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The 155th Street Viaduct, New York City.

The city of New York has of late years made many improvements to facilitate communication in the upper part of Manhattan Island. One of its recent and most important works towards the attainment of this object is the viaduct that is now building in 155th Street, two views of which, with diagram, are given in this issue. The object of the structure is to bring the inhabitants of Washington Heights into connection with the Manhattan elevated railway, Harlem River and its opposite shore, Westchester.

The viaduct is composed of spans forty-three feet between centres, the columns in every other span being connected with each other by means of struts and of latticed iron braces. The columns are eighteen inches square, and rest on concrete piers supported on a foundation of piles. The width of the viaduct, between railings, is sixty-two feet, with a roadway of forty feet and two sidewalks of eleven feet each. These sidewalks overhang the outside longitudinal plate girders, as the conditions of the street limited the transverse spacing of the columns to forty feet.



FIG. 1.—155TH STREET VIADUCT CROSSING ELEVATED RAILWAY AT 8TH AVENUE, NEW YORK.

The viaduct, which is 1,400 ft. long, starts from the very precipitous bluff at Edgecombe Avenue at an elevation of sixty feet above 155th Street, and extends along this street with a uniform descent of $4\frac{3}{4}$ per cent. over the Eighth Avenue elevated station to the Harlem River, where, at a height of twenty-eight feet above the street, a wide platform will form connection with the McComb's Dam road and with the Central bridge. The illustration on this page shows the present appearance of the structure at the point where it crosses the Elevated railway station at the corner of 155th Street and Eighth Avenue, at an elevation of forty-eight feet above the street. Here, as will be seen more clearly from Fig. 2, a level plaza, 150×70 ft., affords ample standing room for carriages. Four staircases of a new and handsome design will lead at this point from the sidewalk of the viaduct to both the elevated platforms and to the street. These stairs will be of wrought iron, six feet wide, and will be provided with a wooden canopy supported by poles of one and a half inch wrought iron pipe. Fig. 3 shows the present appearance of the structure from the Washington Heights side.

The roadway is paved with six inch granite blocks laid on a foundation of bituminous concrete on buckle plates. The wearing surface of the sidewalks is rock asphalt on a basis of bituminous concrete. The superstructure is built of soft steel, and its weight will be about 4,000 tons. Mr. Herbert Steward is the contractor, with the Union Bridge Co. as sub-contractors for the metal work and the Hecla Iron Works as the sub-contractors for the ornamental railing and the staircases. The outlay for the work, which will be completed this summer, will be about \$600,000. The viaduct is built according to the designs and under the supervision of Alfred P. Boller of New York.

A new electric railway will soon be in operation on Staten Island, using twelve Edison motor equipments, and two 100 k. w. generators. Among those interested in the company are C. A. Starbuck, J. C. Thompson, president of the Eames Vacuum Brake Co. and Royal C. Vilas, president of the New York Air Brake Co. The line will be about three and a half miles in length and will use about one-fourth of a mile of the Belt Line track.

Results Attained by the Buda-Pesth Electric Railway.

In connection with the incorporation of the Siemens & Halske Co., of Chicago, described at length in our last issue, the following statistics of the results of operation of the Buda-Pesth electric railway, on which the under-

increase in the number of passengers carried and the income per mile increased from \$1,461 to \$2,585. It would be very interesting to know the relative increase of car mileage and cost of operation, but the official reports are, unfortunately, silent in this respect.

In investigating the reports of the Buda-Pesth horse railway for 1891, a slight decrease in the number of passengers carried is noted, and the income per mile has also fallen. This fact, taken in connection with the increased traffic on the electric line, apparently indicates that the Hungarians prefer electricity to horses as a means of propulsion. While the electric railway carried 114,708 passengers and received \$2,585 per mile monthly, the horse railway carried but 52,627 and received but \$1,606. The latter, therefore, carried less than half the number of passengers and received only 62 per cent. as great an income per mile and month. It must also be noted in this connection that the average fare per passenger was 2.24 cents on the electric line and 3.03 cents on the horse railway. This difference, however, may be explained by the greater length of the horse railway, which is 28.4 miles, and the custom of charging a fare proportional to the distance traveled, which is nearly universal in Europe. Nevertheless, it is evident that the Buda-Pesth electric road is remarkably successful among Austrian railways as regards passengers carried and gross income per mile, for even on the almost constantly crowded lines of the Vienna horse railway the number of passengers per mile is only about 82,000 per month and the income about three-fifths as great. The working expenses are at present about one-

