with manilla. There is no doubt that manilla ropes—especially when new—absorb more power than those of cotton, and this again ought to give the latter the preference for central station work, where efficient power transmission is such a great desideratum. Raw hide rope has much to recommend its use, but its cost appears prohibitive. Composite ropes of iron or steel and fibrous material, in various forms, have also been tried. In one form a series of leather disks were threaded upon a core formed of iron wire rope. This made a very flexible rope, and one which had a good grip in the semi-circular groove in which it was used, but the cost and the difficulty of splicing formed serious objections to the use of this rope. In another case, a core of cotton was used, upon which steel wire covered with flax was woven; but this has not given satisfactory results.

Make of Rope.—While manilla rope is usually of three or four strands, the forms of cotton ropes are various. Three and four strand ropes are very largely employed, but seven strand ropes are also used, while others again use a three, four or seven strand rope, upon which is wrapped or coiled a layer of cord about a quarter of an inch in diameter. The latter forms are not to be recommended for dynamo driving as the outer protecting coil greatly increases the resistance to bending, in addition to complicating the splicing of the rope. The question therefore resolves itself into three *versus* four strand ropes.

The *three strand* rope has the advantage of simplicity of construction, which renders it easier to splice than any other form. Moreover, the strands lie very close together, and the small aperture in the center is completely filled up by the mutual compression of the strands. The three strand rope does not conform so nearly to a circle as does the four strand, and the outer fibres are subjected to greater bearing pressure, while not offering so great a resistance to slippage in the groove as the four strand.

The *four strand* rope, approximating more nearly to a circle than the three strand, and, for a given diameter, containing more fibres, it is clear that it is the stronger rope of the two. On the other hand, to evenly twist four strands into a rope, it becomes necessary to use a central core, which while adding to the weight and cost of the rope, does not bear any portion of the stress. Further, the core detracts from the flexibility of the rope, as the strands on bending around a pulley, slide not only over each other, but also upon the central core. It appears reasonable to suppose, moreover, that the core piece, being straight, must stretch very considerably or break, as the spirally twisted strands outside it will much more easily yield under the load. In spite of these seeming objections, however, excellent results are obtained with well made four strand ropes. In working they soon become quite circular in section and afterwards the wear is inappreciable.

The amount of "twist" put into a rope is not without its influence. A "hard-twisted" rope is materially stronger than a "soft" or "light twisted" rope, but its flexibility is also much less. It may frequently be noticed that some of the intermediate sizes of rope, which are not in general request, are more hardly twisted than others. This appears to be the result of the practice of some makers, who by "hard-twisting" the next larger size of rope, are enabled to produce a diameter somewhat approximating to that required. It would be unfair to say that this practice is generally followed, but it has been done in several instances, and in some cases of dynamo driving, with somewhat smaller pulleys than should have been used, the results have been far from satisfactory.

(*To be continued.*)

THE Tarentum Traction Passenger Railway Company, of Tarentum, Pa., is to install a suburban line six miles in length. J. B. Crawford is secretary of the company.

S. A. DARRACH, a Newark inventor, has brought out a new fender.

Notes from England.

(*From our London Correspondent.*)

In the last installment of these notes it was mentioned that in the three cases where the local authorities had decided on buying up tramways, the arbiters who fixed the price to be paid to the companies decided that structural, not rental, value was the sum payable, and the further statement was made that the companies intended to appeal against this decision to the law courts. The first of these appeals has been brought, and was decided towards the end of January. The case was that of the London Street Tramways Company. The twenty-one years from the time of construction of four and a quarter miles of the company's lines having expired, the London County Council was entitled to buy up the undertaking. The Council decided to do this, and the arbiter, Sir F. Bramwell held (and this also was the contention of the County Council) that under the Tramways Act, all the company was entitled to was a sum for which the tramways in question could be established, minus an allowance for depreciation. The sum he fixed was £64,540. The company maintained that it was entitled, as in the case of any other hereditament, to get the rental value capitalized, and in its case, the company claimed, this should be at twenty years' purchase. The company considered that the fair rent of the tramway, as worked with adjoining lines, was £10,625 per annum, and its claim thus stood at £212,500, and it moved the courts to set aside the arbiter's award.

Mr. Justice Mathew and Mr. Justice Collins, before whom the case came in London, thought that the section of the Tramways Act covering this point was very difficult to construe, but they could not come to the conclusion that Parliament, when the Act was passed, meant that such consequences should follow to the company as were insisted on by the Council. The right to use the undertaking was sold, as well as the undertaking itself. They sent the question back to the arbiter to determine the valuation, but they left it to him to say what was the rental figure, and at how many years' purchase it should be capitalized. It was learned on inquiry that in view of the extreme importance of the question it will be carried to the supreme tribunal, the House of Lords, for decision. If the decision of the court is upheld on appeal, there is little doubt that we shall hear very little more of local authorities purchasing tramway undertakings.

In Leeds it is still doubtful whether the Town Council will work the newly acquired tramways itself or lease them to a company. No decision has been reached, either, upon the question whether cable or electric power shall be used. The people like the Thomson-Houston electric line to Roundhay Park for its speed and comfort, but they do not like the poles and wires. From Leeds, as from other towns—notably Bristol, where an electric line is in contemplation—deputations have visited Wallsall, in Staffordshire, and seem to have been very favorably impressed with the overhead wire system in use there. As many readers are no doubt aware, the trolley wire is in this case carried along the side of the road, and the trolley pole, which has a lateral as well as a vertical play, reaches out sideways and upwards to the wire.

The cable tramway in Brixton, London, which has been open for a year, is now working with the utmost regularity and smoothness. The chairman of the company at the recent meeting of shareholders, was able to announce that the number of accidents per car on the horse lines of the city were three times as numerous as on the cable road. No separate accounts of the operating expenses have yet been published, but I learn from private sources that these will probably soon be obtainable, and that they will reveal an almost incredible economy as compared with the cost of horse traction. In regard to the extension of the cable line, to which reference was made in the last installment of these notes, I find I was in error as to the length of the new road. It is to be three miles reckoned by single track, not by double track, so that the street length will be one and a half miles. This will make the total street length of double track cable road four and one fourth miles.

The significant announcement was made in the beginning of the year that so well pleased was the Liverpool Elevated Electric Railway Company with the working of the line that it released the Electric Construction Company of its contract to work it for two years at a guaranteed traction cost of eight cents per train mile. This shows the great confidence which the railway company already has in the system.

The tramways of Douglas, Isle of Man, will, it is expected, soon be equipped either electrically or with the cable. Probably the former would be preferable, looking to local circumstances.

New England Notes.

The regular monthly meeting of the Massachusetts Street Railway Association, which was held at Young's Hotel, Boston, during last month, proved to be of great interest. The members dined together and subsequently listened to a paper on various types of steel rails, which was read by G. S. Clark, of the Pennsylvania Steel Works, who exhibited samples of many different kinds of rail manufactured by this company. The paper gave rise to an interesting discusson. This was followed by an address from Mr. Hooper, electrical engineer of the Lynn & Boston Railroad, on the subject of "Bonding Rails." The address was replete with valuable information bearing on the subject, the speaker giving at length his experience in the use of various types of bonding rails with copper wire, pointing out the advantages and the disadvantages of each. A very animated discussion followed, some useful hints being given by the various speakers. Other addresses bearing on the same topic were announced, but the speakers were absent. It was decided that at the next meeting the subject of "Mutual Insurance" and "Brake Shoes and Car Wheels" shall be introduced for debate.

The troubles into which the Interstate Railway has got are by no means straightened out as yet. It was decided a few weeks ago that a receiver should be appointed to take care of the stockholders' interests, but owing to the divided and conflicting interests, no receiver has yet been appointed. Application was made last month to the United States Circuit Court, by counsel representing both individual stockholders and many creditors. No less than three different men were suggested as being suitable for the office, but not one of them was appointed. There are points of law involved in the matter, and Judge Colt has permitted counsel to file briefs on the questions argued.

The subject of removing overhead wires from the streets of Boston, is attracting much attention. The State Legislature and the City Council have undertaken to deal with the matter simultaneously, if not conjointly, and with a determination which forshadows success to to the movement. Representative Hoar has a bill before the Legislature, which is supplemented by an order passed in the Council, the effect of which, if the end sought is accomplished, will be to remove from the streets of Boston all electric wires except the trolley wires and the wires necessary for supporting them. A further order was also submitted, with this provision: "That the Board of Fire Commissioners be requested to have an electrical expert located in each of the fire districts." This order was referred to the committee on fire department, but really has an important bearing on the street railways.

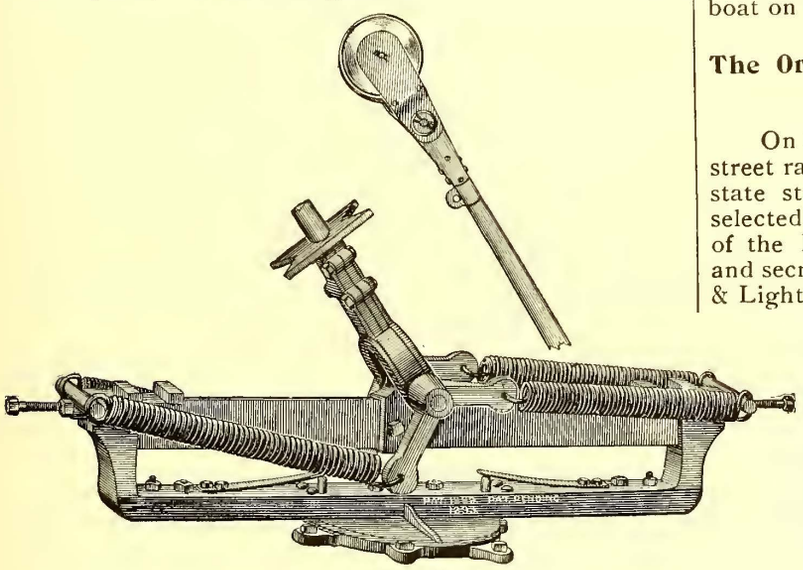
The committee on transit and street railways of the Massachusetts Legislature has made a trip to Bellport, on the Long Island Railroad, fifty-eight miles from New York, to inspect the Boynton Bicycle Railway in operation there. Hon. E. P. Shaw, of Newburyport and Colonel Cunningham, of Chelsea, accompanied the party.

The tramway company of Aix-la-Chapelle, Germany, will install electric power.

A New Trolley.

The accompanying engraving shows a new type of trolley pole put upon the market by the Duplex Trolley Company, of New York, of which C. E. Chinnock is president. The base of the pole, as shown, is supported on a vertical strip of steel which will always keep the flanges of the trolley wheel parallel to the overhead wire, so that there is no tendency to ride over the wire. This gives the pole great lateral range of movement, enabling it to follow closely the variations of the trolley wire, and at the same time insures passing over frogs without danger of jumping the wire.

The pole is jointed just below the fork, and complete vertical flexibility is permitted by the four coil springs shown, which have the usual methods for regulating tension, and the upper part is held in position by flat springs, permitting a slight vertical movement which gives a spring touch on the wire. The wheel itself is composed of four parts; the two flanges, the hub and the tire, the



DUPLEX TROLLEY.

latter being renewable, so that it is only necessary to replace this portion, which can be done at a small expense. This construction also makes the wheel much lighter than with a solid construction, reducing, it is claimed, the wear on the trolley wire.

The lightness of the trolley wheel, and the "duplex" feature of the pole allow the wheel to follow the wire closely, eliminate arcing and noise, and reduce wear and tear on the wire and appliances. The trolley wheels cost 50 per cent. less in consequence for renewals, and will last 50 per cent. longer, making a saving of 75 per cent., claimed, in the life of the trolley wheels.

Mr. Chinnock, who is the inventor of the trolley, has had over twenty years of practical experience in the electrical field, from electrician of the Metropolitan Telephone & Telegraph Company to vice-president and general manager of the Edison United Manufacturing Company, and superintendent of the Edison Electric Illuminating Company, of New York. His long experience in this line has enabled him to bring out a device which meets the difficulties encountered with trolleys.

A Peculiar Accident.

A peculiar accident happened recently on the so-called aerial railway at Knoxville, Tenn. At this point the bank of the Tennessee River is some twenty feet above the water on the Knoxville side, while it reaches a height of nearly 350 ft. on the other side. This suspended railway furnishes access to a park situated on the top of the bluff, directly across from a point about one mile below the city. The car travels on two one and three-eighths inch cables, having a rise of 350 ft., and a span of 1,060 ft, making the incline a little over one in three. These cables are anchored strongly in the ground at the lower end, and to the rock at the top. The car is propelled by an endless, one-half inch cable operated by two twenty horse power engines. The line at its highest point is 350 ft. above the water. The up trip is made by power, and takes three and one-half minutes. The descent is made in one-half minute by gravity. The car is equipped with automatic brakes which will hold it at any point on the line.

On the afternoon of February 18, while making the up trip, with six persons in the car, the hauling cable broke when the car was within a few feet of the top. The brakes stopped the car within forty feet of the bluff, but the small cable commenced to overhaul with great rapidity, until the broken end struck the car, and wrapping round it, caused it to tilt to an angle of 45 degs., and made it impossible to move the car either way on the cables. The passengers were taken out, after considerable difficulty, by means of a rope sling slipped down over the cables from above, and lowered one by one to a boat on the river 350 ft. beneath.

The Organization of the Texas Street Railway Association.

On December 5, 1893, several representatives of Texas street railways met at Waco for the purpose of forming a state street railway association. The following were selected as temporary officers: Chairman, A. Zintgraff, of the Dennison Street & Belt Line Railway Company, and secretary, J. A. Hobson, of the Waco Electric Railway & Light Company. A meeting was called for January 24, 1894, at Austin, to effect the permanent organization.

In accordance with the above action, the First Annual Meeting of the Texas Street Railway Association was held at Austin, January 24, with a representative attendance. The following officers were elected: President, W. H. Sinclair, of the Galveston City Railway; vice-president, J. K. Urie, of the Austin Rapid Transit Railway Company; secretary-treasurer, J. A. Hobson, of the Waco Electric Railway & Light Company. Directors: W. H. Weiss, of the San Antonio Street Railway Company; A. W. Childress, of the Queen City Railway, Dallas; W. H. Sinclair and J. K. Urie. Committee on membership: Carl Drake, of the Laredo Electric Railway Company; J. K. Urie, A. W. Childress and C. A. McKinney, of the Houston City Railway Company. A constitution was adopted, and the Second Annual Meeting set for the Third Wednesday in January, 1895, at Dallas. The delegates were entertained by Mr. Urie, of Austin, and Mr. Drake, of Laredo, and the meeting was closed by a banquet at the Driskill Hotel.

Contracts Let for the Baltimore & Washington Railway.

The projected electric railway between Washington and Baltimore, to which frequent reference has been made in past issues, now seems to be near completion. The president of the road is reported as saying that everything connected with the route has been settled, except the entrance to Baltimore. We understand that the contracts have been let, and it is hoped that the road will be built and in operation by September, 1894. The length of the line will be about twenty-eight miles, and the schedule running time, as estimated, will be one hour.

The same company controls the Eckington & Soldiers' Home and the Belt Railway systems in Washington, and entrance to the latter city will be had over these lines. The gauge of the track will be four feet eight and a half inches, the same as the lines in Washington mentioned. As the gauge of the Baltimore Street Railway Company's lines is five feet four inches, special tracks will have to be laid in the latter city.

Gold's Storage Street Car Heating System.

EDW E. GOLD.

The problem of thoroughly heating street cars has engaged the attention of the Gold Car Heating Company during the past few years, and its efforts in this direction have met with every success.

The following illustrations show the Gold storage heater, the chief factor of this system. The entire apparatus is extremely simple, and and the results which have been obtained from tests during the most severe weather of the past winter have been very satisfactory.

A very thorough test of this system was recently made by the Third Avenue Cable Railroad Company, and for two weeks, during which the thermometer registered below 25 degs., the car in which this heater has been installed was heated to the expressed satisfaction of both the railroad officials and the traveling public. The temperature was maintained at over 70 degs. under all conditions. The following copy of one of a number of tests made on that road shows the heater's capabilities and the economy of fuel obtained by its use. This test was made Tuesday, February 13, 1894, on car No. 424, of the Third Avenue Railroad Company, running between Fort George and the East River at 125th Street:

Time.	Temperature Inside the Car.	Temperature Outside the Car.
2.00	70	13
3.00	72	13
4.00	70	12
5.00	70	12
6.00	70	11
7 00	70	11
8.00	70	10
9.00	70	9
10.00	70	9
11.00	70	8

The fire in the stove was started at 12.40, the temperature inside the car being 18 degs., while the temperature outside before starting was 14 degs.

Thirty-nine pounds of coal was used in the stove. The cost was about 7.8 cents for heating the car for thirteen hours, and there was sufficient coal left in the stove when the test was completed to last for two more trips which in time would be equal to nearly three hours.

One of the very essential features, and that which is in most cases considered the one on which the adoption or rejection of a heating system hinges, is the cost of maintenance of heat per day, which, with the Gold system, is reduced to a minimum.

As shown in our illustrations, a storage heater of sufficient length is placed longitudinally under the seats of the car. This storage heater consists of a length of five inch boiler tube, enclosed in which is a cylinder four inches in diameter, filled seven-eighths full with a strong solution of non-freezing liquid, and sealed at both ends. When steam is turned on, it passes between the outer tube and the interior cylinder, and consequently the warming of the car and the storage of heat commence simultaneously. To obviate the necessity of charging the heater with steam at intervals, a stove, enclosed in which is a coil, is placed underneath the platform of the car, and this enclosed coil is connected with the steam chamber of the heater. When the steam with which the heater has been charged condenses, the condensation flows into the coil by gravity and is again made into steam and returned to the steam chamber of the heater. In this manner the car can be heated for an indefinite period. Should the fire in the stove, through some unforeseen cause, become extinguished, there is at all times sufficient heat retained by the storage heater to keep the car warm for five to seven hours. It is a perfectly simple matter to equip any construction of horse, cable or electric cars with these heaters. As they take up no valuable space in the cars, the cost of the apparatus is saved in a very short time by the seating capacity gained, which in other cases is taken up by the car stove or the fuel necessary to feed the same. A pleasant hot water heat is radiated uniformly through the car, and in damp and wet weather the floor is always kept perfectly dry.

In Figs. 1, 3 and 4, B is the coil stove, C steel floor plate, D door to supply the stove with coal, E supply pipe, F return pipe, H under pipe, M air cock. P safety valve. In Fig, 2 A is outside tube, B inside tube, C strap bolted to heater stand D, F support for inside tube, G steam space on passage, H extension space.

All the fittings and parts of the apparatus are double extra heavy, and will therefore last as long as the car remains intact. That no repairs are needed for this heater is proved by the fact that over 15,000 of these heaters have been in use on the largest railroads of this country and Europe from two to ten years, and yet not one of them has required any repairs whatever.

Comparing this Gold system with that used at the present time, we find that two stoves are used in each car by the Third Avenue Railroad Company, but as is well known, the heat given by them is of little account, and furthermore, they cost at least four times as much for maintenance as does the Gold system.

The name of Edward E. Gold, the inventor of this apparatus, has been a familiar one to the public for the past twenty years, as the patentee of many ingenious appliances. He is a direct descendent of Major Nathan Gold, one of the petitioners (nineteen in number) named in the charter of Connecticut, granted in the reign of Charles II., which petition "was signed by no gentleman unless he had sustained a high reputation in England before he came to New England." Mr. Gold has devoted a great deal of his time during the past twenty years to the science of steam heat, and his heating systems and other railway appliances are well known in the railway world. His patents in the line of car heating are handled exclusively by the Gold Car Heating Company, of which he has always been president.

Mr. Gold's heaters have demonstrated their superiority to all others in the minds of a large number of steam railway managers, and are in use on a large number of the most prominent lines in the country.