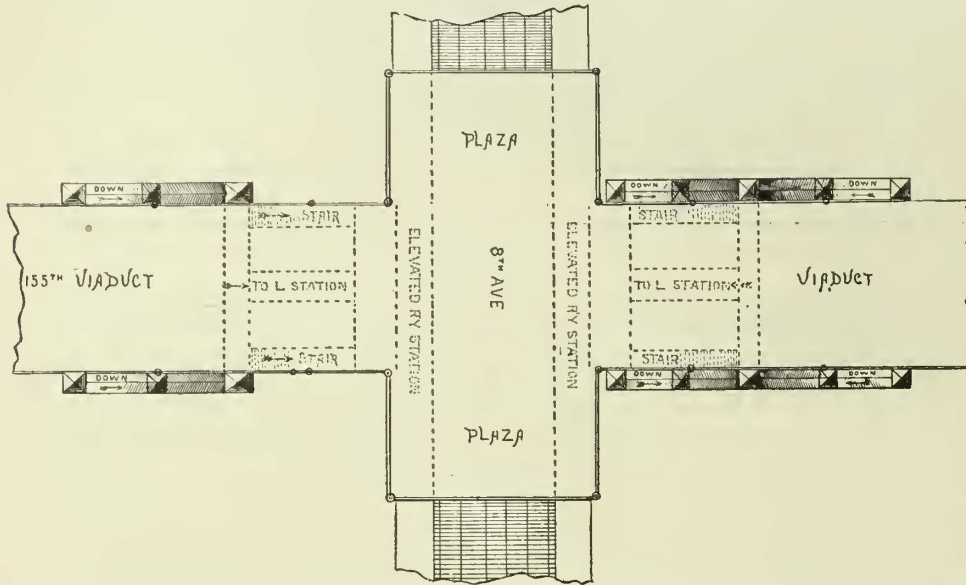


FIG. 2.—PLAN OF ELEVATED RAILWAY CROSSING—155TH STREET VIADUCT, NEW YORK.

ground conduit system of this company is employed, are of some interest. During the year ending December 31, 1890, the first in which this road was in operation, the total number of passengers carried was 4,459,234 and the total income amounted to \$98,851, assuming the value of the Austrian florin to be 35.9 cents. Since there were 5.64 miles in operation during this period, the receipts per mile and month were very nearly \$1,461. In July, 1891,



FIG. 3.—155TH STREET VIADUCT, NEW YORK—VIEW FROM WASHINGTON HEIGHTS.

the length of the road was increased from 5.64 to 6.82 miles. During the year ending December 31, 1891, the greatest number of passengers carried in any month was 854,619 in October, and the least number, 495,373, in February, the average being 718,268 and the total for the year 8,619,214. The total income was \$194,230 or \$2,585 per mile and month.

It will be seen from the above figures that during the last year the number of persons carried has very nearly doubled and the receipts have increased proportionally. The extension of the road in July resulted in a marked

half of the revenue, a much more favorable showing than with the horse railways where the ratio of working expenses to revenue is about twelve per cent. Any of our readers desiring a more complete record of the operations of both the roads in Buda-Pesth, will find the figures in the issue of the Zeitschrift of the Austrian Society of Engineers & Architects for March 18.

THE electric railway at Ashtabula, O., is finished and was put in operation April 11, on which day 1,200 passengers were carried.

A New Compound Steam Motor.

A compound steam motor of somewhat novel construction has recently been built by the Baldwin Locomotive Works of Philadelphia for the Wilmington (N. C.) Street Railway Co., and is shown in the accompanying

Wightman Twenty-Five H. P. Motor.

The Wightman single reduction railway motor was illustrated and described in the pages of this journal about a year ago, but since that time this motor has undergone several improvements which, in the main, relate to the protection of the field windings and the working parts of the motor against external agencies. The latest type of the Wightman motor, shown in the accompanying illustration, is entirely encased in a steel armor, which, while making the motor practically dust and water proof, still permits of ample ventilation. The motor casing is arranged with a view of offering thorough protection to the motor and at the same time permitting of easy access to such parts as require frequent inspection. The casing is made of sheet steel firmly riveted to the motor frame; and this greatly increases the strength of the motor without adding unnecessarily to its weight.

The motor gear case, too, has been improved. As now manufactured, it is of malleable iron and is in three parts, very easy to attach or take off. It is absolutely dustproof, and the parts are so fastened together that it is impossible for them to work loose.