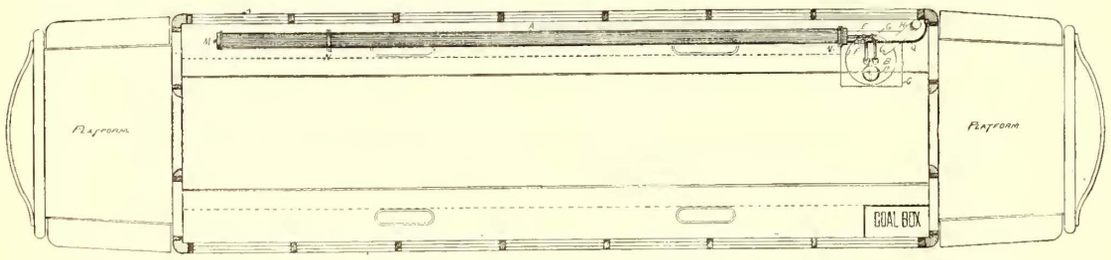


FIG. 1.—PLAN OF CAR EQUIPPED WITH GOLD'S HEATER.

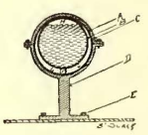
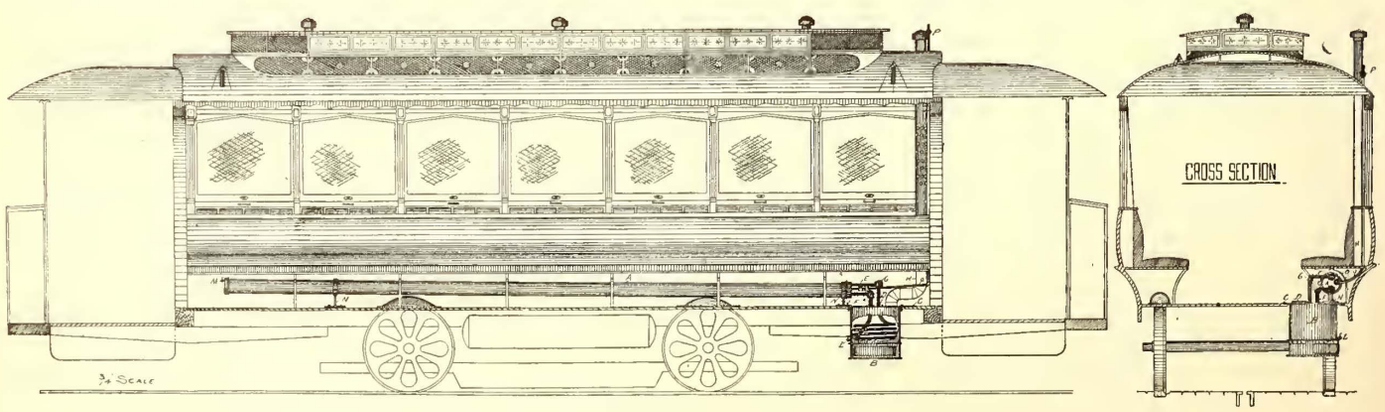


FIG. 2.
SECTION OF STORAGE HEATER.



FIGS. 3 AND 4.—SIDE ELEVATION AND CROSS SECTION OF CAR EQUIPPED WITH GOLD'S HEATER.

The Morrin Climax Steam Generator.

The increasing demand in stations where the ground space is necessarily limited, for boilers that will develop a maximum amount of power and at the same time take up very little room, has led to the use of water tube boilers to a considerable extent. This form of boiler has the advantage of occupying the smallest possible space, and besides its safety from explosion has great durability, and may be repaired when necessary with a minimum loss of time by stoppage. Our illustrations show two views of the Morrin generator as manufactured by the Clonbrock Steam Boiler Works, of Brooklyn, N. Y.

The heating surface of this generator is made up of loops of steel tubes, T, which are expanded into the cylindrical shell, A. Within the shell, A, is a second cylinder, B, which is not necessarily steam and water tight, and is bolted together in short sections for convenience of removal in case of repairs being required. The cylinder, B, is closed at the bottom and a point at the top, which is a little below the water level. The lower end of each of the tubes, T, is connected to the inner cylinder, B, by means of the short tubes, C. These short tubes are not expanded, as it is not necessary that they be kept tight. The purpose of this arrangement is to secure a constant, rapid circulation within the main tubes, which result it accomplishes perfectly. The firebox, V, surrounds the cylinder, A, and the products of combustion impinge upon all of the tubes in succession. The grate may be either stationary, in which case more than one fire door is required, or rotary, when one fire door is sufficient. With a mechanically driven, rotary grate an automatic feed mechanism may be successfully used.

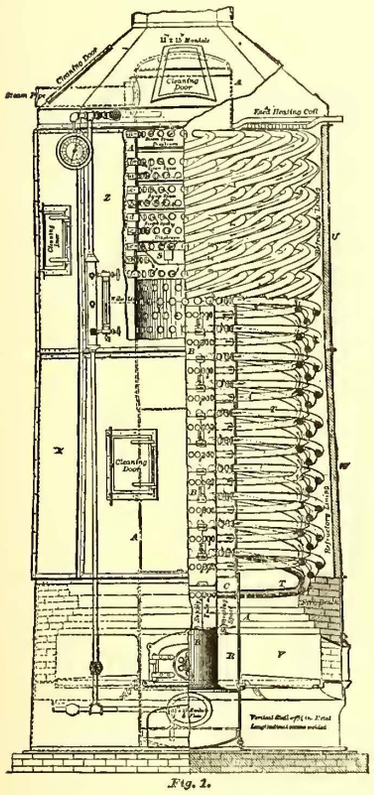


Fig. 1.

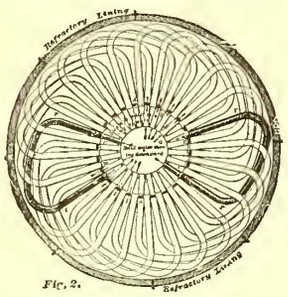


Fig. 2.

VERTICAL AND CROSS SECTION OF MORRIN CLIMAX STEAM GENERATOR.

The builders claim for this generator very high efficiency, as shown by numerous tests, and also the ability to run economically up to 30 and 40 per cent. beyond its rated capacity. The outer casting, U W, is constructed in sections, and may be easily removed to get at the tubes. This generator is made in sizes of from 100 to 1,000 H. P., and has given satisfaction to a large number of users and under widely varying conditions of service. Its satisfactory qualities are well evidenced by successive orders from a number of large electrical and manufacturing companies. The builders also claim great durability, quick repair, the absence of all the complicated joints that are so fruitful a source of leakage in many other water tube boilers.

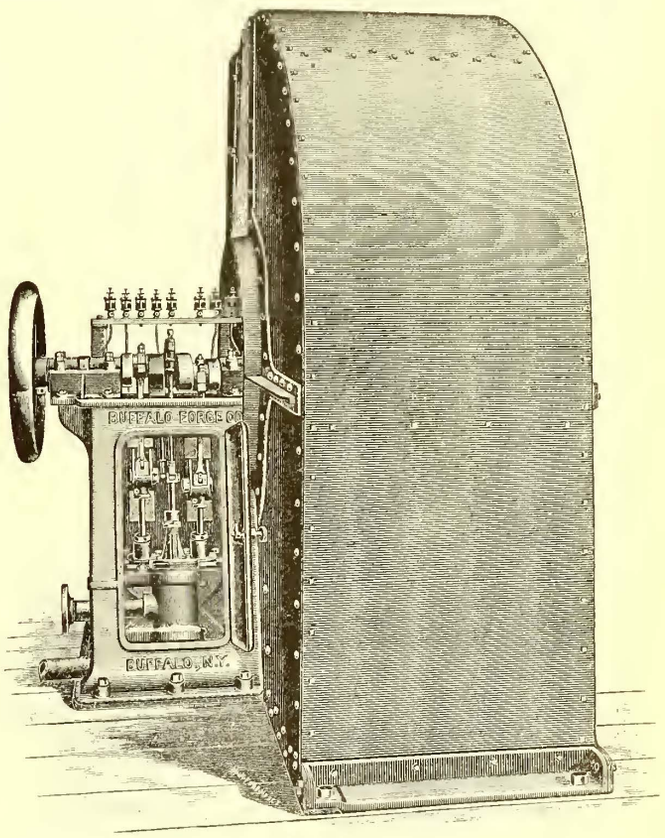
Special Steel Plate Steam Fan With Double Upright Enclosed Engine.

The practice of applying fans to batteries of boilers is not a new one. It is not generally known that by the use of a fan especially constructed for the work, hard coal screenings and slack may be burned, and with great economy. In street railway power houses, and other locations where great quantities of fuel are consumed, this is a great item.

In producing this design the aim has been to secure a type of engine which would develop a large amount of power at high rotative but moderate piston speed. The work required of steam fans for forced draft duty under boilers demands the above, and the illustration presented herewith clearly portrays the construction of the double upright, enclosed engine, built by the Buffalo Forge Company, of Buffalo, N. Y., and employed with its steel plate blowers for such service. Where this engine is to be used in dusty situations, it is built with the working parts entirely enclosed.

The frame is rectangular, and wider at the base than at the bearings. In the larger sizes the cylinders are bolted to the base, which forms a part of the housing, and they can be so arranged that the piston can be readily removed by withdrawing the bolts of the cylinder head and the lower end of the connecting rod, whereby the crosshead, cylinder head and piston can be lifted out without removing any other part. The steam chest is bolted to the cylinder, so that it may be readily removed when desired. The crosshead slides are so jointed to the frame as to enable adjustment for wear. The crossheads have Magnolia metal gibs to prevent cutting of the slides, and have clamp joints for the piston rod. The pistons are of the snap ring pattern, the rings being made of a special metal (some having been used for a long time without internal lubrication). The valve is of the piston type, steam being admitted at the center instead of at the ends. The rods have large wearing surfaces. The crank end is lined with Magnolia metal, and the wrist end has phosphor bronze boxes with wedge adjustment. The crank end adjustment is similar to that of marine engines.

The shaft is of crucible steel, the cranks being opposite each other,



BUFFALO SPECIAL STEAM FAN FOR BURNING SCREENINGS AND SLACK IN BOILER FIRES.

and the eccentric is cast centrally between. By specially arranged jigs, these cranks and eccentrics are so turned that their relative positions are such as to give the proper position to the valve at the various points of the stroke. The eccentric strap is lined with genuine babbitt. The bearings, which in their ratio are large, are bolted to the main housing, and lined with a special brand of babbitt metal, and also fitted with an improved oiling ring. While every portion is made as compact as possible, yet the arrangement is such as to give ready access to all parts of the engine without disturbing others. The stuffing boxes are provided with nuts which screw on to the glands, and while standard packing is used, if desired, approved metallic packing may be substituted. To prevent corrosion, brass glands are used for the rods. The valve rod is of steel fitted with hardened pin and clamp joint. The steam chest has a phosphor bronze bushing to form a guide for the valve rod. The eccentric rod has means for adjustment of the valve without removing the cover. No rocker or its substitute is used, the object being to reduce the engine details to the lowest possible number —a great desideratum in all high speed engines. A hand wheel on the shaft, that the engine may be thrown off the center, is provided.

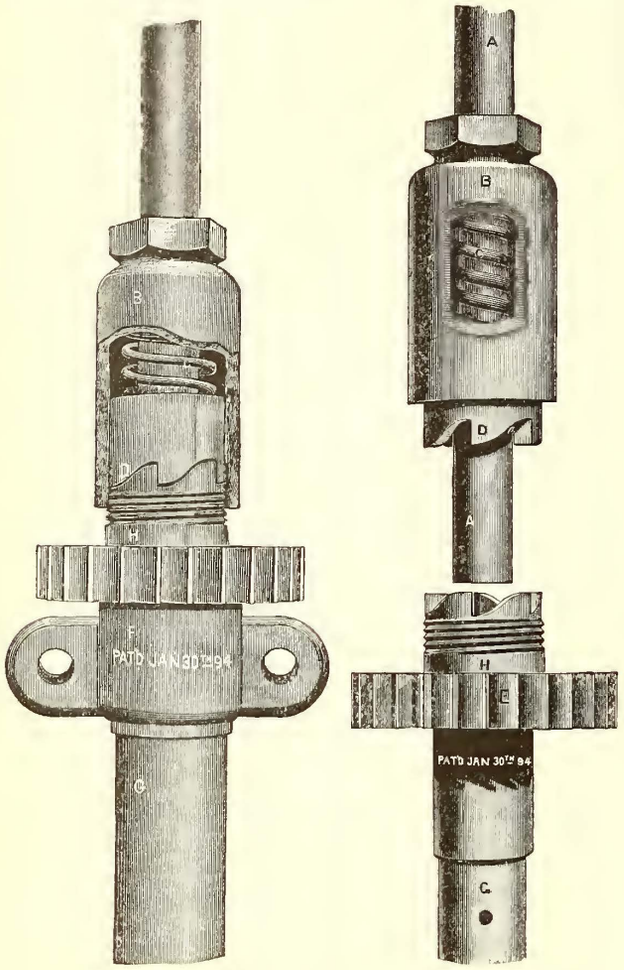
These machines have also been introduced extensively into ocean steamships and are usually so arranged as to serve two purposes, viz., of inducing perfect combustion of fuel, and obtaining the greatest steaming capacity of boilers, at the same time of ventilating the hold and other portions of the ship. The full effectiveness of steamboat boilers is always insured, and is entirely independent of the direction or force of the wind.

Technical Society of the Pacific Coast.

The Technical Society of the Pacific Coast, of San Francisco, Cal., elected the following officers for 1894, on January 19, 1894: President, C. E. Grunsky; vice-president, Geo. W. Dickie; secretary, Otto Von Geldern; treasurer, W. C. Ralston. Board of directors: Frank Soulé, W. F. C. Hasson, Geo. E. Dow, Henry S. Wood, J. Ch. H. Stut.

An Improved Clutch Brake.

The increasing weight of both cars and motors now operated in electric railway service, and the necessity of making the same number of quick stops, makes the call for brake power one of great importance, and naturally draws the attention of managers to the best form of brake attachment. Having this in view and knowing well the defects of the ordinary form of ratchet brake handle, The Safety Clutch Brake Company, of Philadelphia, has brought out a new form of coupled



IMPROVED CLUTCH BRAKE.

clutch brake that seems to possess many features of excellence. This brake is especially adapted for use on electric cars, as this form of service naturally calls for stronger braking power. Our illustrations show two views of this brake. As may be seen from these views, the brake shaft, A, extends down through the hub of the sprocket wheel, E, and operates the same by the clutch, D. This clutch is kept in position by the spiral spring, C, within the casing, B. The clutch, D, which operates the sprocket wheel, E, and the brake chain shaft, G, is situated, as may be seen, close to the bearing, F, which is strongly bolted to the front timber of the platform. The operation of the clutch is therefore much more effective than the ordinary ratchet brake handle, both on account of its increased surface, having five or more points of bearing with an area of at least one and a half square inches, and on account of its nearness to the fixed bearing, F. The brake chain shaft, G, is supported by a brace at its lower end to prevent springing and bending. This brake may be operated either by a wheel or the usual handle.

The makers claim that this is the best brake made, as well as the best made brake, and that 80 per cent. more power can be secured than with the usual form. They also guarantee the brake to last as long as the front end of the car. They have received a number of testimonials from prominent street railways that have used their brake, speaking of it in the highest terms. The officers of this company are: L. Bachenheimer, president; C. E. Baird, vice-president and general manager, and E. M. Fields, secretary and treasurer, all of Philadelphia. The New York agent for this brake is F. C. Fries, No. 83 Tenth Avenue.

The Pittsburgh, (Pa.) Glenwood & Homestead Passenger Railway Company has filed papers for an extension of its route with the Secretary of State.

The Ames Register; A Portable and Stationary Register Combined.

The accompanying engravings show a new departure in car fare registers. The Ames Register Company, of Boston, Mass., has perfected a register that has all the commendable features of a breast register, bell punch register and stationary register combined, furnishing the conductor with a register for his entire day's work, no matter how often he changes cars during that day. When changing from one car to another he also changes the portable register which is made interchangeable, and fits any stationary or car register. After a little study of the illustrations herewith shown, railroad companies will readily understand the manifold advantages possessed by this register. Fig. 1 shows the register ready for operation. Fig. 2 shows the portable register projected and partially in place. Fig. 3 shows the portable register.

FIG 1.—REGISTER READY FOR OPERATION.

The method of manipulating the portable portion of this register is as follows: At the beginning of the conductor's day's work he is furnished with the portable register which he inserts into the stationary or car register. Before operating the register, he records upon his day card the figures that appear on the portable register. At the close of his day's work he turns in the portable register with his money and day card. In computing the conductor's work, the manager simply refers to the portable register to ascertain the number of fares taken during the day.

By the use of this register it is unnecessary to assign an employe to the duty of recording the state of the register, either before the register starts on its day's work or after, for the simple reason that the portable register performs that function. The elimination of this very serious objection will be readily appreciated by railroad managers.

The stationary, or car register, cannot be operated unless the portable register is in place. It is so arranged that the conductor, if so desired by the company, can turn back to zero the stationary, or car register, at the terminus of each half, or at the terminus of each full trip, without removing the portable register or affecting the figures thereon. The portable register is a continuous one, operating to

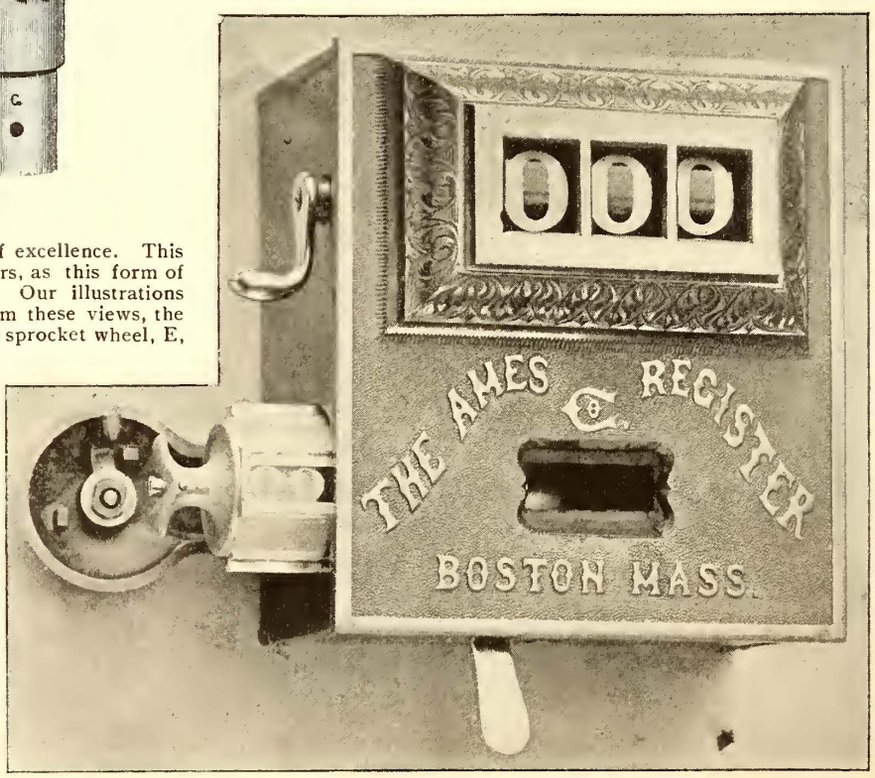


FIG. 2.—PORTABLE REGISTER PROJECTING AND PARTIALLY IN PLACE.

1,000,000, and starting again at zero, making it a perpetual device. The construction is such that tampering with the device is an impossibility. Two distinct reports are given. The construction is such that the mechanism is inaccessible to any official or employe of the railroad, thus making a positive check on those who handle the money or its equivalent. The device is simple, durable and is made of the best quality of material. The entire mechanism is operated by one lever.