The controlling switch used with this motor is of the standard Wightman type, having speed controlling handle and reversing handle combined in one, making the operation of the simplest possible character. Speed regulation with this controlling device is obtained without the use of any external resistance above a car speed of three or

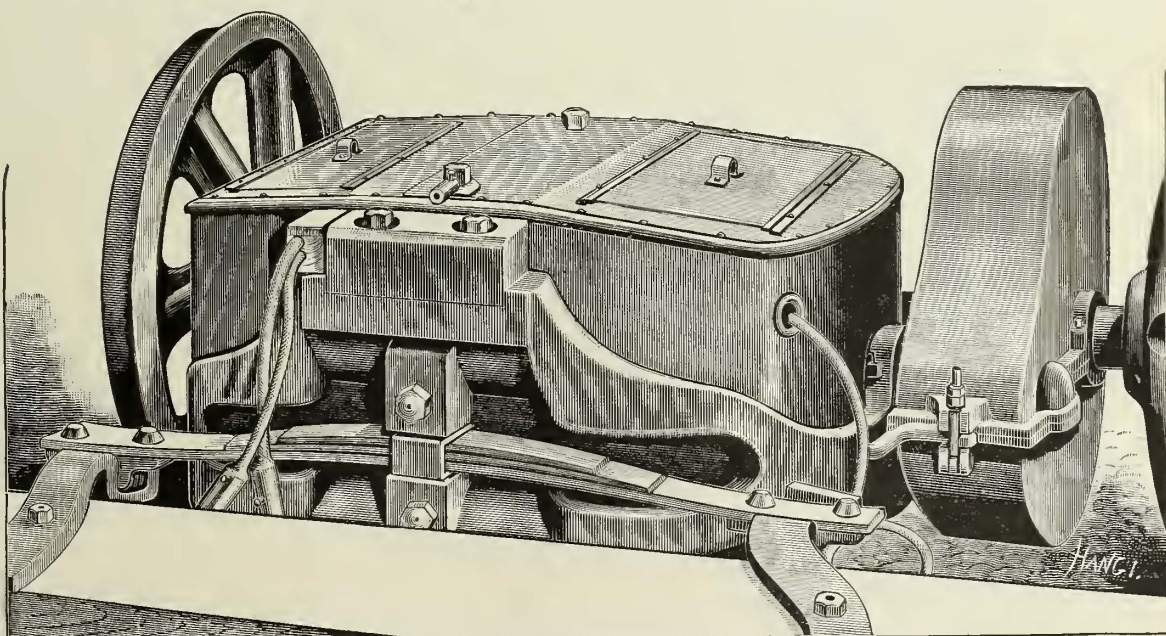


NEW COMPOUND STEAM MOTOR.

engraving. The Vaucrain system of compounding has been adopted. The cylinder dimensions are high pressure, seven and a half inches diameter, low pressure thirteen inches diameter and sixteen inches stroke. The total weight of the engine is 35,500 lbs., all of which, of course, rests on the drivers and is so available for traction.

One great object aimed at by the manufacturers in compounding, besides the economy effected, was noiselessness, and by the expansion of the steam in the two cylinders the pressure is so reduced that the escape of steam is attended with no noise. Moreover, when it is delivered to the condenser such a large degree of expansion has taken place that the temperature of the escaping steam is reduced to such an extent as to facilitate its condensation. The condenser consists of brass tubes placed on the roof, through which all the steam from the cylinders, safety valves, etc., is passed. As the entire volume of exhaust steam passes directly to the condenser, the motor operates by natural draft, and in order to provide sufficient steam the fire box and boiler are made unusually large.

A device is provided for exhausting the steam from the cylinder through ordinary exhaust nozzles and out of the stack instead of through the condenser, when unusual power is required to surmount heavy grades or handle an unusually heavy load. This device is at the control of the engineer, and, of course, instantly changes the machine from a condensing to a non-condensing engine.



NEW TYPE WIGHTMAN TWENTY-FIVE H. P. MOTOR.

four miles per hour. There are five speed contacts possible for each direction of operation.

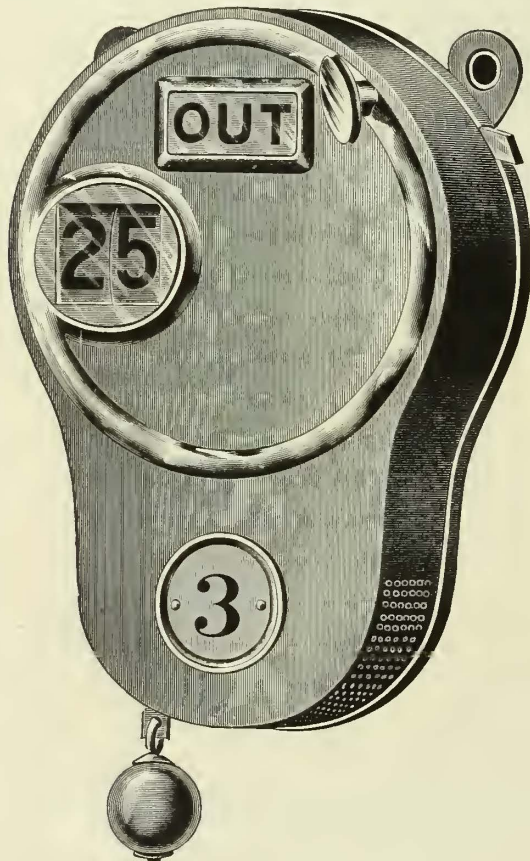
Some recent tests made by Mr. Jas. T. Gardiner, consulting engineer at St. Joseph, Mo., where the Wightman system entered into competition with other well known systems, gave flattering results for the Wightman motor.