The Ames register is claimed to be the only reliable, all around register, and is the only one of its kind manufactured. These registers are in use in Lawrence, Haverhill, Brockton and Allentown. The general manager of the Ames Register Company is Louis Pfingst, 753 State Street, Boston, the well known street railway engineer and inventor.

FIG 3.—PORTABLE REGISTER.

SIX INCH WATER MAIN CORRODED BY ACTION OF RAILWAY CURRENT.

The Importance of Complete Metallic Circuit for Electric Railways.

By J. H. VAIL.*

In the early days of electric railway construction two distinctly different systems were devised and competed for public favor. The one being the overhead double trolley system, affording a complete metallic circuit for the outgoing and return of all the electric current required to move the motor cars, and the other being the single trolley system, using the track and earth as a common conductor for one side of the circuit, and the trolley wire and parallel mains for the opposite side. The double trolley system was found impracticable of operation in many of its details, and the single trolley, because of its simplicity and convenience, has made rapid advances in public favor. The single trolley system has depended largely upon the earth and buried pipe systems for completing the circuit.

Many devices for making the track and earth combined, a more complete and low resistance circuit have been resorted to, such as burying copper or iron plates, old rails or old car wheels, and connecting same to the track; or, at frequent intervals, driving iron rods down in the earth and connecting by wires to track; or by making actual connection with wires from tracks to gas and water pipe systems. Also, for *supposed* reinforcement of the track, we have used a bare wire of iron or copper, buried in the earth, laid parallel to the track, and connected at frequent intervals; also the *supposed* electrical connection of rails at joints, by bond wires of iron or copper, only having a small fractional part of the capacity of the rail as a conductor.

In the early days of electric railway construction it was assumed by experts that the earth and the buried pipe systems would, when combined, form an ample return for the electric current. At that age of the art, experts did not fully appreciate the immense quantities of current that would require to be carried, and, therefore, did not foresee that these currents when disseminated would produce the serious results that have been caused by electrolytic action on systems of pipes buried in the earth and owned by other companies. Frequent tests prove that the earth itself cannot afford the free path for the current that was anticipated. Earth conductivity has been overestimated. Iron and lead pipes, being better conductors than earth, must of necessity carry the current, if no superior path is offered by the method of construction. The natural moisture of the earth hastens the destructive electrolytic action of the current on these pipes. In some soils electrolysis is more rapid than in others. The rapidity of action depends upon the chemical constituents of the soil. It has been found that illuminating gas leakage held in such soils as underlie the cities of New York, Brooklyn, Boston, Philadelphia and elsewhere, hasten electrolytic action.

To prove that the methods of work mentioned are still in vogue, I quote the following section from specifications recently sent out from the office of a prominent electric railway company:

"Each rail shall be connected together by two bonds, made of No. 4 galvanized iron wire (Roebling gauge), to each end of which shall be brazed two nine-sixteenths inch Norway iron rivets. Both of the bonds shall be separately connected with a No. 0 galvanized iron, supplementary wire, by means of No. 4 galvanized iron wire connections, which shall receive at least four turns around both the bonds and supplementary wire and be thoroughly soldered to the same. Ground plates shall be placed about 1,000 ft. apart. They shall be buried not less than eight feet in the ground, preferably in the damp places, and two No. 0 galvanized iron wires shall be brazed to the ground plate and connected one to each supplementary wire in each track, by thorough wrapping and soldering. The ground plates shall be of galvanized sheet iron, two feet square and one-eighth inch thick, bent around in the form of a spiral."

It is evident that electricians had then perfect faith in the earth as a conducting medium. Evidence had not been produced that Mother Earth was incapable of carrying the enormous quantities of current required; neither had an opportunity been afforded to demonstrate her capacity. That some *still* have faith in the earth's ability in this direction is attested by above specifications and other constructions being executed at this date.

Having briefly reviewed the practice for the past few years, let us now have a look at the resultant effects. In cities provided with electric railways destructive electrolytic corrosion is now acting upon gas and water pipes, and will inevitably produce serious impairment of all such underground pipe systems within a brief period, unless prompt measures are taken to prevent further damage. Within the past year strong evidence of damaging electrolytic action has been produced.

Simply for the sake of fixing the evidence on your memory, I will mention only seven instances of electrolytic action of railway currents on gas and waste pipes, in different cities.

1st. A section of iron water pipes shows complete perforation, caused in four weeks' time. The lead covering of telephone cables also show serious damage. A large number of additional items will be found in the report to Board of Electric Subways for 1893.

2d. A plumber in a city in Pennsylvania was repairing a water pipe in a house, and on breaking joint, an electric arc formed across the separating ends of the pipe. This house was not in the direct path of the railway circuit. Investigation followed, proving beyond question the insufficient electric conductivity of the track system; also that the earth did not afford a good return, though the tracks were well grounded. It was found that the railway current was traveling all pipe systems in its effort to complete the circuit to the dynamos in the power station. Actual tests were here made by an expert using standard instruments. From 135 readings of ampere meter it was found that the feed water pipes leading in the station carried an average current of ninety-three amperes. Further careful test proved that with twenty-three cars in operation on the system, 40 per cent. of the total current was carried on the underground pipe systems.

3d. December 15, 1893, a fire occurred in the basement of James Sutherland's house. After being extinguished, investigation showed that the current of the electric railway system had been carried along the iron water pipe, and that probably by vibration causing the pipe to come in contact an arc was formed between the water pipe and gas pipe, burning a hole through the gas pipe, and thus set fire to the gas. The house was saved by prompt action.

4th. Tests show the electric railway current present on the water pipes. In the generating station the fireman gets a shock when he opens the furnace doors of his boiler with the bare hand.

5th. A test recently made by an expert engineer developed the fact of a loss of 24 per cent. on the system, and a difference of twenty-five volts potential between parallel tracks opposite the power station.

6th. Professor Barrett, in an exhaustive report to the Mayor of Chicago, states that "this destructive action is not alone confined to the lead covering of telephone cables, but is acting on gas and water pipes and almost all buried metal work," and that it can only be a question of time when more disastrous results will manifest themselves.

As further and substantial evidence, a cut is here shown, taken from a photograph, of a section of six inch water main from city No. 7. This pipe has been entirely corroded through by the action of the electric current of the street railway system which was constructed under my direction about four years ago.

This effect was produced in about two and one-half years.

Abundance of additional and substantial evidence can be produced. These serve to prove the case which cannot longer be denied nor assigned to other causes. It has been stated that in an electric railway system where a connection has been made to water pipes, the pipes have carried as much as 28 per cent. of the total current. Instances are known where as much as 40 per cent. is carried on the pipe systems. It is the opinion of the writer that any gas or water pipe system used as a carrier of electric currents will not only be corroded through the body of the pipes, but will surely in due time show defects at the joints, as here will occur higher resistance than in any other portions of the pipe system. It has been proven by test that the electrolytic action of even five amperes of current on an iron pipe is considerable, and that much damage will result in one year. The rapidity of action depends upon character of soil, amount of moisture and quantity of current; the destructive action is constant and sure.

I do not wish to create unnecesssary alarm, but there can be no

*Read before the National Electric Light Association at its seventeenth convention held at Washington, D. C., February 27, 28 and March 1, 1894.

question that a grave danger confronts us, and must be surmounted. Instances are numerous proving that the electric railway current is present on the gas and water pipes in buildings contiguous to electric railway lines. Even those of us who are familiar with handling the electric current hesitate to draw a combination of electricity with our gas and water. We know that the gas and water pipes entering our houses may be charged with such a current, and that it only remains for the circuit to be completed by a possible accident through our bodies, or the occurrence of a fire by automatic action between vibrating pipes. City engineers, water companies and gas companies are placing the responsibility upon the railway companies for the damage caused on pipes by electrolysis. Any system using ground plates, ground rods or substitutes therefor, or bare return track wire buried in the earth, is constructed primarily to utilize the earth as return circuit; when the earth does not afford good return the current is sure to follow the water pipes, gas pipes or other buried conductors offering the path of least resistance. We now see that these prove to have been only makeshift methods to reduce the cost of construction. We find that the evidence thus produced, and the troubles constantly occurring in existing street railway systems are sufficient to show that all methods of grounding the track circuit or connecting to pipe systems should be entirely discontinued; it therefore becomes of vital importance to so construct the electrical railway system as to avoid all electrolytic action on buried systems of metal work that are the property of other concerns.

Having produced the evidence and established the case, let us briefly analyze the matter and ascertain the reason for these results. The whole case may be stated in the single sentence, that *the electric current must under natural laws follow the path of least resistance.* What was intended to be good has proved to be defective electrical work executed in connection with track systems, has not given to that side of the system a perfect path for the travel of the current; the conductivity of the rail circuit being impaired to such an extent that the electric current must force itself through the earth or through metal pipe lines buried therein. We must here diverge for a moment to show how the incandescent electric light system operated in multiple arc compares with the railway system. An electric railway system may in some degree be compared with a system of electrical distribution for incandescent lighting, the groups of lamps in buildings connected in multiple arc, comparing with each car and its motors demanding current. The systems otherwise differ in important particulars; the load on the electric light system is not subject to such violent fluctuations as on the electric railway, where the instantaneous demands for current, and its equally prompt release must be controlled. The current required for the car is a moving load as the car progresses on its route; this and all other differences of conditions must be duly considered when laying out the system of distribution. With the electric lighting system, the current for consumption is derived from the mains, the equalization of pressure is maintained through the feeders, the mains are of equal capacity on either side of the system.

With the electric railway the track forms one side of the consumption circuit, and must be so treated in regard to distribution of current as to utilize its carrying capacity equally with the other side, and thus equalize the delivery of current. The electric conductors composing a system of distribution for electric railways should be so well proportioned as to show the minimum variation of pressure throughout the system, even when the entire number of cars are in operation. This equality of pressure is an important requisite for the economical working of the motors. The writer has tested electric railway systems operating with a station pressure of from 500 to 550 volts, and showing only 300 to 325 volts on various divisions of the system. Here is a direct loss between dynamos and motor car of over 40 per cent. Is it, therefore, any wonder that some roads report extraordinary coal consumption? Such loss in pressure indicates radical faults in the original planning of the system and the distribution of copper. When operating under low voltage, the motors demand an increased quantity of current above what should be the normal supply, thus augmenting the heating effect in the armatures and fields, the efficacy of the motors being reduced in corresponding ratio.

A further examination into other features of construction requires some consideration of the bonding of rail joints. The existing method of utilizing railway tracks for conducting large quantities of current are faulty in at least three particulars: First. Restricted conductivity at joint, due to insufficiency of the rail bonds. Second. Neglecting to properly utilize the track as a conducting medium. Third. Failure to provide a complete circuit of low resistance. For electrical purposes we cannot regard the joint plates and bolts as of any permanent value; the contact is electrically imperfect, the metal surfaces oxydized and under constant movement, due to passing cars pounding the rail joints. The rail sections are in many systems of ample conductivity to carry more than the requisite current, provided that they are perfectly bonded and properly connected by feeders with the dynamos. We must, therefore, bond the rail joint in such a *mechanical* manner as to maintain perfect *electrical* contact, and with sufficient metal to restore at the joint nearly the full conductivity as of the rail itself, and at the same time to give the existing joint plates their present freedom of motion. It has been found that a system of track with faulty rail bonds will give a shock to animals, and, possibly, to human beings, should the same be brought into actual contact in such a manner as to complete through them the broken circuit.

It will be readily understood how difficult it is to maintain proper inspection of the electric bonding where the bonds are covered up by the street pavement. Under such conditions the ground circuit and the bonding escape inspection until excessive coal consumption, loss of current and other troubles force themselves upon the attention of the street railway management. Observation proves that a faulty rail bond will show its location in winter by heating, due to high resistance, and if snow be present on the ground around the joints the snow is partially melted, thus indicating location of the fault. Let us turn our attention for a few moments to the question of the conductivity of the rails. For the purpose of comparison we will assume that iron has six times the resistance of copper. (The actual proportion being 1 to 5.63).

	56 POUND RAIL.		70 POUND RAIL.	
	One Rail.	Single Track of Two Rails.	One Rail.	Single Track of Two Rails.
Area in sq. inches	5.4874	10.9748	6.8593	13.7186
Equal in area to circle whose diameter is in inches	2.642	3.735	2.95	5 90
Equivalent in cir. mils. to	6,980.000	13,960,000	8,702.500	17,405,000
Resistance per foot B. A. units	.00000845	.00000422	.00000679	.00000339
Equivalent to copper resistance in cir. mils	1,175,000	2,350,000	1,463,000	2,926,000
Equivalent to copper rod whose diameter is	1.13	1.533	1.21	1.71
Safe carrying capacity of iron reckoned at ⅓ that of copper in amperes	390	780	488	976

Table prepared by G. F. Sandt, E. E.

NOTE.—In the above statement the areas of rails have been determined by use of the planimeter. The ampere capacity of iron has been based upon the most reliable data obtainable. The author believes that the figures submitted are sufficient for comparisons, but cannot guarantee their absolute accuracy.

The following table gives the current strength that can be carried by iron wire, within doors, in still air, and without becoming unbearably warm to the hand; that is, not to exceed a temperature of 50 degs. Centigrade:

B. & S. GAUGE.	AMPERES.
10	16
9	19
8	21
7	25
6	28
5	32
4	37
3	43
2	50
1	58
0	67
00	77
000	90
0000	105
½″	117
¾″	208
1″	302

Data furnished by A. E. Kennelly, February 12, 1894.

These figures serve to show how utterly absurd it is to bond a track of seventy-pound T rails with iron rail bonds No. 4 or No. 0 in size, and to pretend to reinforce their conductivity with a No. 0 iron or even a No. 0 copper wire. It is like laying a twelve inch water main and then putting a half inch pipe alongside to help it out. The No. 0 B. W. G. copper wire has a resistance of over twenty times the single track of fifty-six pound T rails per foot and the No. 0 B. W. G. iron wire over 112 times the resistance per foot of the same track. How, then, can either of these be of any adequate assistance for conducting current. The writer knows personally of several instances where the copper supplementary wire has absolutely disappeared. The writer believes that 99 per cent. of the money expended for so-called supplementary wire is absolutely thrown away. The same money expended in other directions will give more adequate return.

Does not this show conclusively that we should give our attention to the more perfect bonding of the rail joints, and also to apply track feeders in such a manner as to utilize the conductivity of the track and thereby make it fulfill the service of which it is capable when properly treated? We are in error when the track system is named as a return circuit. The track system of all electric railways should really be the positive side or outgoing circuit. The writer fully explained this in a brief article in the Street Railway Journal about a year ago. It will be readily understood that as the current travels from positive to negative, therefore any arc which occurs between the trolley wheel and the trolley wire will carry metal from the trolley wheel and deposit the same on the trolley wire. If the reverse method of connection is made, the trolley wire will lose the metal, the same being deposited on the trolley wheel, and in time the strength and conductivity of the wire must be seriously impaired, eventually resulting in breakages. It is also important that existing systems of operating electric railways should be promptly taken in hand and the proper remedies intelligently applied.

The three-wire system has been mentioned by some engineers as a possible solution. I will here diverge for a minute to state that a trial was made four years ago under favorable conditions—not to avoid electrolysis, but to save copper. We developed physical difficulties of operation which warned us to avoid the three-wire system in future electric railway work. I believe I am safe in stating that 90 per cent. of the electric railways have their systems so constructed as to largely restrict the conductivity of the rail circuit. A one-sided system is fundamentally wrong. The quantity of current to be controlled is so enormous that ordinary makeshift methods will not answer.

Having carefully analyzed the whole matter, I feel justified in recommending that we must adopt the complete metallic circuit as the standard for the best electric railway practice. This can best be obtained by the following method: First. By so bonding the track as to render the *rail joints* of as low resistance and nearly equal conductivity to the rails, and to execute this work so as to maintain this improved

condition; and second, the track system must be supplied with insulated feeders leading direct from the bus bars in the station to predetermined points of the track system, and thus offer a perfect low resistance path for this side of the electric circuit, the same as is obtained with the trolley line and the overhead system. All of these features and improved methods have been put in practice by the writer. The only proper system is one that affords a well insulated and complete metallic circuit of low resistance, that will give an ample path for the complete unrestricted circulation of the entire current from pole to pole of the dynamo, thus offering no inducement for the current to follow such conductors as gas or water pipes, but, as it were, actually robbing the earth of any desire to carry the current. I am not recommending extravagant methods, but only such as are deemed essential for economy, and of a practical nature for reducing expenses and augmenting dividends. The item of cost cannot properly be urged as an objection, because where the whole construction requires a large investment, *every detail* of the work should be so executed as to be *permanent* and *enduring*. If the details are carefully analyzed it will be found that the cost of frequent reconstruction, maintenance and renewals of rail bonds and bare wire amount to an excessive rate of interest on original investment, and would soon pay the small additional cost to build a complete metallic circuit. The superior service obtained from a complete metallic system of low resistance with the proper application of insulated track feeders will, within a brief period, more than refund a reasonable interest on the investment through the saving of fuel alone, not counting other economies in renewals and maintenance. The track feeder system will be far less costly than the double trolley system.

Whether track feeders should be laid underground or erected overhead is a question largely controlled by local conditions and capital available. I express a *preference* for *underground* work as being more permanent and subject to the least cost for repairs. The original construction is certainly more costly for underground. The actual cost of copper is the same in either. The necessity of constant repairs, under existing methods, and the damage to water and gas pipes by electrolytic action, simply proves that it is but a question of time as to how long before electric railway companies will be forced to adopt the complete metallic circuit. Where experience and practical knowledge are applied, the cost will not be excessive. It is not difficult to arrive at an exact method of doing the work and an accurate estimate of its cost.

The writer has observed on some roads that large quantities of copper for return circuits have been placed at great expense, apparently without a proper conception of how to obtain the best results. Frequently, a far less amount of copper judiciously applied for improved distribution by the feeder system, would give superior equalization of pressure at reduced cost. If for the movement of cars, singly or in quantities, at a high rate of speed, the electric current is to be distributed uniformly over an electric railway system, the subject must be handled with as much scientific accuracy as is always used for a perfect system of incandescent lighting, in order to obtain equal distribution and free flow of current in both sides of the system. The writer has fully and completely provided for all contingencies in the following manner: First. By a careful study of the conditions under which a system will be operated; these important points being ascertained with reasonable accuracy, the requisite supply and distribution of current for the service is determined, and the system of conductors arranged to meet the requirements. For the proper supply of electric current, the important *underlying principles* of the feeder system must be *thoroughly* understood. Second. The conductivity and current carrying capacity of the track system is calculated, and a system of insulated track feeders is provided leading from the switchboard in station and connecting at predetermined points, and with a calculated fall of potential. Each feeder must be determined for its maximum current requirements at a stated drop in potential. The actual work required of the feeder and number of track feeders necessary is determined upon such factors as: The cars in service—their weight, speed and headway; the position of power station and the geographical lay of the railway system; the weight of rails, and whether double or single track, and the amount of load concentrated on sections of track between feeder junctions. The carrying capacity or conductivity of the sum total of all the feeders of the system will be found to give complete and ample circuit for the free flow of the entire current required, and to take care of extra heavy traffic and blockades at any point. The parallel track main is only applied in sections of systems extending over very large territories and long distances. The conductivity of the rails is calculated with as much care as the overhead system, and when the track needs reinforcing, the purpose is accomplished by laying a thoroughly insulated main line (not a bare line) and making frequent sub-feeder connections bonded to the track. If used at all, this main will be of large size. Such a system, accurately worked out, will show by actual test with instruments on the cars a surprising equality of electro-motive force throughout a large territory.

A very careful test has been made with instruments on moving cars, throughout a system covering forty miles of streets, with double tracks, equal to eighty miles of single track. The readings showed Maximum volts, 512; minimum volts, 420. Average of electro-motive force over entire system, 460 volts, the electro-motive force in station, at bus bars, being 520 volts. The feeders were calculated for 10 per cent. drop. The actual average drop from dynamo to motor does not exceed 12 per cent. This will be found to result in *reduced* fuel consumption, *better* working of the motors, a most satisfactory *reduction* in repair accounts and an improved *general economy* of the entire system. In the system of distribution secured by the above method, the use of ground plates, rods or other insufficient methods is needless; the current travels only over the paths provided for it, and electrolysis of gas and water mains is entirely obviated.

Annual Report of the Massachusetts State Board of Railroad Commissioners.

The annual report of the Massachusetts State Board of Railroad Commissioners was presented to the legislature February 7. An abstract of the portion of the report relating to street railways will be found below.

The commission reports that returns have been received from sixty companies, one less than in 1892. Of this number, forty-three were engaged in operating railways, eleven had leased their roads, two had been consolidated with other companies, three companies had not completed their lines, and the railway of one company was not in operation.

The total length of street railway September 30, 1893, including double track, but not sidings, was 874.14 miles—an increase of 119.29 miles over the preceding year. Of this total, 711.08 miles were operated in whole or in part by electric power, and 163.06 wholly by horse power. This shows, as compared with the previous year, an increase of 214 78 miles equipped with electric power, and a decrease of 95.49 miles equipped for horse power only. The aggregate capital stock of the sixty companies, September 30, 1893, was $25,883,575, an increase of $2,293,039.

The whole amount of cash dividends paid the last year was $1,716,-637.50—an average of 6.63 per cent. on the total amount of capital stock outstanding at the end of the year, as against 6.71 per cent. in 1892. Computed (as it should be) on the mean amount of capital stock outstanding at the beginning and end of the year, the average dividend the last year was 6.94 per cent., as against 7.34 per cent. in 1892. Thirty-five companies paid no dividends. The average rate on the capital stock of the twenty-five companies which paid dividends was 8.22 per cent.

The gross assets of the companies, September 30, 1893, were $50,-130,273.20; gross liabilities, $49,589,687.91. The funded debt of the companies amounted to $14,109,000—an increase of $4,138,850 over the previous year.

During the last ten years it is noted that there has been a steady and rapid decrease in the surplus of the companies. In 1884 the surplus was $1,039,360, or 13.44 per cent. of the capital stock; in 1889 the amount was $726,740, or 5.91 per cent. of the capital stock, and in 1893 the surplus was $540,585, or 2. 09 per cent. of the capital stock.

The total number of passengers carried by all the companies making returns to the board, was 213,552,009—an increase of 19,380,067. The number of passengers carried on the street railways exceeded the annual number carried on all the railroads in the state, by 93,772,062. The total number of miles run by street cars was 34,507,282—an increase of 4,829,246 miles. The total number of round trips run was 4,481,171—an increase of 312,713. The average number of passengers carried per round trip was 48—one more than in 1892.

Comparing the figures for 1893 with those for 1883, there has been an increase in the last decade of 142 per cent. in the number of passengers carried, of 125 per cent. in the number of miles run, and of 96 per cent. in the number of round trips annually.

The total income of the companies from all sources, for the year ending September 30, 1893, was $10,894,704.11, and the total expenditures were $10,617,641.99, leaving a net balance of income for the year of only $276,762.12 to carry to surplus account.

The percentages of operating expenses to gross income from operation, for the last decade are as follows: 1884, 78,37; 1885, 80.02; 1886, 80.04; 1887, 82.81; 1888, 81.07; 1889, 78.80; 1890, 74.80; 1891, 76.13; 1892, 71.74; 1893, 69.26.

The ratio of operating expenses to gross income from operation has fallen in the last five years from 81.07 to 69.26 per cent.—a marked decrease. The percentage for the last year was, in fact, a little lower than that for the railroad corporations of the state, which was 69.79 per cent. The net earnings from operation have increased, on the average, from $2,420 to $3,810 per mile of railway owned, and from 5.56 to 9.65 cts. per car mile run during the last five years.

There has been in the last five years an increase from 40 to 74 cents in the average net earnings per round trip run, and from .96 to 1.56 cents per passenger carried.

The average cost of the street railways of the state per track mile (including the cost, but not including the length of sidings) was $26,792 for construction, $15,455.06 for equipment, and $11.738.03 for land, buildings and other permanent property, making a total average cost of $53,985.69 for each mile of main railway track, including double track.

The figures are of value as showing just how heavily the street railways, as a whole, are capitalized, or, in other words, the average amount per mile on which dividends and interest are, if possible, to be earned. The cost, as returned by the several companies, ranges from $13,745 to $98,907 per mile.

The report says: "It is too early as yet to draw exact and final conclusions with regard to the financial economy of electric power, as compared with horse power, in street railway operations. It is desirable, however, both for the investor and the public, that current opinion on this point should conform as nearly as may be to the truth, and that false or exaggerated ideas, if such have gained a footing, should be set right.

"The question here is not whether electricity is a success as a motive power, or whether, taking into account the convenience, comfort and dispatch of street car travel on the one hand and the obstruction and danger to ordinary travel on the other, the electric system is, on the whole, preferable to the horse system. The present question is whether the electric system promises a larger return on the capital invested, and thereby a possible future reduction of the charges for transportation; so that the new system may be fairly expected in the long

run to prove not only more remunerative to the stockholder, but cheaper for the public."

A comparison of the railway year just closed with that ending in 1888, the last in which the railways were operated wholly by horse power, will evidently afford the fairest and most satisfactory test of the financial results of the two systems thus far.

Earnings and cost.	In 1888, cents.	In 1893, cents.	Per cent. of Increase.
Net earnings per passenger carried	0.96	1.56	62.50
Net earnings per car mile run.....	5.56	9.65	73.56
Net earnings per round trip.....	40.00	74.00	85.00
Net earnings per mile of railway..	$ 2,420.00	$ 3,810.00	57.44
Cost of railway per mile.....	33,985.00	53,986.00	60.22
Capitalization per mile.....	32,304.09	53,307.09	65.20

"The most direct and conclusive test of the net earning capacity of the two systems is a comparison of the increase in the net earnings per mile of railway with the increase in the cost of railway per mile. Applying this test, it will be seen that, while the net earnings per mile are 57 per cent. greater, the cost and capitalization per mile are respectively 60 and 65 per cent. greater in 1893 than in 1888—the odds being clearly in favor of the horse system.

"As in the case of a newly built and furnished house, the necessary repairs and renewals for the first few years are comparatively slight. For this reason the cost of the maintenance of the new system, which is chargeable to operating expense, has thus far been abnormally small, and the consequent showing of net earnings from operation has been abnormally large. The extraordinary reduction of the last two or three years in the ratio of operating expenses to gross income from operation is largely, if not wholly, to be explained in this way.

"The returns show that the railway companies as a whole have been running closer and closer to the wind during the electric period, and have substracted from the old surplus much faster than they have added to the new divisible income. We must conclude, then, taking everything into the account, that there has been thus far no demonstration of the superior net earning capacity of the electric as compared with the horse system, but rather the reverse.

"It can and should be said without hesitation or qualification that the electric system has not shown or indicated any such margin of profit as to justify the expectation of more than ordinary returns on money legitimately invested in it. The idea, which seems to have obtained some currency, that the electric railway system is a bonanza of rare and inexhaustible wealth is clearly a delusion, and has doubtless proved to some a snare.

"Instead of inflating the liabilities and straining the earnings and surplus for the division of ostensible profit, the manifestly safe and imperative policy for the electric companies—and that without special regard to the present unusual stringency of the times—is to keep the capitalization and charges upon income within the narrowest possible limits, and to set apart year by year some substantial portion of the earnings as a fund for future contingencies, and for the increasing burdens of expense which are sure to come, and whose weight is now only partially felt or known. The recent action of the directors of the West End Company, much the largest and one of the most ably and successfully managed of the street railway companies, in voluntarily reducing the rate of dividend on its common stock, was eminently wise and commendable in every point of view. Such action ought to enhance, and doubtless has enhanced, the value of the stock in the estimation of every well informed stockholder and sagacious investor."

The total number of persons injured in connection with street railway operation, as reported by the companies for the year ending September 30, 1893, was 585, of whom forty-five received fatal injuries. The number of passengers injured was 311, of whom only two were injured fatally. Most of the accidents to passengers occurred as they were getting on or off cars. The injuries to employes were forty-eight in all, of which five were fatal. The number of injuries to travelers and others on the street was 226, of which thirty-eight were fatal.

One in 686,662 of the passengers carried was injured, and only one in 106,776,004 was killed; street cars were run on the average 152,686 miles without injuring, and 908,089 miles without killing any traveler or other person on the street, and on the average 7,659 round trips were run without injuring, and 99,579 round trips without killing any passenger, employe or traveler, or any other person.

Five-eighths of all the passengers on the street railways of the state were carried the last year by the West End Company, and considerably more than one-half of all the car miles and round trips run were run on its lines. In view of its metropolitan location, and the comparatively thronged and congested condition of the streets through which the bulk of its traffic passes, it will be interesting to compare the casualties on this railway with those occurring on all the other railways taken as a group.

Reducing the ratios to percentages, it appears that the casualties to passengers carried were 39 per cent. less on the West End than on the other railways, while the casualties to persons on the street were 26 per cent. less per car mile run, and the casualties to passengers and all other persons were 22 per cent. less per round trip on the other railways than on the West End.

It also appears that on the West End the casualties to passengers and all other persons were 44 per cent. greater in the electric than in the horse car service per car mile run.

The whole number of grade crossings of railroads by street railroads, on the 30th of September last, as reported in reply to a circular issued to the railroad companies, was 133—the total number of such crossings has grown in the last two years from 116 to 133. The most noticeable change, however, is in the increase from 26 to 100 in the number of electric railway crossings, while the horse railway crossings have dropped from ninety to thirty-three, and bid fair to give way altogether to the new system of motive power.

If the construction of 100 grade crossings of railroads by electric railways were to be brought forward as a direct and original proposition it would be received with the serious apprehension which it deserves, and would be permitted, if at all, only under careful restrictions and regulations similar to those which sixty years' experience has proved to be necessary in regard to the crossings of railroads on the same level. It is not to be believed that the allowance of 100 such crossings outside of the public highways would for a moment be thought of. Of all the perils which attend travel on railroads and railways in this commonwealth, there is no one which, in the apprehension of the board, is so serious, both in its character and extent, as that here pointed out.

The report repeats last year's suggestion of the expediency of limiting the issue of bonds of street railway companies to the amount of the paid up capital stock.

During the last year, taking the street railway companies, as a whole, they issued $4,138,850 of additional bonds, while the addition to paid capital stock was only $2,293,039, or about half as much. Seven companies had, September 30, 1893, bonds outstanding in excess of paid capital stock. The capital stock was $2,575,000 and the bonds $5,115,500, the excess of bonds being $2,540,509.

It should be stated in justice to the other companies that their paid capital stock at the same date amounted to $23,308,575, while their aggregate bonded indebtedness was only $8,993,500; so that the other companies, as a whole, were far within the limit above recommended. Railroad corporations have been for many years subject to such limitation by the general law of the state.

In ten years the number of street railway employes has grown from 3,846 to 8,070; cars from 1,926 to 4,040; horses have diminished from 8,996 to 3,531.

On the question of consolidations and the attendant increase of capital stock, the report says:

"Without going into details, it may be stated that five purchases and consolidations have taken place during the last year. The seven companies concerned—the two purchasing and the five purchased companies—had on September 30, 1892, before consolidation, according to their annual reports to the board, a total capitalization (capital stock and net debt) of $3,857,140. The two purchasing companies, after absorbing the other five, had on September 30, 1893, according to their annual reports to the board, a total capitalization of $8,580,077—an increase of $4,722,937, or about 125 per cent. These figures do not include the $4,000,000 of bonds issued by the Lynn & Boston, nor the excess of those bonds over the unfunded debt.

"The seven companies reported in 1892 a total of 142.80 miles of railway track owned, and the two consolidated companies reported in 1893 a total of 159.93 miles—an increase of 17.13 miles, or about 12 per cent. It is gathered from a comparison of the two sets of reports that, in the intervening year, some 46.61 miles of original horse railway line were also equipped for electric motive power. Making a liberal allowance for the cost of this new construction and re-equipment, there still seems to be left a very large fraction of the $4,722,937 of increased capitalization unaccounted for; at least the board is unable to account for it."

Changes in the Brooklyn City Railroad Company.

Daniel F. Lewis has resigned the presidency of the Brooklyn City Railroad Company, and has been elected to succeed Felix Campbell as president of the Long Island Traction Company, the lessee of the lines controlled by the former corporation and run by it. The Board of Trustees of the Traction Company, which was organized under the the laws of Virginia, and has a capital of $30,000,000, has been changed by increasing the number of directors from five to thirteen. The executive committee is comprised of Daniel F. Lewis, E. W. Bliss, Felix Campbell, Crowell Hadden, S. L. Keeney and Martin Joost. Among the new directors are Abraham Abraham, of Abraham & Strauss; W. S. Sloan, of the Delaware, Lackawanna & Western Railroad Company, and James Timpson, of the Mutual Life Insurance Company. The other officers, besides President Lewis, are E. W. Bliss, vice-president; W. A. H, Bogardus, general manager, and Cyrus P. Smith, secretary and treasurer. The same officers have been chosen for the Brooklyn Heights Railroad Company. The offices held by Mr. Lewis as president, and Mr. Bogardus as secretary and treasurer of the Brooklyn City Company, have not yet been filled, but these new directors have been chosen: Richard L. Edwards, Edward B. Bartlett, Frederick A. Van Iderstine, Samuel W. Browne and Edward Merritt. They succeed Messrs. Bliss, Lewis, Keeney, Polhemus and Lyman, who have resigned.

Performance of Storage Battery Cars in Snowy Weather.

The Waddell-Entz storage battery cars in use upon the Second Avenue line in this city received a rather severe test during the recent heavy snow storms. On January 27 the cars ran all day and performed their schedule trips, although the horse cars on the same line were running on half time with four horses. On February 14 and 15 the conditions were also very severe, particularly on the morning of the 15th, a foot of snow having fallen during the night. On both days the cars had no difficulty in keeping up to their schedule. Several of the daily papers commented favorably at the time on the satisfactory performance of the storage battery cars.

Personal.

Mr. L. H. McIntire, electrical engineer of the People's Traction Company, of Philadelphia, was a visitor in New York last month.

Mr. F. B. Brownell, president of the Brownell Car Company, of St. Louis, spent a considerable portion of last month in New York.

Mr. John A. Brill, of Philadelphia, was in this city recently. He considers that the prospects for business during the coming year are excellent.

Mr. Harold B. Thorne, formerly of the General Electric Company, is now representing the Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y.

Mr. E. F. Seixas, formerly of the *Street Railway Gazette*, has connected himself with the Walker Manufacturing Company, and will be located with Western Manager Barclay, in the Monadnock Building Chicago.

Prof. Sydney H. Short, of Cleveland, has decided to engage again in the manufacture of electric railway apparatus, and has been appointed superintendent of the new electrical work of the Walker Manufacturing Company.

Mr. Edward I. Robinson, general manager of the Laclede Car Company, of St. Louis, Mo., has been in the East during the past month, engaged in closing up some important contracts for the company which he represents.

Mr. Joseph McNaugher, Jr., superintendent and treasurer of the Pittsburgh Steel Hollow Ware Company, of Pittsburgh, Pa., has been making an extended trip in the interest of his firm. He reports a bright business outlook for 1894.

Mr. W. J. Cook, vice-president of the McGuire Manufacturing Company of Chicago, Ill., made a trip through the East last month. He spent some time in New York, and reported the truck business as excellent, and a large demand for McGuire trucks.

Mr. F. X. Cicott, late manager of the *Railway World* of London, Eng., and well known among the electrical fraternity in this country has formed a business connection with the Pettingell-Andrews Company, of Boston, manufacturers of electrical appliances.

Mr. G. J. Melms, general manager of the Milwaukee Electric Railway Company up to the consolidation of that line with that of the Milwaukee Street Railway Company, has returned from a European trip, and passed through this city last month on his return to Milwaukee.

Mr. Geo. W. Myers, the popular secretary of the Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., was a recent visitor at our office. Mr. Myers reported the various departments of the Lewis & Fowler Company as busily engaged in manufacturing, and anticipates an excellent demand for supplies during the coming year.

Mr. H. Ward Leonard read an interesting paper last month before the American Institute of Electrical Engineers upon "How to Operate an Electric Railway, 100 Miles From the Power Station." Mr. Leonard's plan involves the ingenious application of an alternating current using step-up and step-down transformers with his motor generator system for cars.

Mr. G. E. Pratt, well known and popular in the street railway fraternity during his long connection with the Lamokin Car Works, has severed his connection with that company and has accepted a position with the Jackson & Sharp Company, of Wilmington, Del. This latter company is to be congratulated for having secured the services of so capable a representative for introducing its cars to street railway managers. We extend to both Mr. Pratt and the company with which he is connected our best wishes for future success.

Mr. T. J. Durnin, who has for many years been manager and secretary of the West Side Railway Company, of Milwaukee, and who has retired owing to the transfer of that company's line to the Milwaukee Street Railway Company, was last month presented a handsome gold watch, chain and charm by the employes of the West Side line. The charm was an electric car worked in gold, with seven diamonds to represent the windows, and with an emerald to represent the headlight. Archibald McNaughton, the retiring superintendent of the line, was presented with a gold headed cane.

Mr. C. Densmore Wyman, of New York City, who was president last year of the New York State Street Railway Association and was for a long time general manager of the Central Park, North & East River Railroad Company of that city, has resigned his position with the General Electric Launch Company and accepted the position of general manager of the Milwaukee Street Railway Company, of Milwaukee, Wis. Mr. Payne, formerly general manager and vice-president of that company, will retain the latter position, but has been obliged to resign that of general manager on account of the pressure of duties, in connection with his work as one of the receivers of the Northern Pacific Railroad Company. We extend our hearty congratulations to both the Milwaukee Street Railway Company and Mr. Wyman.

Obituary.

MRS. JOSEPHINE D. SMITH, who has for several years past carried on the business of the late Willard H. Smith as a manufacturer of railroad center lamps and reflectors, died at her residence, 83 Halsey Street, Brooklyn, February, 23. Her death was the result of severe burns sustained by falling into a gas log fire while suffering from an attack of vertigo on the evening of February 5. The manufacture of car lamps, as carried on for many years by W. H. Smith, under the name of "Smith of New York," and Smith lamps attained a wide reputation, which has been retained and increased under Mrs. Smith. The manufacture and sale of lamps will be continued by her son, C. E. Smith, who has long taken an active part in the management of the business.

Severe Tests of a New Fender.

The Leonhardt automatic safety car fender has lately been given a series of severe tests on the street lines in Pittsburgh, Baltimore and Washington. The Pittsburgh daily papers make the following comments on the tests made in that city:

The *Pittsburgh Press* says, in speaking of this fender: "'Hey, there—look out—What's that blamed fool trying to do?' was the simple observation of the cornerman at Fifth and Wood, shortly after 11 A.M., as a pedestrian seemingly threw himself in front of car No. 20, of the Fifth Avenue line. The officer rushed up to the car and found the suspected suicide calmly enjoying a ride in the pneumatic safety car fender, which was being tested for the first time on this line. With a look of intense disgust the officer retired, saying: 'I thought the fellow was drunk and casting swine before perils.' The experiment was repeated, and was eminently successful in each case, between Wood and Market Streets, as well as at other prominent points along the line. The pneumatic fender bagged its game every time with such apparent ease and safety that it might be used with profit in recruiting Col. Geo. W. Elkins' Sunday School, for it would surely fetch the boys. The Leonhardt fender is a combination of pneumatic rubber tube two and a half inches in diameter, and a rope netting which can be detached and changed to either end of the car in a moment's time. The fender when struck will lower automatically and is also under full control of the motorman. In view of the number of accidents occasioned by rapid transit, this fender would be an economical addition to the stock of a street railroad."