Among their recent orders the Wightman Electric Manufacturing Co. have recently been awarded the contract for twenty car equipments and a 300 H. P. generator for the Seashore Railway Co. of Asbury Park, N. J.

New Portable Fare Register.

In the accompanying illustration is shown a new portable fare register, made by the International Register Co., of 302 Dearborn Street, Chicago. A heavy, clumsy register is a burden to a conductor, especially during hot weather, and the fact that this device, the cut of which is three-quarters the standard size, weighs only sixteen ounces and is extremely compact, is claimed as an especial advantage. The register is made in a thoroughly workmanlike manner, on well defined mechanical principles, and will not easily get out of order. The whole mechanism is made of a high grade of steel, such parts being tempered as are subject to the most wear. The outside case is of German silver, highly polished, and can be kept bright with a little care. The register is thoroughly accurate and reliable in its operation, and cannot be tampered with.

The face or trip register counts up to 100 fares, and can be shifted or reset to 0 from any point. The perma-



NEW PORTABLE FARE REGISTER.

nent register, which is seen from the back, has a total capacity of 10,000 fares; if necessary this can be made 100,000 or even 1,000,000. One valuable feature of this permanent register is the concealing slide, which can be set to cover the totals by means of a key, thereby concealing the permanent record from the conductor. This is considered an advantage by many street railway companies, for the reason that, if on a busy day the conductor should forget to ring some fares (intentionally or otherwise) he is obliged to turn over all the money he has when settling, in order to save himself, as he does not know what the totals are.

Although on the market but a comparatively short time, the demand for these registers has been large, the manufacturers reporting the equipment of some fifteen roads throughout, together with a number of orders from roads putting on additional cars.

An electric elevated railway, seven miles long, is proposed in Elberfeld, Barmen, Germany. The plans which have already been submitted by Siemens & Halske, of Berlin, contemplate equipping all the cars with motors and running them in trains of two or more. The elevated road will be situated at the side of a river.

Brooklyn Street Railways.

BROOKLYN CITY RAILROAD CO.

This company operate more miles of track in Brooklyn than any other railway company and cover a most extensive territory. To give all of the routes covered by their cars would occupy too much space, but a mention of the following principal points touched will give some idea of the vastness of this company's system: Greenpoint, Long Island City, Hunter's Point, Tenth Street, Twenty-third Street, Grand Street, Broadway, Houston Street, Roosevelt Street, Fulton, Wall Street, Hamilton, South and Thirty-ninth Street Ferries; Wallabout market; Washington, Tompkins, City, Carroll and Prospect Parks; County buildings, Calvary and Holy Cross cemeteries, Brooklyn Bridge, Ridgewood, Newtown and Richmond Hill. The charter of the company was granted in 1853, and at the present time the company own and operate under lease a total of 180 miles of track, of which 142 employ horse power, eighteen steam power and twenty electric power. The track on the portions of the road operated by horses is from forty-five to sixty-four pounds in weight, and of a variety of types, principally centre bearing, tram and girder. The cars owned by the company are 1,548 in number, of which 815 are box, 714 are open, twenty-nine are steam motors and twenty electric cars, which latter will be referred to more particularly later. These cars are from the shops of the following well known companies; Lewis & Fowler Manufacturing Co., J. M. Jones Sons Co., John Stephenson Co. and J. G. Brill Co.

The average car mileage per day (horse) is 43,475. Each horse in good health covers sixteen miles per day. The average number of passengers per day is 201,215. The total number of horses owned by the company is about 5,500. To accommodate this large number of horses and cars the company have twenty-six different depots located at various points along the routes covered by them.

The first use made by this company of electric power for the propulsion of their cars was upon their branch extending from Thirty-ninth Street Ferry, South Brooklyn, to Bensonhurst and Gravesend Bay near Coney Island. This branch, which is nearly seven miles long, is laid with sixty-three pound girder rail of the Lewis & Fowler type the trolley wire being supported by tubular iron poles. The rolling stock consists of twenty eighteen foot open cars and as many open trailers, all being of Lewis & Fowler manufacture. The motor cars are mounted on Manier trucks and each is equipped with two fifteen H. P. S. R. G. Thomson-Houston motors. A speed of from fifteen to twenty miles an hour is often maintained on this line, the route being for a large part over new streets and in suburban districts. As many as 20,000 people have been carried on this line in one day.

The power house is a temporary wooden structure 80 x 100 ft., and the power equipment consists of four Babcock & Wilcox high pressure boilers with a National feed water heater, two 350 H. P. McIntosh & Seymour tandem, compound engines and eight 100 H. P. Thomson-Houston multipolar generators. The flywheels are belted directly to the generators, perforated belting manufactured by Charles A. Schieren of New York being employed. The car barn is located directly in the rear of the power house, and occupies a space of 350 x 100 ft., and has a capacity for seventy-five cars.

The capital stock of the company is \$6,000,000 upon which a dividend of 2 per cent. quarterly is paid. The amount of bonds which the company are allowed to issue is \$6,000,000. At present only one-half this amount has been put on the market. These bear 5 per cent. The offices of the company are at 10 Fulton Street. The officers are Daniel F. Lewis, president; E. D. White, vice-president; H. M. Thompson, secretary and treasurer; Thomas P. Swin, assistant secretary and treasurer; J. C. Cameron, superintendent.

The new electric equipment of the Brooklyn City Railway, some details of which were given in our last issue, is being pushed rapidly forward. The Fort Hamilton and Hamilton Avenue lines are the ones selected upon which

the electric system will be first installed. They will be supplied with current, temporarily, from the Second Avenue station described above. The company, however, have prepared plans, and will soon commence work on an extensive power station which will be located on New York Bay at the foot of Fifty-second Street. For convenience in the receipt of fuel, this station will have a solid bulkhead dock 100 X 700 ft. close to it and fronting the bay. On this will be placed a large coal pocket from which will be run coal elevators. These elevators will fill cone shaped receptacles which will empty fuel in front of each boiler so that the firemen can draw coal as desired.

The engines will be eight in number, of 1,000 H. P. each, manufactured by E. P. Allis & Co. of Milwaukee, and of the Reynolds-Corliss type. These engines will be stronger in certain parts than any others built. The boilers will be furnished by the Babcock & Wilcox Co. of New York, and will be of extra heavy material, probably the strongest of their size ever built. The generators will be supplied by the Thomson-Houston Electric Co., and will be of about 750 H. P. capacity each. They will be erected on an elevated gallery in the centre of the power station, about sixteen feet above the ground floor,

and side bearing rails, from the mills of various manufacturers; all recent orders, however, having been supplied by Wm. Wharton, Jr. & Co., of Philadelphia.

The rolling stock of the company consists of 218 cars of which 113 are closed and 105 open. The number of horses owned by the company is 642. The number of passengers carried by the cars of the company in 1891 was 9,620,369. During the fiscal year ending June 30, 1891, the total car miles made were 1,515,857.38. The books of the company show that the cost per car mile, including all expenses except fixed charges during the year ending June 30, 1891, was 20.36 cents. Including fixed charges the cost per car mile was 21.95 cents. The authorized capital stock of the company is \$2,000,000 of which one-half has been issued. 1000 5 per cent. bonds of \$1,000 each have also been issued. The dividends paid during the last fiscal year on the capital stock amounted to 4 per cent.

The offices and principal depot of the company are contained in a substantial brick building situated at the corner of DeKalb and Central Avenues. The greater part of the ground floor of this building is devoted to housing of cars in actual use. The offices of the company occupy the



OFFICES AND PRINCIPAL DEPOT OF BROOKLYN CITY & NEWTOWN RAILROAD CO., BROOKLYN, N. Y.

on which the engines will rest, and will be belted directly from the engines without countershafts. The arrangement decided upon is to connect two generators by friction clutches with one driven pulley, the armatures being in line, and the pulley carried on pillow blocks between the generators. This arrangement enables the operation of either generator or both directly by one engine. The size of the station will be 100 X 400 ft., and in the basement all piping will be exposed, to facilitate inspection and repairs. After the equipment of the Fort Hamilton and Hamilton Avenue lines the company will equip the Court Street, Third Avenue and Flatbush lines. The company expect to have forty-five miles of single track in operation by next fall, with 150 motor cars and the same number of trail cars.

BROOKLYN CITY & NEWTOWN RAILROAD CO.

The lines of this company if drawn on a map would show the shape of a cross. One line, known as the DeKalb Avenue line, commences at Fulton Ferry and extends to Newtown Township, Queens Co.; the second line has one terminal point at the Grand Street Ferry and the other at Prospect Park, and is known as the Franklin Avenue line. The total number of miles of track owned by this company is twenty-one and a half, laid with from forty-five to sixty pound, centre bearing

northwestern corner of this building. In the northeastern corner are the paint and repair shops of the company, each shop being of sufficient size to accommodate six cars. The former is completely equipped with all appliances used in making small repairs, including a band saw, lathe, power drill, forge, etc., as well as two pits to facilitate access to the car running gear. The paint shop, upon the recent visit of one of our representatives, contained six open cars which were being varnished and otherwise fitted for the coming summer service.