The *Pittsburgh Dispatch* comments as follows: "A new guard for street railways invented by a Baltimorean was given a practical test by the Fifth Avenue line yesterday. A man stationed himself on the track below Wood Street, and was knocked down by a car running at full speed. He fell on the guard and was carried twenty feet before the car was stopped. He was uninjured. The dangerous test attracted a great deal of attention from pedestrians, who feared the man was intending to commit suicide."

Another prominent Pittsburgh paper says: "A new safety fender was tried on one of the Pittsburgh Traction cars and worked very successfully. A man stood on the track in front of the car on Fifth Avenue and was picked up without injury. He repeated the performance successfully. A policeman who saw the act thought the man was attempting suicide, and at first wanted to arrest him."

The "Pitt" Patent Folding Gates.

Folding iron gates have, of late years, come in for a great variety of uses in situations where sliding or swing screens were considered necessary. The "Pitt" patent folding gates manufactured by the William R. Pitt Composite Iron Works, New York, are among the best devices in the market for this purpose. They are simple in construction, and answer equally well for closing or protecting a small doorway or an opening fifty feet or more in width. These gates are constructed on the well known lazy tongs principle, and fold compactly and turn out of the way, thereby occupying very little space. The principal feature of the "Pitt" patent is the use of channel bars placed back to back, thereby giving great strength and stiffness with minimum weight. These gates are familiar to the general public, as they are used in a great number of situations where the hardest service is required, such as on ferry boats, elevator doors, and in various situations as safety devices, on elevated and other steam roads. These gates have also had a large use on surface roads, as safety guards on the off side of platforms and between motor cars and trailers. This company also manufactures a great number of different styles of fixed screens, grills and railings, as well as the familiar form of fixed platform guard, largely used on cable and other lines.

Some New Philadelphia Corporations.

THE West Side Traction Company is a new company which is the lessee of three railroad companies controlling about twenty-seven miles of streets in West Philadelphia. The capital stock authorized is $10,000; and the officers are: Clifford Pemberton, Jr., president; Frank Mauran, Jr., treasurer; Francis E. Bond, secretary.

THE Cherry Street Passenger Railway Company was incorporated February 12, 1894, with a capital stock of $12,000, for the purpose of constructing and operating an electric railway. The president of this company is Henry C. Moore, of 624 Tioga Street, Philadelphia. Others interested are, David C. Golden, McClellan Hersh and Joseph A. Lugar, all of Philadelphia.

THE Huntingdon Street & Connecting Street Passenger Railway Company was incorporated on February 15, with a capital stock of $6,000, for the purpose of constructing and operating an electric railway. The president of the company is Geo. D. Widener, of 1202 North Broad Street, Philadelphia. Others interested are: P. A. B. Widener, W. L. Elkins and David H. Lane, all of Philadelphia.

Equipment Notes.

James, F. Kelly, of New York, has been appointed general Eastern agent of the National Electric Manufacturing Company, of Eau Claire, Wis , with headquarters at Room 906 Temple Court, New York.

The Goubert Manufacturing Company, of New York, has opened a branch office at 403 Lewis Building, Pittsburgh, Pa., which will be in charge of J. H. Harrison. A full line of the Goubert feedwater heaters and Stratton steam separators, of which this company is the sole manufacturer, will be kept constantly on hand.

The Robins Life Guard & Manufacturing Company, of Philadelphia, Pa., manufacturers of the Robins life guard, is equipping the cars of the Suburban Traction Company, of Orange, N. J., and also those of the Norristown Passenger Railway Company, of Norristown, Pa., with its safety device.

Robert Poole & Son Company, of Baltimore, Md., the well known manufacturers of cable machinery has sent us a large drawing, handsomely framed, of the plant installed by it for the Baltimore Traction Company, on Gilmor Street. The picture shows a portion of the power station broken away, with the machinery, sheaves, etc., in position.

The W. S. Hill Electric Company, of Boston, Mass., is meeting with marked success in its efforts to gain the appreciation of street railway managers. This company manufactures an excellent line of switches particularly adapted for this special class of work. Among its customers are included the largest street railway corporations in America.

The Worcester Construction Company, of Worcester, Mass., has sent us a most convenient pocket reference book, containing useful data for street railway builders. The book is pocket size, and is handsomely and durably bound. It also contains testimonials of different street railway companies to the excellent work performed by this construction company.

William Hazelton, 3d, of New York, American representative of the Arbel establishments, France, has presented us with a large photograph, handsomely framed, of the Arbel Works, at Rive-de-Gier (Loire), France. The wheels of this company have an international reputation, and the extent of the company's works can be seen at a glance from the photograph.

The Waddell-Entz Company, of Bridgeport, Conn., owing to the present financial stringency, has been forced to apply for a receiver. The officers of the company state. however, that its affairs are in a hopeful condition, and owing to the valuable nature of the different patents and processes under its control it is expected that a reorganization and resumption may soon be effected.

The Campbell & Zell Company, of Baltimore, Md., wrote us the end of last month that it was in the market for a number of new or second hand boilers and machine tools. These include double and single head planer, screw cutting lathes of different sizes, radial and column drills, belt cutting machine, vertical boring mill, horizontal flange punch, plate bending roll, plate planer and suspension drills.

The Berlin Iron Bridge Company, of East Berlin Conn., is building for the Grosvenor-Dale Company, at Grosvenor-Dale, Conn., its new coal sheds of iron. These are arranged that the coal can be unloaded direct from the cars into the pockets without handling. The Grosvener-Dale Company expects to save a large amount of money each year by saving the expense of handing its coal the second time.

The Pittsburgh Steel Hollow Ware Company, of Allegheny, Pa., reports that its well known and popular steel ware is meeting with unqualified success. The gongs manufactured by this company seem to fill a long felt want, and to be extremely popular with street railway companies. The sound of the gongs is clear and pleasant to the ear; at the same time the bells are extremely strong and durable.

The Wakefield Electrical Engineering Company, of No. 731 Reading Terminal, Philadelphia, Pa., has secured a contract for a seven mile extension of the Lehigh Traction Company, at Hazleton, Pa. The road is to be built in a very substantial manner, and graded according to the best steam road practice, and will also include several large trestles. The work will be in charge of A. W. Gilbert, constructing engineer of the Wakefield Electrical Engineering Company.

Ralston & Company, successors to Ralston & Henry, of Philadelphia, write us that the firm of Ralston & Henry has been dissolved by mutual consent, W. B. Henry retiring. F. W. Ralston, Jr., will carry on the business of the old firm under the name of Ralston & Company, and respectfully solicits a continuance of patronage from former customers. He guarantees prompt execution of orders and care in the filling same, and also very low figures on the line of goods handled by him.

Sheaff & Jaastad, of Boston, is the title of a new firm of electrical, designing and constrncting engineers which has entered the field with good prospects of suceess. The principals are W. N. Sheaff, E. E., and A. U. Jaastad M. E., both of whom have had a long and varied experience in electrical and engineering work. Their offices are in the Cushing Building, Water Street, Boston, where they are preparing plans and specifications for a 5,000 H. P., lighting and power plant in the West, together with several others of a smaller capacity.

H. McL. Harding, of New York, who has charge, in the East, of the sale of the Walker Manufacturing Company's electric railway and power transmission machinery, will soon open an office in the handsome Postal Telegraph Building, corner of Broadway and Murray Street, New York. Mr. Harding is most enthusiastic over the outlook for the Walker Manufacturing Company in its new departure. Mr. Harding has had long experience in the sale of electric railway appliances, and is thoroughly posted on the needs of street railway companies in this line.

F. W. Friis, of Newark, manager of the National Railroad Detective Agency of that city, whose excellent detective work has given Mr. Friis a wide reputation for work of this character, has found the demands for experienced operators so large that the extension of his business has become necessary. Mr. Friis has, therefore, bought out the detective agency formerly managed by John S. Wood, at 176 Broadway, New York. Mr. Friis will run this agency in connection with his National Railroad Detective Agency, and will call it the New York branch of his Newark office.

Albert & J. M. Anderson, of Boston, Mass., have secured the contract from the People's Traction Company, of Philadelphia, to supply all the overhead insulators used on this road. When it is taken into consideration that every manufacturer of insulators in the United States has been bidding for this contract, it will be easily understood why Messrs. Anderson should feel proud of being the persons selected to supply these goods. It is universally admitted that this company manufactures a most perfect line of street railway insulators. The company also carries a full line of switches, etc.

The Consolidated Electric Storage Company, of New York, and the Brush Electric Company as co-complainants, have sued the Electric Storage Battery Company and W. W. Gibbs, president (manufacturers of the chloride accumulator), for infringement, in the United States Circuit Court for the District of New Jersey. The suit is brought on the Brush storage battery patents, recently sustained by the United States Circuit Court of Appeals; more especially patent No. 337,299. The motion for preliminary injunction was heard before Judge Green at Trenton, on February 20.

The Leonhardt Automatic Safety Car Fender Company, of Baltimore, Md., has been given a thorough and severe test on the street lines of Pittsburgh, Pa., as well as in Baltimore and Washington. In Pittsburgh, as in the other cities, very satisfactory results were obtained. The line upon which the test occurred was Fifth Avenue, and a number of men and boys were run down in various positions, and were picked up by the fender without injury. These tests attracted a good deal of attention from pedestrians, who feared that the persons upon whom the tests were made were intending to commit suicide.

W. B. Merrill & Company, of Boston, Mass., the sole manufacturers of Tripp metallic packing, report business as exceptionally good. The fact that the Broadway Cable Company has adopted this company's packing, after testing several other makes, is significant. Tripp packing is also in use at the Brooklyn Traction Company's plant, People's Traction Company, Philadelphia, and on the engines of the Montreal Street Railway Company. It has given excellent satisfaction wherever used, and the company has yet to hear of one single instance where the Tripp metallic packing has been taken out and replaced by other styles or make of packing.

Haight & Clark, of Albany, N. Y., manufacturers of the special trolley wheel illustrated in a recent issue, adapted to clean the trolley wires of ice and sleet coating in winter, report an increasing demand for this appliance. This firm writes us that it is now prepared to negotiate for the sale of its Canadian patent. Its sales in Canada, though no special efforts have been made to secure purchasers, have been most gratifying, while the call for the wheel in the United States has been far beyond the manufacturers' expectations. Haight & Clark are also iron and brass founders, and have special facilities for turning out iron, brass, composition, aluminum and aluminum bronze from patterns furnished them.

The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., has established a San Francisco agency in the Mills Building of that city. Here the company will carry a large stock of its standard supplies to satisfy immediate wants, and will be represented by H. A. Russell, assisted by R. B. Elder, both of whom are already well known in the electrical business on the Pacific Coast. The company's well known reputation will probably stimulate the work of electrical construction in this section of the country and will lead, it is thought, especially to the construction of a large number of long distance power transmission plants, in the installation of which the Westinghouse Electric & Manufacturing Company has been especially successful.

The Siemens & Halske Electric Company is rapidly covering the entire country with its representatives, and is opening offices here and there, placing in charge of the very best men to be had. An office in Boston has been opened, and R. C. Wiggin, late chief of the power and motor department of the General Electric Company, has been appointed agent. Mr. Wiggin has a wide and successful experience in the electrical business, and cannot fail to be of valuable service to the company he now represents. The wisdom and judgment displayed by the Siemens & Halske Company in securing competent and popular men in the electrical business as its representatives, augurs well for the future success of the company in this country.

The Sterling Supply & Manufacturing Company, of 47 Cedar Street, N. Y., is the title of a new corporation organized under the laws of that state. This company has purchased all the patterns, tools, etc., of Benton & Key, the manufacturers of the well known "Sterling" register, adopted by the Broadway cable road, also the "Monitor" type of register which has been in use by the Third Avenue Railroad for the past eighteen years. The new company is now manufacturing a large quantity of registers, and is well equipped in every way to furnish the registers in any quantity on short notice. The company

will also manufacture the "Sterling" sand box, which has been received with favor among street railway managers. The new company has ample capital, and no doubt will do a prosperous business.

The Joseph Dixon Crucible Company, of Jersey City, N. J., has recently added to its list of publications a most interesting treatise on the method of manufacturing lead pencils entitled "The History of a Lead Pencil;" by Walton Day. This pamphlet forms very interesting reading for all, and tells many facts that will be new to a large number of readers. The company has also recently issued a second and revised edition of its pamphlet entitled "Graphite as a Lubricant," which is especially interesting to engineers and others who have machinery under their care. The extent to which graphite is used for this purpose is an excellent indication of the satisfaction which it has given, but for the benefit of those who wish still further proof, the Dixon Company has included in this pamphlet testimonials from users in all sections of the country.

Chas. Ludlow Livingston, of Pittsburgh, Pa., electrical engineer and contractor, has removed his offices from the Fidelity Building to 713 Penn Avenue, where he will occupy an entire floor. Encouraged by his success during the nine months he has been in business, Mr. Livingston now proposes to give more attention to the construction of electric street railways. He will make a specialty of contracting for the complete equipment of roads, so that managers can, in giving him contracts, center the entire responsibility for the satisfactory operation of the construction upon one man. Judging from Mr. Livingston's already acquired reputation in the other branches of the electrical contracting business, he is fully competent to bear the responsibility. Mr. Livingston is assisted by an able force of engineers and superintendents who can be relied upon to sustain his reputation.

The Wainwright Manufacturing Company, of Massachusetts, manufacturers of corrugated copper tube, feed water heaters, surface condensers and expansion joints, etc., of Boston, writes us that it has transferred to the Taunton Locomotive Manufacturing Company, Taunton, Mass., the right to sell and manufacture the goods which it has supplied for several years past. For four years the Taunton Company has manufactured all of the Wainwright Companys' heaters, condensers, expansion joints, and corrugated gaskets, under a manufacturing contract, and is thus thoroughly acquainted with the various requirements of its customers, and with the technical and engineering features of the business. The long business experience of the Taunton Locomotive Manufacturing Company, and its high reputation are guarantees that the appliances which the company manufactures will be of the highest class.

The Philadelphia Engineering Company, of Philadelphia, has received an order for one of its Corliss winding engines from the Chamberlain Coal Company, of Pottsville, Pa., Francis A. Pocock, engineer. This winding engine has 34 in. steam cylinders, 60 in. stroke, to be operated by steam at 125 lbs. pressure per square inch, generated by a battery of Stirling boilers. The engines are provided with the Stevenson link reversed by steam gear, with an oil cataract. The engine is to be of the standard, Philadelphia-Corliss liberating valve gear, controlled by a sensitive governor of the Porter type. The hoisting drums are 10 ft. in diameter. 10 ft. long, with powerful hand and steam brakes. The adjustment of the lift is effected by a toothed gear clutch, thrown in and out with worm gearing. The main shaft bearings are 17 ins. in diameter by 30 ins. long, the body of the shaft between the bearings being 19 ins. in diameter, the central bearing being 19 × 30 ins. The engine is to lift an unbalanced load of 50,000 lbs. at the rate of 1,000 ft, per minute. The engine and drums will about 325,000 lbs.

The Buffalo Forge Company, of Buffalo, N. Y., manufacturers of power blowers and exhaust fans, whose apparatus is illustrated in this issue, has met with a remarkable call for large buildings. School trustees, especially, have learned the value of this company's system, and have from time to time recommended the purchase of Buffalo plants. We have seen copies of letters received by this company from trustees and principals of schools which speak in the highest terms of this apparatus. One letter from C. L. Plunkett, of Salt Lake City, Utah, described the use of the Buffalo Forge system in the Lincoln school of that city. Mr. Plunkett, among other remarks says: "Yesterday, with the temperature hovering close to zero, a test of all the school buildings in this city was made, and one of the Buffalo Forge Company's plants, that in the Lincoln School in the Sixth Ward, carried off all the laurels. The temperature in the nine rooms during the entire day varied only 2 degs. from the other, and to accomplish this result only 700 lbs. of slack were used, at a cost of less than a $1.00. All of the time in this building the apparatus is delivering thirty cubic feet of outside air for each of the 500 pupils domiciled there per minute. You will note that the above results are even better than in the Lehi plant last winter—which plant, by the way, is the pride of all the people of Lehi."

The Page Belting Company, of Concord, Mass., has sent us a very handsome calendar for 1894, giving a view of the seventy-two and seventy-one inch, three-ply World's Fair Crown tandem belts in use in Chicago, and in connection with the Allis engine, and described in the STREET RAILWAY JOURNAL. The photograph was taken by an exposure of twelve minutes, while the belt was running at 5,600 ft. per minute under a full load. The perfection of the running of the belts is shown by the absence of flap and vibration. A copy of the award given to the Page Belting Company, and of the medal awarded, is given on the calendar. Also given are a number of testimonials of the value of the Page belts. The company writes us that among other recent orders it has sold a large belting equipment to the Suburban Electric Railway Company, of Elizabeth, N. J. This contract, which is for fifty-two, forty-two and forty inch belts, was awarded the Page Company for Crown belting, among eleven competitors. The company has also received an order for a fifty-four inch belt from the Union Railway Company, of New York. During the last month the company has executed orders for 15,000 ft. and upwards of Crown and Eureka Dynamo belting for shipment to Japan.

Warren Webster & Company, with works at Camden, N. J., and Chicago office at No. 2 Canal Street, Chicago, Ill., reports among the many orders received for the Webster vacuum feed water heater and purifier, one from the Pullman Palace Car Company, Pullman, Ill. This is for three more Webster vacuum feed water heaters and purifiers, aggregating over 5,000 H. P., to equip this company's entire works, also one from the Williams vacuum system of steam heating, so as to utilize the waste exhaust steam without back pressure upon engines for heating purposes. Past orders received from the Pullman Company have amounted to 2,700 H. P., and were for apparatus installed in the Pullman plant at Pullman, Ill., during the past four years. These times of small margins are compelling a close scrutiny as to the methods in manufacturing, in order to secure greatest economy in the use of steam. Warren Webster & Company claim to have the best methods for correcting feed water for boilers, and for utilizing exhaust steam for heating purposes without back pressure upon engines, giving the best results upon all points of economy. They built their present new works at Camden, N. J., last year, and are now commencing an extension of 60×65 ft. in their wrought iron department. Examinations and estimates are made by them free of charge.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., finds business constantly increasing, and has been obliged to take another floor in the building which is occupied in Pittsburgh. The company is now employing about twenty-five men at its works exclusively in the manufacture of pick-up fenders and wheel guards. The safety devices of this company have been so often described in this publication that their particulars are familiar to our readers, and require no further description. The February contracts of this company called for 500 pick-ups and wheel guards. The high reputation of the device has spread to all sections of the country and even further, for among the requests for information and prices received by the company were some for fenders to be used in Australia and New Zealand. The company has also under contemplation the establishment of a Canadian agency. The company is building 150 wheel guards for the Philadelphia Traction Company, and has closed a large contract in New Orleans. Several other large contracts, it is expected, will be closed soon and these, when completed, will be announced in the STREET RAILWAY JOURNAL. In Williamsport, Pa., the fender is in use on the Passenger Railway Company, and Mr. Young, the superintendent of the road, writes that it recently saved a boy's life. The Central Traction Company, of Pittsburgh, also reports four lives being saved by the fender board.

The Robinson Electric Truck & Supply Company, of Boston, Mass., is building Robinson radial trucks as rapidly as possible on orders for immediate delivery. It expects to ship about forty radial trucks during the month of February. The Robinson Company has designed a new truck for four wheel cars, which is radically different in principles of construction, ftom any truck now in the market. It is extremely easy in riding, and, it is claimed, has less of the end teetering motion than any four wheeled truck yet brought out. This truck will be ready to put on the market this spring. Mr. Robinson's reputation as a truck designer and builder is too well and favorably known to need comment here. His production of the radial truck is sufficient proof of this. Mr. Robinson's promise therefore, to bring out a four wheel truck "differing in principles of construction from any truck now in the market," will arouse a great deal of interest, and the new truck will be watched for by railway men on the alert for something better than they now have. The Robinson radial is claimed to be the best truck known for cars having bodies eighteen feet and upwards in length. The new four wheel truck, however, is designed to meet the demands of those who use short or light cars. It is adapted, nevertheless, to carry as long and heavy a car as any four wheel truck in the market, and with greater steadiness. The new truck is known as the "Robinson Ajax Truck."