The second floor of the building, which is of three stories altogether, is devoted mainly to stable purposes, and this part presents a neat, clean and light appearance to the visitor. There are altogether seven rows of stalls. The passage ways are concreted, and there are a number of ventilators and light shafts. On this floor are also the blacksmith shop, where five horseshoers are constantly employed, and the harness and repair room.

The third floor is devoted to the storage of cars not in use, and here also are the feed rooms. The company cut their own feed in a room specially devoted to this purpose, from which it is taken to an adjoining room, thoroughly mixed and thence descends by a shaft to the stable floor where it is distributed by means of a number of low, four wheeled wagons. The cars and feed are hoisted to the upper floor by an elevator. The power for operating this

elevator, as well as the feed and other machinery is supplied by a thirty-five H. P. engine built by William A. Harris, of Providence, R. I., and is situated in the basement. The boiler for this engine was built by the Whittier Machine Co. The depot of the Franklin Avenue line occupies nearly the entire block bounded by Franklin Avenue, Carroll and Crown Streets, and the tracks of the Brighton Beach steam railroad; it was built in 1888.

The officers of the company are John N. Partridge, president; Louis Fitzgerald, vice-president; Duncan B. Cannon, secretary and treasurer; John L. Heins, superintendent.

The company are looking forward to substituting electric motors for horses, in the near future, but have not yet perfected their plans.

ATLANTIC AVENUE RAILROAD CO.

The tracks of this company, which cover at present twenty-three miles, are principally in the western part of Brooklyn. There are altogether ten different lines operated by this company, the cars on each line being distinguished by means of different colors and lights. These lines are as follows: Bergen Street, Butler Street, Fifteenth Street, Fifth Avenue—City Hall, Fifth Avenue—South Ferry, Hicks Street—Crosstown line, Hoyt Street—Crosstown line, Park Avenue, Seventh Avenue and Vanderbilt Avenue. The present track is laid with a fifty to sixty pound, centre bearing tram rail, most of which was supplied by the Pennsylvania Steel Co. The cars are 383 in number, of which 191 are closed cars and 192 open. These are from the works of a large number of companies; Stephenson, Brill, Jones, Lewis & Fowler and Feigel being each largely represented. An average of 166 cars is used per day and the average total car mileage is 7,640. The average number of passengers carried per day is 42,398.

The extent of territory covered by the cars of the company involves the employment of eight separate depots which are located as follows: Bergen Street and Albany Avenue; Butler Street and Nostrand Avenue; Ninth Avenue and Twentieth Street; Seventh Avenue and Twentieth Street; Fifth Avenue and Twenty-third Street; Third and Atlantic Avenues; Boerum Place and State Street; Park and Clinton Avenues. The depot at Fifth Avenue and Twenty-third Street is the largest, and here they keep 300 of the 1,600 horses owned by them. Here also they grind their own corn and oats for all the stables, 1,200 bus. being prepared per day. The grinding machinery consists of two Cogswell mills run by a fifty H. P. engine. The proportions used of corn and oats are at present two-thirds of the former to one-third of the latter; but in summer they are mixed in equal proportions. The total number of employes in the service of the company is 685.

The company are rapidly pushing forward their work of electrical construction. The power station will occupy an entire block between Third Avenue, First Street, the Gowanus Canal and Second Street, and will have a water front of 200 ft. on the canal and 630 ft. on the First Street basin. The boiler equipment will consist of three batteries of Babcock & Wilcox boilers, each battery comprising two 250 H. P. boilers. Each boiler will be twenty-three feet long, the tubes will be one-half inch thick and will rest on extra heavy shelves. The engines will be supplied by C. & G. Cooper & Co. of Mt. Vernon, O., and will consist of one 350 H. P. and three 500 H. P. tandem, compound, condensing engines. The latter size has been selected as the unit for future work, and the station has been designed for an ultimate capacity of 5,000 H. P. The flywheel of the smaller engine will be of 40,000 lbs. and the larger of 60,000 lbs. weight. The dimensions of the main shafts are twelve and thirteen inches in bearings, and fourteen and fifteen inches outside of bearings, respectively, and the cylinders are guaranteed for a steam pressure of 136 lbs after having been re-bored once. The same firm also supply one condenser and two air pumps to be run by a smaller engine. Salt water will be used for condensing purposes. The generators, as mentioned in our last issue, will be of the Westinghouse type.

The company, in preparation for the electrical equip-

ment, are laying three different types of rails; from Twenty-seventh to Thirty-seventh Streets on Fifth Avenue, the Lewis & Fowler girder rail is employed, and from Fifth to Washington Avenues on Atlantic Avenue, a section of the Duplex street railway track is being installed. Each of these sections is about one-half mile in length. For the remaining ten miles of track which the company will construct at present they have ordered a side bearing girder rail, weighing seventy pounds per yard, from the Pennsylvania Steel Co. This rail will be mounted on chairs which will be spiked to the ties, and at the joints the Samson bridge chair, manufactured by the Tramway Rail Co. of Pittsburgh, will be employed. The tie decided upon will be 5 x 9 ins., and will be laid thirty inches between centres, with extra ties at each joint. The rails will break joints alternately. The ties, which have been already ordered, are 16,000 of yellow Florida pine and 10,000 of Connecticut white oak.

The poles will be tubular, mostly twenty-eight feet long, with shrunk rings at each joint, and will be supplied by Wallace & Co., of New York. Span wire construction will be used upon most of the line, but on the part of Ninth Avenue which is next to Prospect Park, side poles with fifteen foot brackets extending over both tracks have been decided upon, to avoid the necessity of erecting poles on both sides of the street. The car bodies will be supplied by the St. Louis Car Co. and the present order calls for fifty. Each car will have a length over all of twenty-seven feet and length of body eighteen and a half feet, and will be finished inside with mahogany, with ceilings of three-ply birdseye maple. There will be six windows on each side furnished with curtains of silk Burgess cloth. Rattan spring seats with backs of mahogany will be used, and both seats and backs will be supplied with Wilton carpet coverings if the company decide to use them. Each car will also carry four one and a half inch beveled edge mirrors and will be fitted for electric heaters. The bodies will be mounted on Peckham trucks and operated, as mentioned in our last issue, by Westinghouse motors. Both trucks and motors will be sent to St. Louis for attachment to the cars, and the cars will be sent to Brooklyn fully equipped from St. Louis.

The company contemplate equipping, first, both the Fifth Avenue lines from Thirty-seventh Street to the Bridge, one by way of City Hall and the other by way of South, Wall Street and Fulton Ferries and the Butler Street line from New York Avenue along Butler Street and Atlantic Avenue to South Ferry. After these lines are equipped they will be followed by the Bergen Street line from Buffalo Avenue to South Ferry, and the Crosstown line from the Bridge to Hamilton Ferry by way of Boerum Place and Sackett Street. The first engine is to be delivered on or before June 15, and the company hope to be able to have some of the cars in operation by July 4.

The authorized capital stock of the company is \$2,000,000 of which \$1,200,000 has been issued. The bonds authorized, new issue, are \$3,000,000 of which one-half will be issued to cover outstanding bonds. The officers of the company are: President and general manager William Richardson, secretary Wm. J. Richardson and treasurer N. H. Frost. The office of the company is at the corner of Atlantic and Third Avenues. L. H. McIntire is electrical engineer in charge of the power station, and Barry & McTighe of the general construction.

THE CONEY ISLAND & BROOKLYN RAILROAD CO.

This company were the second to adopt electric power in Brooklyn and own twenty-two miles of track, of which at present sixteen are horse and six electric. The electrically equipped portion of the line extends from Coney Island past Prospect Park to, at present, the corner of Ninth and Smith Streets and connects there with the horse car portion of the line which has terminals at Hamilton and Fulton Ferries. The track on the electric section consists, for about two-thirds of the length, of T rail, the route being a suburban one. The rails used for the horse lines in the city are of the centre bearing, stringer type weighing about forty-five pounds to the yard. These

rails are now being replaced by a sixty pound stringer rail made by the Pennsylvania Steel Co., and spiked directly to the stringers, the latter being laid on ties three feet between centres, the two being connected by iron knees. The joints rest on plates. The return circuit is made by galvanized iron bonds supplemented by a return wire. This construction has been in use at the Coney Island terminus of the electric line for over a year and has given good satisfaction. The rolling stock of the company consists of 115 cars, of which forty are box and sixty-one open horse and trail cars, and fourteen are box motor cars. The car bodies are from the factories of a large number of companies, the latest having been furnished by the John Stephenson Co.

The company have two stables, the principal one being at the corner of Fifteenth Street and Eleventh Avenue, and here at present 200 horses are cared for. The other stable is at the corner of Smith and Huntington Streets in the same building with the offices of the company, and here 100 horses are kept.

The horse cars make a daily mileage of forty and the electric cars of sixty. The electric cars in winter run every half hour, but in summer run sometimes every four minutes, with one or two tow cars each. Upon several occasions the company have had thirty-six cars in operation upon the electric division, and have carried as many as 20,000 people in seventeen hours on this part of their lines.