The Young Lock Nut Company, of New York, at this season of the year, when the construction of new street railways and the repairing or changing of old lines is engaging the attention of both the financial and engineering world, is the recipient of many inquiries in regard to its lock nut. This device, although opposed in its action to the spring washers so long in use, is not only theoretically correct in all the principles on which superiority is claimed for it, but three years' hard test have shown that these claims are well founded. To no more severe work could it be put than on the elevated railroad in this city, where a two years' test resulted in its adoption. Many other roads are using it with equal success. It is simple; its action is governed by a natural and never failing law; it is efficient, and above all in these days, it is a matter of economy which should not be overlooked by any railroad. Among the advantages claimed for it are that no one can be imposed on by the use of poor metal in its manufacture, as the quality of the meterial used does not enter into the question as with the spring washer, where it is the main, we might say, only, consideration. It can be reversed, and has not to be thrown into the scrap heap after one application. The following, lately received from D. S. Carll, chief engineer of the Washington & Georgetown Railroad, speaks for itself: "Replying to yours of the 14th inst., would state that the Young lock nut is giving us entire satisfaction where used. We are using these locks on the bolts that fasten our gripguards to their brackets around curves. We formerly had a jam nut on these bolts and they were continually getting loose; but since using the Young lock nut they have given us no trouble at all."

The Mather Electric Company, of Manchester, Conn., has been reorganized, and the management taken into the hands of a syndicate of Hartford capitalists. The old board of directors has resigned and the following officers have been chosen: President, Maro S. Chapman; vice-president, T. C. Perkins; secretary and treasurer, John L. Bunce. Directors: Charles E. Perkins, T. C. Perkins, M. S. Chapman, Henry A. Redfield, Charles M. Jarvis, John L. Bunce and Norman McD. Crawford. The new officers are all men prominent in electrical and mechanical circles, and intend to inaugurate an aggressive policy in the manufacturing field. The new superintendent of the electrical manufacturing departments is Theodore Gonet, formerly connected with the Westinghouse Electric & Manufacturing Company. He will have associated with him W. E. Powell, now of the Mather Company. Maro S. Chapman is largely interested in a number of paper mills in New England, is president of the Perkins Electric Lamp Company, and the Waring Electric Company, both of Manchester, and until the present time has been vice-president of the Mather Electric Company. Thomas C. Perkins, although a young man, is well known in the electrical fraternity, especially in the West, through his association until recently with W. B. Pearson, of Chicago, as Western representatives of the Ball & Wood Company, of New York City. John L. Bunce has been connected with the Perkins Switch Company and also with the Pope Manufacturing Company, of Hartford. Charles E. Perkins is a well known expert and patent lawyer, of Hartford. Henry A. Redfield is president of the Phœnix National Bank, of Hartford. Charles M. Jarvis, president of the very successful Berlin Iron Bridge Company, of East Berlin, Conn., is too well known to require introduction, as is also Norman McD. Crawford, of Philadelphia, an electrical railway engineer in connection with the Pennsylvania Railway Company, the Philadelphia Traction Company, etc., etc., etc. The company starts out under the reorganization free of all debt, with a paid up capital of $250,000. The company intends to make a specialty of large dynamos and generators. In anticipation of the heavy work in which the company expects to engage, it has recently erected a new shop, 200 × 50 ft., equipped with a twenty ton traveling crane.

WESTERN NOTES.

The Metropolitan Electric Company, of Chicago, Ill., is having large sales of its new "Metropolitan" lamp, which is giving good satisfaction. This company has moved into its new building 186—188 Fifth Avenue, Chicago, where it has ample store and office facilities, besides warerooms, and is putting in a large line of staple goods to take care of all orders without delay.

The Jones Bros. Electric Company, of Cincinnati, O., is about to put upon the market a new lightning arrester, which is claimed to be the simplest and most reliable manufactured. This arrester is manufactured in three designs, one for electric street car use, one for station work and the third for outside work. The company writes us that it will send a full description of this arrester upon application.

The Bass Foundry & Machine Works of Fort Wayne, Ind., the success of whose car wheels was mentioned in our last issue, turns out a wheel which is giving good satisfaction where used. The greatest care is taken in the manufacture of this wheel, and the agents of the company justly take pride in the high grade of article which the company manufactures. The list of users of this company's wheels is large and constantly increasing.

The Lunkenheimer Company, of Cincinnati, O., whose renewable seat gate valve has been illustrated and described in these columns, is having remarkable success in introducing the valve in street railway and electric light and power stations. The valve has a number of important features which recommend it for service, and the claims made for it are its simplicity, strength and compactness, and seem to be well substantiated by the service the valve is giving.

The Fulton Truck & Foundry Company, of Cleveland, O., as mentioned in our last issue, has established a general Eastern office in the Havemeyer Building, New York. Wm. Hazleton, 3d, who is well known to the street railway fraternity, is in charge, and has a handsomely furnished office on the thirteenth floor, where he will be ready at all times to explain the merits of the Fulton Truck & Foundry Company's steel truck, the "Imperial," and other appliances manufactured by it.

The American Car Company, of St. Louis, started up its works on full time in the middle of February, and is now working on a large number of orders received from various parts of the country. During the recent shutdown, the management has had the works made more perfect in its appointments than ever, placing them in an unrivalled position for turning out the largest amount of fine work. The company expects its paint shop, with a capacity of 160 cars at one time, to be filled in the future with new cars in fulfillment of orders now on its books.

The Fitzgerald-Van Dorn Company, of Lincoln, Neb., manufacturers of the well known Van Dorn drawbar for electric, cable and elevated railroads, writes us that business during 1893 was very satisfactory, considering the universal stagnation in trade, and that business had already opened for 1894 with a boom. This company's drawbar is now in operation on some forty lines of street railroads, including elevated, cable and electric. The company has recently added to its list of customers the Philadelphia Traction Company, the Electric Traction Company, of Philadelphia, and several other important companies. Several improvements, it is stated, have been added to the drawbar during the past few months, and its manufacturers claim now that it is without a peer in the market.

The Charles Munson Belting Company, of Chicago, has received an order for 141 ft. of sixty inch, three-ply, Eagle belt from the American Wire Company, of Cleveland, O. It was especially gratifying to this company to receive the order, as the circumstances under which it was awarded showed that merit was the quality considered. The Munson Company put in two forty-four inch, three-ply belts at the American Wire Works four years ago, which have given splendid satisfaction. They have never given the least trouble, and have transmitted full horse power ever since they were first placed on pulleys. These belts travel 7,000 ft. a minute, and are subject to very severe strain. They are still in excellent condition, and will last the Wire Company for a long time to come.

The Ohio Brass Company, of Mansfield, O., manufacturer of electric railway supplies, is putting a new track bonding device on the market. This is a steel cap which is made to fit snugly over the end of the bonding wire, and into the hole which is drilled in the rail. The mode of fastening is as follows: The end of the wire is pushed through the hole, and the cap is slipped over it and both are then inserted into the rail. A few blows of a hammer are sufficient to fasten it into place. The crimp in the cap extending its whole length allows it to shrink into the wire sufficiently tight to insure a perfect air and moisture proof joint. The facility and ease with which these are used, together with their low selling price will surely recommend them to every street railroad man. The Ohio Brass Company also advises us that its new catalogue is now ready for distribution.

The G. C. Kuhlman Company, of Cleveland, O., is evidently not troubled wirh the general depression in business which is prevalent in all sections of the country. This company seems to have no difficulty in obtaining orders at all times for its cars, and its works at present are extremely busy turning out rolling stock. Among the cars on which this company is now engaged are six for the Cleveland & Berea Railway Company and eighteen cars for the Cleveland Electric Railway Company. The work on these latter, especially, is to be the finest possible, and these cars when finished will be deservedly a source of pride both to the railway company and to the manufacturers. Mr. Kuhlman is expecting to close other contracts shortly with two large roads outside of Cleveland, which will compel the company to make large additions to its already extensive works, which are now being run to their full capacity.

H. F. J. Porter and Albert Fisher, of Chicago, have formed a partnership under the name of Fisher & Porter, and will carry on a contracting and engineering business, with offices at 1025 Monadnock Block. Their line will be the complete equipment of steam plants, giving special attention to large work. Mr. Porter was formerly first assistant mechanical engineer at the Exposition during its construction, and afterward assistant chief of the machinery department. Mr. Fisher has been well known as the Chicago representative of the Ball, Watertown and Green engine companies. Fisher & Porter have recently been made Western representatives of the Providence Steam Engine Company, builders of the improved Green engine, and of the Altoona Manufacturing Company, builders of the M. A. Green engine. They are also making arrangements with other Eastern manufacturers as agents, so as to be able to handle a great variety of business.

J. L. Barclay of Chicago, is now occupying his new business quarters on the sixteenth floor in the south end of the Monadnock Building, in Chicago. The suite of offices is admirably planned for handling Mr. Barclay's electrical interests, and was primarily selected by him for exploiting the sales of the Walker Manufucturing Company's electric railway and electric power transmitting machinery, the Central and Western selling departments of that company's business being under Mr. Barclay's immediate supervision. H. McL. Harding, who also represents the above company, has his headquarters for the Eastern department in New York. While the general electrical interests of the Walker Manufacturing Company will receive the combined attention of Messrs. Harding and Barclay, all selling business directly connected with the Western and Middle States will be exclusively transacted at the Chicago headquarters. District and sales agents are now being appointed in the various districts; among the latter are men who have the confidence of street railway managers, and thoroughly posted in the details of the business. Mr. Barclay feels very much encouraged at the business outlook notwithstanding the financial depression, inquiry for the heavy types of generators and motors, such as the Walker Company manufactures, being numerous. A description of these machines will be published in a later issue.

The St. Louis Car Company, of St. Louis, reports business as very brisk and the prospects for the future very encouraging. The company, as mentioned in the last issue, has recently received a contract from the People's Traction Company, of Philadelphia, Pa., for 400 electric motor cars. 250 of these are to be built immediately, and the remainder as the railway company demands. One-half will be closed cars with twenty foot bodies, and the remainder open cars with twenty-eight foot bodies. The latter will have coach seats, and will be very similar in design and arrangement to the standard long cars used in St. Louis, and built by the St. Louis Car Company. Both closed and open cars will each be mounted on two four wheel, maximum traction trucks, and equipped with two twenty-five horse power, General Electric single reduction motors. The car company reports a very large sale of its No. 8 truck, of the suspended spring base type. The general manager of the company, P. M. Kling, is perfecting a new four wheel truck to be used under long cars. Besides the Philadelphia order the company has also contracted to send 300 cars to various points throughout the country, such as Pottstown, Pa., St. Louis, Scranton, Pa., Topeka, Kan., which are among the largest buyers. The St. Louis contract is that of the Baden & St. Louis Railroad Company, which calls for ten twenty foot cars, with seven coach seats on each side, double doors, mounted on the St. Louis Car Company's improved No. 8 steel truck, and propelled by two twenty-five horse power, General Electric single reduction motors.

New Publications.

The Genett Air Brake for Cable and Electric Railways. Published by the Genett Air Brake Company, Chicago, Ill.

This is a handsomely gotten up and illustrated catalogue of the Genett air brake. The efficiency and practical operation of this system has been well shown by the numerous roads adopting it for their cars, and the results of tests published from time to time in the STREET RAILWAY JOURNAL. The catalogue treats of the description of the system, fully explaining its construction and operation, and also clearly illustrating all the different parts in detail, as well as the manner of adjusting, operating and maintaining these brakes. A large illustration is shown of the application of the Genett system to a typical motor car and trailer street railway train. The catalogue is handsomely printed and illustrated, and gives much valuable information regarding the system.

Dynamo and Motor Building for Amateurs, With Working Drawings. By Lieut. C. D. Parkhurst, New York. The W. J. Johnston Company, Limited. 163 pages, 71 illustrations. Price $1.00.

There is a fascination in the use of electrical machinery which appeals with great force to most people, and induces many to seek a more intimate acquaintance with the methods of generating and utilizing electrical power. The book mentioned above gives in clear and concise form instructions for building simple forms of motors and dynamos which will give fairly efficient results. These, if followed by the student, will not only give him apparatus which has a commercial value, but what is more important, will give him that practical knowledge of mechanical and electrical principles involved in the working of electrical machinery, which he can attain in no other way. The work is accompanied with working drawings and other aids for helping the reader in constructing motors and dynamos. An appendix is added in which is contained data of some of the high type dynamos and motors, which will be of assistance should the amateur wish to design any other types than those treated in the book.

After the Fair: The Twenty-fifth Anniversary Souvenir of the Page Belting Company. Published by the Page Belting Company, Concord, Mass.

The excellent exhibit which the Page Belting Company, of Concord, N. H., made at the World's Fair, Chicago, formed a striking feature of that exposition, and is familiar to our readers through illustrations given of the principal installations made, in our issues last year, during the continuance of the fair. The desire to provide a permanent record of the exhibits shown at Chicago, which the company could present to its friends and customers, has induced the Page Company to issue the handsome pamphlet whose title is given above. This pamphlet contains views, not only of the special exhibits made in the machinery and electrical buildings by the Page Company, but also of the exhibits made by the engine and electrical companies and other machine builders in which the Page belts were an essential and important factor in transmitting power. Views are also given of the Intramural power station, showing the installment of Crown belting, and of lighting plants in various parts of the grounds, in which Page belts were used. The testimonials of a large number of users of the belts at the fair are included in the pamphlet, together with views of the offices of the company and its works at Concord, N. H.

The Inventions, Researches and Writings of Nikola Tesla, by T. Commerford Martin. New York. Published by *The Electrical Engineer*. Cloth, 500 pages, 330 illustrations and new portrait. Price $4.

The extended investigations of Mr. Tesla in the electrical field have opened up to us an immense tract of hitherto unexplored territory, and have not only enlarged our conceptions of the properties of the mysterious force electricity, but indicate a direction in which still more wonderful discoveries will probably be made before many years. Too much credit can hardly be given to that class of inventors of which Mr. Tesla is a type, who, almost alone and unaided, have devoted their energies to increasing our knowledge of the operation of electrical force tn new fields. The practical value of many of Mr. Tesla's inventions and discoveries has already been demonstrated, and all have an important bearing on electrical development.

The first part of the book contains an account of Mr. Tesla's work in polyphase currents, some of which have proved of inestimable value in perfecting the plans of the Niagara Falls power transmission plant. The second section of the work treats of the electrical experiments performed by Mr. Tesla with currents of high potential and high frequency, and the third includes a variety of his inventions in other branches of electrical work, such as dynamos, motors, arc lamps, etc. In that section, some of the Tesla early "phase" motors are described.

The work contains Mr. Tesla's most important lectures and writings which, though previously published, have been so scattered as to be often inaccessible. The author, Mr. Martin, has used his usual careful judgment in compiling the work and has made even the most abstruse and technical of the investigations so attractive that even the non-technical reader will find it appealing irresistibly to his interest.

ARTICLES of incorporation were filed at Elizabeth, N. J., February 15 by the Suburban Railway & Electric Company, the incorporators of which are James B. McGiffert, of Roselle, W. B. Ilosmer, of Boston, John S. Bartlett and Charles H. Fewhall, of Lynn, Mass. The capital stock of the company is $300,000.

List of Street Railway Patents.

U. S. STREET RAILWAY PATENTS ISSUED JANUARY 23, 1894, TO FEBRUARY 13, 1894, INCLUSIVE.

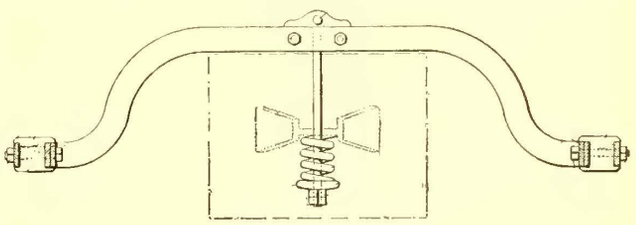
JANUARY 23.

TROLLEY WHEEL—George C. Bourdereaux, Peoria, Ill. No. 513,076.

A trolley for electric cars comprising two separable portions or halves fitted together to form the trolley wheel and a casing for the trolley bearings, a series of rollers inclosed by said casing and having enlarged bearing ends and a central bearing shaft constructed to engage the enlarged ends of said series of rollers.

MOTOR SUPPORT FOR MOTOR TRUCKS—Walter S. Adams, Philadelphia, Pa., assignor to J. A. Brill, same place. No. 513,226.

The first claim of this patent reads as follows: In combination, the side bars, a cross bar or bars, the web of which extends upwardly, having an outward bend or enlargement on the end or ends adjacent to the side bars, and a thimble having recesses within which both the side bars and the enlarged ends of the cross bar or bars lie, the metal of the thimble resisting downward stress of the cross bars independent of any other connection.



PAT. NO. 513,226.

CAR BRAKE—G. M. Brill, Philadelphia, Pa. No. 513,229.

In a car brake the combination of brake beams, brakes secured therein, equalizers secured to the beams and directly connected together. An upright lever included in the connecting mechanism and means connected with the car wheels for primarily operating the upright lever and drawing the ends of the equalizers each toward the opposite beam.

TRACK SWEEPER FOR RAILWAYS—G. M. Brill, Philadelphia, Pa. No. 512,230.

Sweeping brooms are supported at opposite ends of the car truck, in such a way that they may be revolved when desired. These brooms rest normally in contact with the rail. All brooms are operated from the same source of power, in such a way that they may be all simultaneously operated, or by disconnecting one or more, the others may be operated independently.

CAR BBAKE—George F. Brandau, Cohoes, N. Y. No. 513,298.

A swinging brake shoe normally held away from the track and having a cam portion and adapted, when released, to fall by gravity into contact with a car track. The cam portion engages with the brake block, in such a way as to force it into engagement with the car wheel.

ELECTRIC MOTOR FOR STREET CARS—Benjamin G. Lamme, Pittsburgh, Pa., assignor to the Westinghouse Electric & Manufacturing Company, same place. No. 513,401.

In a motor for electric cars, an armature mounted upon the axle of the car, and two field magnets independently sleeved upon the axle and suspended at their rear ends from the car body.

SPAN WIRE FOR OVERHEAD ELECTRIC RAILWAYS—Sidney H. Short, assignor to the Short Electric Railway Company. No. 513,426.

Covers the use of parallel overhead conductors with span wires composed of two or more sections, the sections being insulated from each other.

SAFETY BRAKE—Kitchell A. Maynard, Kansas City, Mo., assignor of one half to William M. and Geo. M. Randall. No. 513,432.

Consists of a brake pivotally carried by a cable car, and having its lower end passing into the grip slot, and friction rollers carried by said lever at the upper and lower sides of said grip slot, and adapted to bear upon the upper and lower sides of the slot rails.

JANUARY 30.

TROLLEY WIRE FINDER—Edward Gale, Peoria, Ill. No. 513,566.

A trolley pole and wheel, with a revoluble guard extending laterally beyond the vertical planes of the sides of the wheel.

DYNAMO BRUSH—W. H. Fleming, Bayonne, N. J. No. 513,611.

A brush consisting of successive layers of wire gauze put together under high pressure, and disposed diagonally to the length of the brush.

CAR BRAKE—Herbert E. Collett, Chelsea, Mass., assignor of three-fourths to Herbert E. Collett, Jr., Lynn, Mass., and Charles W. Armstrong and James Howard Bing, Philadelphia, Pa. No. 513,670.

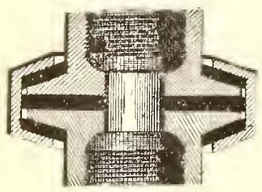
Covers a sectional rotary brake staff in combination with a ratchet fast to its lower section, and so arranged as to form a clutch. A companion clutch member is fast to the upper section, and a cap encloses the clutch mechanism and is attached to the ratchet.

Car Brake—Willard Curtiss, Grand Rapids, Mich., assignor of one half to Wm. T. Powers and Wm. H. Powers, same place. No. 513,672.

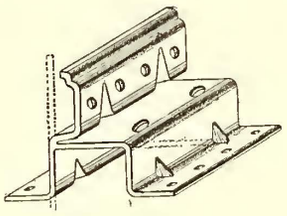
In connection with a cable car and slot rails, employs a laterally and vertically movable bar, having a brake shoe adapted to engage said slot rails, springs to maintain said bar in mid-position laterally, and means for vertically moving said bar.

Wheel Fender or Guard for Cars—Georg Blakistone, Baltimore, Md. No. 513.701.

Consists essentially of a sheet of flexible material, attached at its rear end to the car, and having a loose bar on its front end suspended by means of operating cords or chains from the car platform. The sheet is normally held up by the cords or chains, and lowered as occasion demands.



Pat. No. 513,670.



Pat. No. 513,711.

Wheel Fender for Cars—Georg Blakistone, Baltimore, Md. No. 513,702.

Embraces the sheet employed in No. 513,701, with the addition of supporting rods and springs to hold down the outer end of the sheet.

Safety Fender or Trap—Georg Blakistone, Baltimore, Md. No. 513,703.

Same as No. 513,702, with an automatic tripping device to release the fender.

Railroad Rail Joint—Arthur J. Moxham, Johnstown, Pa. No. 513,711.

A rail joint consisting of a base plate supported by two vertical sides provided with two angular feet, a brace on one side attached to the ends of abutting rails, and a separate splice bar acting as a washer for said bolts.

Combined Chair and Cross-Tie for Railroad Rails in Track—Arthur J. Moxham, Johnstown, Pa. No. 513,712.

A metallic cross-tie having a rail chair struck up therefrom, forming a rail seat, the metal of the tie being forced out laterally in the operation of striking up the chair.

Electric Connection for Railway Rails—Alfred Green, Rochester, N. Y., assignor of one-half to William Rosbrough, same place. No. 513,777.

The combination with the rails of an electric railway of a return conductor wire and wire connections provided with stems and slots, said wire being removably fixed in the slots; the wire extends and is

Pat. No. 513,777.

supported beyond the ends of one or more rails in each direction whereby when the wire is unfastened, as by unsoldering, so that the rails may be removed without interrupting the current.

Trolley Pole Stand—Gustav Valley Cleveland, assignor to the Steel Motor Company, same place.

This comprises a base plate for attaching to the car top, a trolley pole plate bearing a socket for engaging the trolley pole, such trolley pole plate being suspended by means of links the links; from the one side engage hooks or opposing members of the base plate; the links from the other side of the trolley pole plate engage a crosshead. A coiled spring connects with and acts on the crosshead in the direction to hold the links taut.

Spring Spoke Wheel—Gustaf Valley, Cleveland, O. No. 513,848.

Covers a wheel consisting of a rim provided with curved seats upon its inner periphery, flat spring metal spokes substantially U shaped, a recessed hub, and securing blocks and bolts adapted to detachably secure said spokes to the curved seat and hub.

Street Railway Brush—Philip A. Coonradt and Arthur R. Coonradt, Rockford, Ill. No. 513,888.

Covers the combination of a brush for each rail and a spring bar for each brush having an adjustable connection with a part of the truck, the brush having an adjustable connection with a bar, a shaft, a flexible connection between one spring bar, and shaft and a flexible connection between the other spring bar and the first mentioned flexible connection passing over suitable pulleys.

Power Transmitting Mechanism for Electric Locomotives—Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. No. 513,895.

Covers the combination with an electric motor and a shaft or wheel to be driven, of an electric speed reducing mechanism connected to the moving part of the motor and to the shaft or wheel, and consisting of two parts in close proximity to and adapted to electrically attract or repel each other. A friction clutch is also connected to the moving part of the motor, and to the said shaft or wheel.

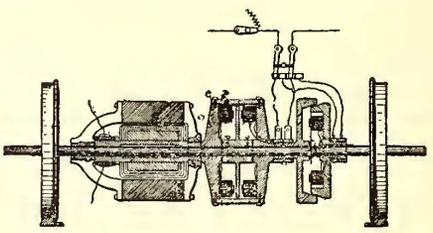
February 6.

Conduit Electric Railway—Rufus C. Beardsley, Lafayette, Ind. No. 514,056.

Comprises a slotted conduit, switch boxes arranged alongside the same, electric switches in the boxes, movable parts of which project into the conduit, and removable covers for the boxes upon which a portion of the switches is mounted.

Closed Conduit Electric Railway—Frank M. Ashley, Hawthorne, N. J. No. 514,112.

Comprises a closed conduit and a traveling switch moving in the the same, the latter consisting of a body mounted upon wheels, an armature carried by but movable, independent of the body, brake



Pat. No. 513,895.

shoes bearing upon the wheels, and a system of levers connecting the armature with the brake shoes, whereby a movement of the former will be imparted to the latter.

Electric Railways—Frank M. Ashley, Hawthorne, N. J. No. 514,113.

Embraces an overhead wire divided into sections, an underground wire divided into corresponding sections, branch wires connecting the corresponding sections of the two wires together, and a hanger located at the joints between the sections of the overhead wire, the same consisting of two metallic plates bolted to the opposite sides of a block of insulating material, the ends of the wire sections being connected respectively to the two metallic plates, and a said branch wire connected to one of said metallic plates.

Electric Railway Conduit—Frank M. Ashley, Hawthorne. N. J. No. 514,114.

Embraces a conduit divided into two compartments located in the same horizontal plane, one of which is closed and the other open, a traveling switch moving in the closed conduit and rails located above and below the switch upon which the latter runs, one of said rails being sectional, and a sectional conductor located in the open compartment with its sections connected respectively with the sections of the sectional rail.

Electric Railway—Oscar A. Enhohn, New York, assignor to Edward C. Reiss and John J. Ashley, Brooklyn, N. Y., and Frank M. Ashley, Hartshorne, N. J. No. 514,120.

Comprises a conduit divided into two longitudinal compartments, one sealed and the other open, a circuit controller running in the open compartment, and electro-magnetic apparatus carried with the collector and controlling the movements of the circuit controller.

Safety Guard for Street Cars—George T. Foster, Rochester, N. Y. No. 541,121.

Embraces cranked arms pivoted to a car, curved rods attached to said arms at one end and connected with slotted keepers on the car at the other end, a cross rod connecting the arms, a network attached to the cross rod and curved rods, and a pneumatic fender mounted on shafts provided with rollers, said shafts entering sockets in the cranked arms, and springs for forcing the fender forward. In connection with the foregoing employs a supplementary guard.

Underground Electric Conductor—Henry A. Seymour, Washington, D. C., assignor to the Short Electric Railway Company, Cleveland, O. No. 514,133.

Comprises a tube flexible on its under side, an electrical conductor located within the tube and supported therein out of contact with the inner walls of the tube, and electrical contacts secured to the under side of the tube and adapted to be lifted into contact with the electrical conductor by an under-running trolley.

Closed Conduit for Electric Railways—Henry A. Seymour, Washington, D. C., assignor to the Short Electric Railway Company, Cleveland, O. No. 514,134.

Embraces an inverted shell and an electric conductor secured to its under side, an electric conducting diaphragm secured to the depending edges of the shell, and retained out of contact with the conductor by its gravity, and adapted to be forced upwardly into contact therewith by an under-running trolley.

Safety Car Fender—George Latz, Baltimore, Md. No. 514,234.

A safety fender attached to the truck frame, and constructed with spaced slats, the higher portion of which is placed horizontally and the lower portion projecting forwardly and downwardly inclined with an eye at the lower end thereof, and a connecting bar which extends through the eyes of all the slats.

ELECTRIC TROLLEY WHEEL SHIELD—Henry S. Pruyn, Hoosick Falls, N. Y. No. 514,274.

In an electric railway, an electrical conductor mounted along the roadway, a hood or covering protecting said conductor and open on its under side, a car adapted to travel along the roadway, a current collecting device carried by the car and passing up under the hood to make contact with the conductor, and a shield carried by and protecting the contact device and extending under the edge of the hood. Also covers a trolley wheel for electric railways provided with a guttered shield.

TROLLEY WIRE SHIELD—Louis Eschner, Philadelphia, Pa. No. 514,353.

Embraces an open bottomed shield or guard, an internal insulating block mounted upon one side of said shield, and a conductor secured to said insulating block and having both an upwardly projecting and a downwardly projecting flange beyond the same whereby it is adapted for receiving a trolley either from above or from below.

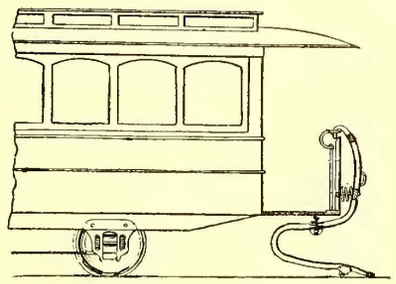
CABLE GRIP—John A. Tauberschmidt, Washington, D. C. No. 514,389.

A cable grip constructed with two pivoted and peforated jaws forming the lower grip member, and an upper grip member having lateral integral projections extending outward through the perforations of the pivoted jaws to engage the said jaws exteriorly and lock them.

FEBRUARY 13.

ELECTRIC RAILWAY—Paul W. Leffler, Minneapolis, Minn., assignor to Leffler Electro-Magnetic Railway Company, Chicago, Ill. No. 514,561.

Consists of a car having a system of armature magnets and a series of field magnets in the line of travel, the car being furnished with an automatic rotary pole changer and a rotary magnetic controller driving said pole changer and operated by the field magnets, whereby the adjacent magnetic members are excited with a constant and opposite polarity.



PAT. NO. 514,749.

CAR BRAKE—John Kerwin, Detroit, Mich., assignor of one-half to Andrew McBride and John Campbell, same place. No. 514,655.

A brake consisting of bands extending over the top of each of the truck wheels and a compensating lever fulcrumed between the wheels and connected at its extremities with said bands, and a lever for operating the band over the front wheel.

POLE FOR ELECTRIC RAILWAYS—Edw. W. Serrell, New York. No. 514,665.

A metallic pole composed of three or more members, having their bodies wider at one end than the other, and united at the center by angle irons throughout their length, and tie bands surrounding the pole at intervals.

BOND WIRE FOR ELECTRIC CONDUCTORS—Alfred Hoffman and Joseph Brogan, Milwaukee, Wis. No. 514,714.

A bond wire with laterally bent ends and washers with radial channels for the admission of the portions of the wire adjacent to the points, so that the wire may lie flush with the outer surface of the said washers.

ELECTRIC RAILWAY SYSTEM—Paul W. Leffler, Minneapolis, Minn., assignor to the Leffler Electro-Magnetic Railway Company, Chicago, Ill. No. 514,718.

Consists of a car or other travelling body, a magnetic field extending along the line of travel, a magnetic armature carried by the car, a magnetic pole changing mechanism operating according to the speed of the car, so that the forces of magnetic attraction and repulsion will co-operate to propel said car.

LIFE GUARD FOR STREET CARS—Theophile Euphrat. No. 514,749.

Consists of a scoop catcher suspended from above the bottom of the front edge of the car, having its front edge close to the rails and a little in advance of the front edge of the car.

TROLLEY—John A. Williams, Altoona, Pa. No. 514,801.

Consists of a hanger having the edges of the arms curved inwardly, and removable shaft blocks seated in said hanger, and trolley wheel shaft keyed to the said blocks and hanger.

INSULATING JOINT—Emil F. Gennert, Brooklyn, N.Y. No. 514,822.

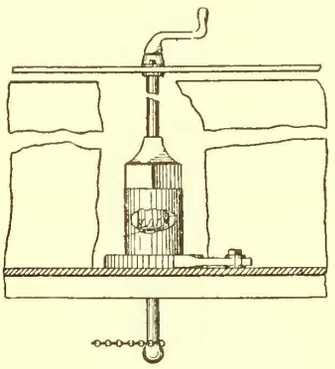
Consists of two sections provided with interlocking lateral flanges, strips of insulating material separating the ends and flanges, and a cup-shape ring pressed or clamped over them and separated therefrom by strips of insulating material.

ELECTRIC RAILWAY CONDUIT—Robert L. Hampton, Athens, Ga. No. 514,827.

A conduit having a trolley rail chamber with a slot in its top and a drainway below, and a cable way located at the side of the trolley rail and provided with removable rack bars to support and separate the cables.

ELECTRIC SWITCH FOR RAILROADS—Wm. M. Henderson and Wm. C. Henderson, Philadelphia, Pa. No. 514,850.

Consists of a combination of levers actuated by the wheels of the car and in connection with electric mechanism to operate the switch.



PAT. NO. 514,822.

ELECTRICALLY OPERATED STREET INDICATOR FOR CARS—Henry C. Barker, St. Louis, Mo., assignor to Jacob Stocke, Jr., and Henry C. Beekman, same place. No. 514,878.

Consists of an indicator carried by the car, a cam block located on the trolley wire, a contact piece on the trolley arm and a contact point on the car having electrical connection with said indicator and operating the same when the cam is engaged by the trolley.

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

Annual Meeting of the National Electric Light Association.

The Seventeenth Convention of the National Electric Light Association was held in Washington, D. C., February 27, 28 and March 1, 1894.

Some of the topics for discussion were: "What is the Most Economical Size for Arc Dynamos?" "Arc Lights on Incandescent Circuits;" "How to Rate Arc Lamps;" "Underground Circuits;" "How to Wire Buildings;" "Commercial Alternating Motors;" "Electrolytical Effects of Return Currents;" "Motors *vs.* Flat Rates;" "Storage Batteries."

A paper entitled "Electric Lighting at the World's Fair, and Some of Its Lessons," was illustrated with stereopticon by T. C. Martin and L. Stiringer. There was also one entitled "The Importance of Complete Metallic Circuits for Electric Railways," by J. H. Vail. which is given on another page in this issue.

The Lake Shore Route.

The Lake Shore Route, between Buffalo and Chicago, is celebrated all over the world as affording the embodiment of luxury in travel. Its new Day Coaches are sixty feet in length, and will seat fifty-eight people, comfortably. They are fitted with the Gould platform and automatic coupler, Westinghouse air brakes and signal, heated with steam taken from the locomotive, and at night are brilliantly lighted with Pintsch gas, for which purpose five elegant bronze chandeliers depend from the roof of the car.

The interior of the coaches is finished in mahogany, highly polished and paneled. Each coach has a nice lavatory and toilet. The latest models contain separate toilet rooms—one for ladies and one for gentlemen. The car seats are of the style known as the Mason tilting, with high, spring backs and broad seats. They are richly upholstered in crimson plush. The windows, which are of plate glass, are large, and each is fitted with a spring-roller curtain, in shade to blend with the interior finish, and every feature is of the best.

The dining cars in service on the trains of the Lake Shore & Michigan Southern Railway are operated by the company. The cars are neat and tasty in all their appointments. Great care is exercised to provide the patrons of the Lake Shore Route with a service which shall prove satisfactory. As a result, dining on the trains of the road is accomplished in a very satisfactory and comfortable way.

The sleeping cars in service on the Lake Shore Route are of Wagner build. Ordinarily, they contain twelve sections, a state-room, a smoking apartment, and toilets for ladies and gentlemen. In some instances, however, there are cars containing sixteen sections, the state-room being omitted. Every valuable device is embodied in their construction.

The Lake Shore operates a most perfect sleeping car service between the cities of Chicago, Cleveland, Buffalo, New York and Boston in connection with the New York Central and Boston & Albany Railways. This is not only the direct, best and only double track route between the cities mentioned, but the Lake Shore is the only line from Chicago conveying passengers into New York City without a ferry transfer.⁂

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Feb 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	113	115
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	101	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	101	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	101	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	100	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	112	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	112	115
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	110	115

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Feb. 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.....	80	90
City & Suburban Ry. Co	50	3,000,000	.....	1	.....	30	33
Central Pass. Ry. Co	50	300,000	.....	...	.....	60	65
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	15	15¼

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort	1892	500,000	.....	5	.....	109	109½
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	105	105½
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	108	109
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D.	5	1942	101½	102
" " "	1891	1,250,000	M. & S.	6	1901	104½	105
City Pass. R. R. Co	1891	2,000,000	"	5	1911	111	111½

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. Feb. 19. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,406,000	J. & J.	4	1887	76	77
West End Com'n	50	9,085,000	J. & J.	3	1890–1892	44¼	44¾

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Feb. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co	10	6,000,000	Q.—J.	2	.....	162½	163½
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	.....	.....
" " common	100	6,000,000	.....	...	1893	.....	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	.....	.....
Long Island Traction Co	100	30,000,000			1893	17	18

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	.....	102
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	.....	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	104	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	107	109

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN Charleston, S. C., Feb. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	0	.....	.....	70
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	6

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 167 Dearborn Street, Chicago, Ill., Feb. 21.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	300	315
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	226½	228
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	135	136

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	100	.....
Chicago Passenger	1883	400,000	F. & A.	6	1903	102	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	98	99½
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	102	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101¾	102
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	.....	98
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	102½	103

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,750,000	Q.—J.	5	.....	105½	106
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	107½	110
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	60	65
" " " Pref.	100	100,000	.....	6	.....	95	100
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	.	.....	19	20½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1894	100	.....
" "	.....	50,000	J. & J.	7	July, 1895	101½	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	99	100¼
	.....	150,000	J. & J.	5	.....	101	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	111½	112½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104¼	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	105	109
" " "	.....	300,000	J. & J.	6	Jan. 1914	101	101½
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	.....
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	112½	115
S. Cov. & Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	112½	115

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co.	100	12,000,000	.....	....	1893	50	51
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	55	57

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	101	102½
" " City " "	1893	2,349,000	.....				

DETROIT STOCKS.—Corrected by CAMERON CURRIE & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Feb. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. Feb. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	200	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	100	125

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Feb. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	84	85
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	33	34

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	98	98½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	114	115
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	114	115
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Feb 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$400,000	J. & J.	4	.....	50	55
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	.....	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Aug. 1, 1894	104	.....
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Feb. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.	100	1,200,000	Quart.	1½	1867	131⅛	136½
Crescent City R. Co.....	100	1,150,000	"	1½	1866	.....	87½
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	39¾	41
New Orleans City & Lake Co.	100	1,600,000	Quart.	1¾	1860	108	120
Orleans R. R. Co.....	50	185,000	"	2	1868	.....	60
St. Charles Street R. R. Co ..	50	600,000	"	2½	1865	59	62½

Bonds.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	.....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100	.....
do do new	1886	40,000	M & N	6	1896	100	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	113¾	116¼
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	96	.....
St. Charles Street R. R. Co...	1881	120,000	J & D	6	'92-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, Feb, 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry.(p'd up sh.)	50	$2,000,000	M. & N.	4	May, '91.	167	169

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....

NEW YORK STOCKS AND BONDS.—Corrected by JAMES MCGOVERN & Co., 6 Wall St., New York, Feb. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	185	.....
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	140	145
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	123	126
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4	.....	.....	298
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	40	50
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	.....	236
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	118	120
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	190	200
Third Avenue.....	100	5,000,000	Q.—M.	4	.....	170	175
23d St.....	100	600,000	Q.—F.	2½	.....	.....	290
Ninth Avenue.....	100	800,000	Q.—J.	1¾	.....	134	140
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	108	.....
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	104	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	103	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	103	.....
" 2ds Interest as rental	.....	1,000,000	J. & J.	5	July, 1905	97	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	115	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	100	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	96	97
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	.....	57
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	104	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	.....	102
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	.....	111
23d St.....	.....	250,000	M. & N.	7	May, 1893	100	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	103

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING, 143 South Fourth st. (Bullitt Building), Philadelphia, Feb. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	265	270
Continental.....	50	1,000,000	J.—J.	6	1873	126	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	330	335
Germantown.....	50	1,500,000	Q.—J.	2¼	1858	110	112
Green & Coates...	50	500,000	Q.—J.	3	1858	121	125
Hestonville...	50	2,050,000	.....	...	1859	33	38
Lombard & South.....	25	500,000	A.—O.	8	1861	90	90
People's Traction Co.....	50	10,000,000	.....	...	.....	28½	29
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	152	153
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	76½	79
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	93	94
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	225	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	206	210
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	223	225
Union.....	50	1,250,000	J.—J.	9½	1864	195	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	100½	101
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	101	102
Baltimore Traction.....	25	5,000,000	.....	1	1889	15⅝	15¾
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	40	55
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	13¾	14½

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	108	109
" " Imp.	1892	1,250,000	M.—S.	6	1901	104½	105
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1932	100	101
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort..... ...	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Outstanding.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr. 306 Times Bldg., Pittsburgh, Pa., Feb. 17. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	...	.....	19½	20
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	58¼	58½
Pitts. & Birmingham R. R. Co	.....	3,000,000	.....	...	.....	13⅛	13¼
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	55	57
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	18	19
Pittsburgh, Allegheny & Man	.....	3,000,000	.....	1½	.....	37	37¼
West End R. R. Co.	50	200,000	J. & J.	...	.....	.....	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	.....	3,000,000	.....	...	.....	22	22¾

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	1927	109½	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	105	107
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	94½	95
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500 000	J. & J.	5	1931	103½	104
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	98½	99
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	101	103
Central Traction Co.	1889	375,000	J. & J.	5	1919	101½	103
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1922	100	102
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	95
Suburban Rapid Transit	.....	.....	.....	...	.....	96	100
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Inc'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Inc'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS, Bankers, Providence, Feb. 17.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....

BONDS.	Date of Issue	Amo'nt Outstand'g	Interest Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	95	100
Newport St. Ry. Co.	.....	50,000	.....	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Jan. 18.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	24	30
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	40	44
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	20	25
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	23	25
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	.....	80
do do Common.	100	4,000,000	.....	...	1892	13	20
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	.....	90
do do Common.	100	3,000,000	.....	...	1892	20	30
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	35	40

BONDS.	Date of Issue	Amount Out standing.	Interest Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	88	95
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	95	99
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	89	90
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	85	90
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	85	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Feb. 13.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	5	.....	99½	100¼
Geary St., Park & Ocean R.R. Co	100	1,000,000	.....	1	.....	.....	100
Market Street Cable Co.	.....	17,892,000	.....	...	.....	39¾	40
Metropolitan Electric	.....	.....	.....	...	.....	.....	30
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	20
Sutter St. R. R. Co.	.....	.....	.....	...	.....	.....	90

Bonds.	Date of Issue	Am't Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	.....	5	.....	102½	.....
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	104	104¼
Geary St., Park & Ocean	.....	.....	.....	...	.....	100½	.....
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	.....	119¾
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	113⅜	.....
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	.....	115
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	95	101
Powell Street R. R.	.....	700,000	M. & S.	6	1912	.....	118
Sutter St. Cable Co.	.....	.....	.....	..	.....	102½	103

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., Feb. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	50	60
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue	100	112,000	Dec. '88	2	1885	125	150
Lindell	100	2,500,000	.....	...	1890	72½	74
Missouri	100	2,000,000	Q.—J.	2	1891	180	200
People's	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis	100	2,000,000	J. & J.	3½	1890	155	160
Fourth Street & Arsenal	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	.....	...	1890	150	200
St. Louis & Suburban	100	2,500,000	.....	...	1891	30	40
Southern, Pfd.	.....	800,000	.....	...	.....	90	92
" Com.	.....	700,000	.....	...	.....	82	85

BONDS.	Date of Issue	Amount Outstand. ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground	1892	1,800,000	J. & J.	5	1912	96	98
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	102	103
Fourth St. & Arsenal	1888	50,000	J. & J.	6	1898-1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895-1910	100	100
Missouri Cable	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort	1882	125,000	J. & D.	6	1902	98	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable	1889	800,000	J. & J.	6	1889-1914	90	95
St. Louis Cable	1890	1,500,000	M. & N.	5	1900-1910	100	102
Union Depot	1890	4,000,000	A. & O.	6	1900-1910	104	105
Southern	1884	200,000	M. & N.	6	1904	100	102
Southern	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban	1891	1,400,000	F. & A.	5	1921	95	97
St. Louis & Suburban (Incomes)	1891	300,000	.....	6	.....	70	75

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Feb. 17. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	260	300
Metropolitan R. R.	50	750,000	Q. J.	2	1864	85	95
Columbia R. R.	50	400,000	Q. M.	1	1870	55	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	18	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	15	.....
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	.....
Rock Creek R. R.	100	401,700	.....	...	.....	.....	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....

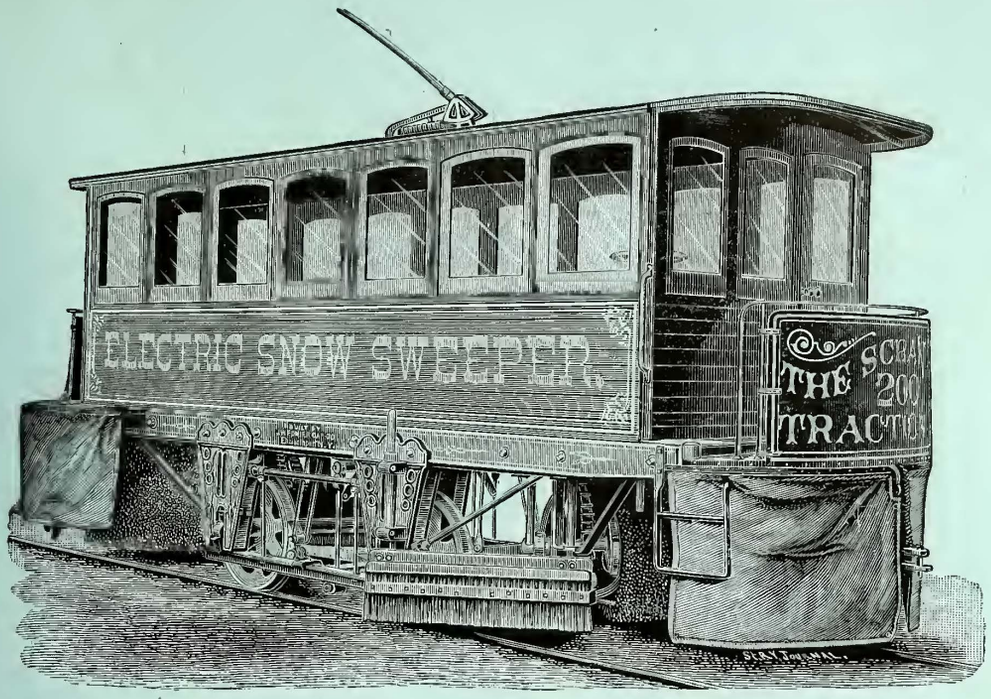
BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Wash'ton & Geo'town conv't.	'83-'91	3,000,000	J. & J.	6	1899-1929	125	150
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	.....	100
Capitol & North O St. R. R.	1921	240,000	J. & J.	6	1921	85	93
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	101	105
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

Financial.

THE annual report of the Winchester Avenue Street Railway Company, of New Haven, Conn., showed total receipts for the year $190,880.

$ $ $

THE Columbus (O.) Street Railway Company reports as follows as to its operations for January: Gross earnings, 1894, $42,193.36; 1893, $38,198.29; increase, $3,995.07. Operating expenses, 1894, $22,678.34; 1893, $28,769.66; decrease, $6,091.32. Net earnings, 1894, $19,515.02; 1893, $9,428.63; increase, $10,086.39.



Snow Sweeper with full length cab, the motorman operating same on the inside. Same as built by us for Scranton Traction Co.

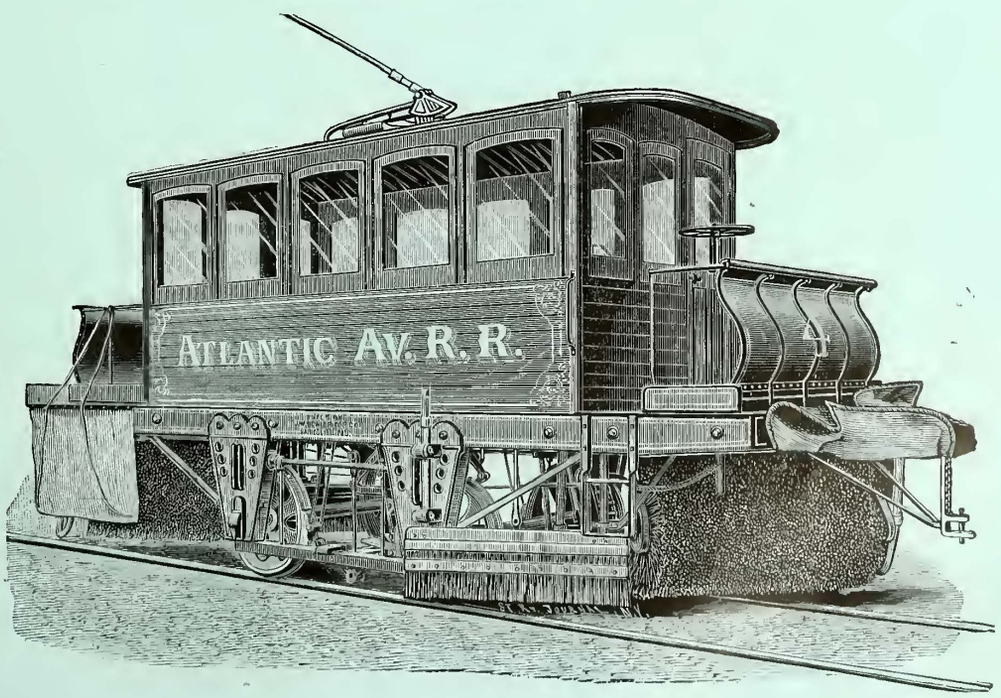
ELECTRIC SNOW SWEEPERS

BUILT BY THE

J. W. FOWLER CAR CO.

WORKS AND GENERAL OFFICE,
ELIZABETHPORT, N. J.

Electric Snow Sweeper to be operated with the motorman on the platform, motor operating the brooms inside cab. Same as built by us for the Atlantic Ave. R. R. Co., Brooklyn, N. Y.



THE Milwaukee (Wis.) Street Railway Company has placed a second mortgage for $1,300,000 on the property, and these bonds go, it is said, into the treasury of the North American Company to pay for claims.

$ $ $

A. D. TITSWORTH, general manager of the Richmond (Ind.) street railway company, has been appointed receiver of the Electric Street Railway Company of that city, and not of a city in another state, as printed in a recent issue.

$ $ $

THE West End Street Railway Company has issued $2,000,000 twenty-year, 4½ per cent. gold bonds to a local syndicate. Receipts for the bonds sold during February at 94 and interest, and one house has sold more than $100,000. The bonds will be dated March 1, 1894.

$ $ $

THE Buffalo (N. Y.) Railway Company submits the following comparative statement of its operations for January: Gross earnings, 1894, $117,881.50; 1893, $101,874.44; increase, $16,007.06. Operating expenses, 1894, $73,373.56; 1893, $75,704.24; decrease, $2,330.68. Net earnings, 1894, $44,507.94; 1893, $26,170.20; increase, $18.337.74.

$ $ $

THE Pittsburgh (Pa.) & Birmingham Traction Company submits the following statement of its operations for January: Gross earnings, 1894, $23,006.70; 1893, $28,143.50; decrease, $5,136.80. Operating expenses, 1894, $11,803.11; 1893, $15.416.70; decrease, $3,613.59. Net earnings, 1894, $11,203.59; 1893, $12,726.80; decrease, $1,523.21.

$ $ $

THE Pittsburgh (Pa.) & Birmingham Traction Company submits the following statement of its operations for December: Gross earnings, 1893, $24,282.49; 1892, $30,425.56; decrease, $6,143.07. Operating expenses, 1893, $13,692.90; 1892, $14,669.01; decrease, $976.11. Net earnings, 1893, $10,589.59; 1892, $15,756.55; decrease, $5,166.96.

$ $ $

THE Denver Consolidated Tramway Company paid January 20 a dividend of 1 per cent. on its capital stock of $3,000,000, making the dividend $30,000. The dividend was for the six months ending December 31. The company has recently restored the service cut off during the panic of last summer, and reports a steady growth of revenue.

$ $ $

THE North Shore Traction Company, of Lynn, Mass., gives the following as a statement of its operations for January: Gross earnings, 1894, $74,206.85; 1893, $70,523.76; increase, $3,683.09. Operating expenses, 1894, $57,511.40. Net earnings, 1894, $16,695.45. We are unable to give the operating expenses for January, 1893, as the various companies now comprising the system were operated separately.

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THE report of the Buffalo (N. Y.) Railway Company for the last quarter of 1893 is given: Gross income, $127,797; net income, $34,003; cash on hand, $38,227, and profit and loss (surplus), $345,756. For the same quarter last year the gross income was $106,070; net income, $24,103. The report of the Crosstown Railroad Company, of Buffalo, for the same quarter shows: Gross income, $26,415; net income, $4,726; cash on hand, $6,117; profit and loss (surplus), $56,594.

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THE Paterson (N. J.) Railway Company submits the following statements of its operations for the months of December, 1893 and January 1894: December, gross earnings, 1893, $18,220.56; 1892, $22,-756.56; decrease, $4,536. Operating expenses, 1893, $13,067.67; 1892, $15,907.80; decrease, $2,840.13. Net earnings, 1893, $5,152.89; 1892, $6,848.76; decrease, $1,695.87. January, gross earnings, 1894, $16,-713.75; 1893, $19,243.77; decrease, $2,530.02. Operating expenses, 1894, $12,047.28; 1893, $14.405.52; decrease, $2,358.24. Net earnings 1894, $4,666.47; 1893, $4,838.25; decrease, $171.78.

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AT the annual meeting of the shareholders of the London (Ont.) Street Railway Company, held on January 18, the following were elected directors for the ensuing year: H. A. Everett, T. H. Smallman, Greene Pack, E. W. Moore, S. R. Break. The following officers were also elected: H. A. Everett, president; E. W. Moore, vice-president; S. R. Break, secretary-treasurer and general manager. The annual report for 1893 shewed gross earnings to be $52,244.60, being an increase of $13,702.22 over the year 1892. The operating expenses for the same period were $40,686 93, leaving the net revenue $11,557-.67, being an increase of $4,175.25 over 1892.

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AT a recent meeting of the stockholders of the National Railway of Illinois, a corporation controlling five of the street railways of St. Louis—the St. Louis or Broadway line, Cass Avenue & Fair Grounds, Northern Central, Union, Citizens' or Franklin Avenue, and the Baden & St. Louis lines—the following board of directors was elected: W. T. Baker, E. Buckingham, T. J. Lefens, G. T. Smith, D. G. Hamilton, E. G. Foreman, C. L. Raymond. All are re-elections except Mr. Raymond who succeeds C. L. Hutchinson. The annual report of the president states that traffic was much interfered with by the depression in business and the reconstruction of certain parts of the road, but the policy of retrenchment was pursued. The following statistical statement was made:

Net gain from its properties to which the National Railway Company is entitled, $199,947.27, or 9.0885 per cent., against 10 per cent. for 1892. Of the five roads the total gross receipts have been for 1893, $1,416,817.74, showing a decrease from 1892 of $20,729.47, or 1.4 per cent. Operating expenses, $851,851.06, or 60.12 per cent., a decrease of $23,118.23; net receipts, $564,966.68; fixed charges (interest, taxes and insurance)—showing a decrease of $21,989.91—$309,683.85. Total, $255,282.83.

Trips made in 1893, 877,302; number of car miles, 11 844,031; passengers carried, 28,313,504. Gross receipts of cable lines. $1,035,445.03; gross receipts of horse and electric, $381,372.71; total, $1,416,817.74; decrease of cable, $50,987.91; increase of horse and electric, $30,258-.44; net decrease, $20,129.47.

Operating expenses: Cable lines (59.4 per cent.), $607,649.73; horse and electric (64 per cent.), $244,201.33; total current and operating expenses, 1893, 60.13 per cent.; total current and operating expenses, 1892, 60.86 per cent.; decrease, 1893, .0028 per cent.

Mileage, cable lines, 9,368,758; mileage, horse and electric, 2,475,-273; total, 11,844,031; decrease of mileage of cable, 425,453; increase of mileage of horse and electric, 322,127.

Cost of operating by cable per car mile, except interest, 7.32 cts.; including interest, 9.34 cts.; cost of operating horse and electricity per car per mile, 11.09 cts.; including interest, 13.11 cts. Cost to carry each passenger: Cable, including interest, 4.12 cts.; horse and electric, 4.25 cts. Passengers carried per car mile run: Cable, 2.257; horse and electric, 3.082. Operating expenses, including all fixed charges: Cable, 82.11 per cent.; horse and electric, 85.05 per cent.

California and the Midwinter Fair.

A more favorable opportunity than the present to visit California will probably never be offered. The rates for excursion tickets, via the Northwestern Line, are the lowest ever made, and, aside from the delightful semi-tropical climate of California, the Midwinter Fair at San Francisco, which is now in the full tide of success, is a most potent attraction to the tourist and pleasure seeker. The trip from Chicago to California is made, via the Northwestern Line, in the marvelously short time of three and a half days. Palace Drawing Room Sleeping Cars leave Chicago daily, and run through without change, and all meals en route are served in dining cars. Daily Tourist Sleeping Car service is also maintained by this line between Chicago and San Fran-

cisco and Los Angeles, and every Thursday the party is personally conducted by an experienced excursion manager. Completely equipped berths in tourist sleepers are furnished at a cost of only $4 each from Chicago to the Pacific Coast, thus enabling passengers to make the journey in a most comfortable and economical manner. The Northwestern Line has issued a number of illustrated pamphlets descriptive of the Midwinter Fair, and also containing detailed information concerning rates, routes, etc., copies of which will be mailed free upon application to W. A. Thrall, General Passenger and Ticket Agent Chicago & Northwestern Railway, Chicago, Ill., if you mention this publication.⁂

Florida Winters.

The "Clyde Line" is the only line making the trip between New York and Jacksonville without change. Six beautiful, fast steamships, the "Algonquin," "Iroquois," "Cherokee," "Seminole," "Yemassee" and "Delaware" are assigned to this service, and they leave Pier 29, East River, Mondays, Wednesdays and Fridays at 3 P. M. By this line all the dust and annoyances incidental to railroad travel are avoided. A pleasant feature of the trip is the stopping at Charleston, S. C., for half a day. The visit to this "Venice of America" is certain to be amply repaid. The steamships have the most complete modern fittings and accommodations, including elctric light, call bells and elaborate saloons and cabins.

Write the "Clyde Line" for one of their "Facts About Florida," as they take pleasure in furnishing them free of charge.⁂

Of Interest to Travelers.

The Baltimore & Ohio Railroad announces that it has placed on sale round trip tickets at reduced rates to the winter resorts in Florida and the South, and also to such points of interest as Luray, Natural Bridge and Gettysburg. This company has also arranged to place on sale excursion tickets to San Francisco and other points in California, on account of the Mid-Winter Fair, at unusually low rates. Excursion tickets are now on sale to Baltimore and Washington via the famous Royal Blue line.

With its vestibuled train service, via Washington, to Cincinnati, St. Louis and Chicago, the Baltimore & Ohio is in the best of condition to handle Western and Southern travel. That the line is a popular one, is attested by the immense World's Fair business handled this summer.

Those contemplating a trip West or South this winter should write to C. P. Craig, general Eastern passenger agent, 415 Broadway, New York, for rates and other information.⁂