The power station, which supplies current for the electric cars, is a wooden building at about the centre of the portion of the railway at present in operation by electric power, and contains two McIntosh & Seymour engines of 250 H. P. each. These are belted directly to four Thomson-Houston standard generators of 100 H. P. each. The boilers are of the Babcock & Wilcox type. The present electric car equipment consists of twelve cars supplied with Thomson-Houston motors and two with Edison apparatus. A speed of from fifteen to eighteen miles per hour is often attained on this route. The overhead construction employs centre poles with double brackets.

The company, however, are making rapid progress with the equipment of their entire line with electric apparatus, and expect to have all the line in operation with this power by the middle of May. They have commenced work on a new power station to be located at the corner of Ninth and Smith Streets, and having a water front of 230 ft. on the Gowanus canal. This station will contain two Corliss-Wright engines, which will be belted directly to four Thomson-Houston generators of 250 H. P. each. The boilers will be two in number, and of the Climax type. The officers of the company are H. W. Slocum, president; E. F. Drayton, secretary and treasurer; D. W. Sullivan, superintendent. The Coney Island & Brooklyn Railroad Co. also control the

PROSPECT PARK & FLATBUSH RAILWAY CO.

This company own three miles of track laid with a thirty-four pound stringer rail, four box cars and ten horses. The stable is at the corner of Franklin and Gravesend. The officers of this company are H. W. Slocum, president; H. W. Slocum, Jr., secretary and treasurer; D. W. Sullivan, superintendent. This line will probably be equipped with electric power after the work on the main line of the Coney Island & Brooklyn road has been finished.

THE BROOKLYN HEIGHTS RAILROAD CO.

This line, the only cable surface railway in Brooklyn, has one-half mile of double track, extending from the Wall Street Ferry to the Brooklyn Court House, and has a $9\frac{1}{2}$ per cent. grade for a portion of the way. It was formally opened for traffic on July 20, 1891, and took the place of a line of omnibuses.

The power house is of brick one story high and located on State Street about 2,000 ft. from Montague Street on which the cars run. The driving machinery is in the basement, and power is furnished by one 250 H. P. tandem, compound, condensing engine manufactured by C. & G. Cooper & Co., of Mt. Vernon, O. The boilers are from

the works of the National Water Tube Boiler Co., of New Brunswick, N. J. The driving drums are of the Walker differential ring type. The line is laid with a Lewis & Fowler girder rail having a weight of sixty pounds to the yard. The rolling stock consists of eight cars which are vestibules and finished in mahogany and cherry. They were manufactured by the Lewis & Fowler Manufacturing Co., and equipped with the Barnes automatic friction brake. The grip is of the upper jaw pattern and receives the cable on either side. The capital stock of the company is \$200,000, and they have issued \$250,000 in 5 per cent. bonds. The office of the company is at 40 State Street. The officers are: D. F. Lewis, president; J. E. Searles, Jr., vice-president; E. Johnson, secretary; G. S. Studwell, treasurer, and A. Rogers, superintendent.

BROADWAY RAILROAD CO.

This company's lines are entirely operated by horse power, and they occupy an extensive territory in the eastern part of Brooklyn. The principal starting point for the cars is at the foot of Broadway, E. D., and from that place the lines radiate in a number of directions, the Broadway or main line extending to East New York, the branches being on Reid Avenue to Atlantic Avenue, Sumner Avenue to Bergen Street, and Ralph Avenue to Pacific Street. The company also have a two mile extension from East New York to Cypress Hills Cemetery.

The entire length of line is a little over twenty-three miles, which is all laid with sixty pound, double grooved rail. The rolling stock consists of 203 cars, of which 117 are box and eighty-six open. These run on a headway of from three to eight minutes in the day, and in the night from ten to forty minutes. The number of horses owned by the company is 700. The number of passengers carried in 1891 was 8,094,413.

The depots are on Fulton Street, at East New York, Reid Avenue corner of Chauncey Street, Bergen Street near Troy Avenue, and at the corner of Ralph Avenue and Pacific Street. The average number of miles covered by each horse when in good condition is from eighteen to twenty per day. The capital stock is \$525,000, on which a dividend of $7\frac{1}{2}$ per cent was paid last year. The amount of bonds issued is \$350,000, which pay 5 per cent. annually. The offices of the company are at 21 Broadway, E. D. The officers are Edwin Beers, president; Robert Sealy, secretary and treasurer; H. Myerholz, superintendent.

THE BROOKLYN & JAMAICA RAILWAY.

This railway connects the city of Brooklyn with the town of Jamaica, having its terminus in Brooklyn at the Manhattan crossing and Fulton Street. It was the first electric line installed in Brooklyn and was originally equipped with Van Depoele apparatus; the overhead construction and power equipment was changed, however, to adapt it to the under running trolley, about two years ago, and two Edison generators and several Edison motors were added.

The line at present is 12.8 miles long, and is laid with a fifty-seven pound, side bearing, tram rail, laid upon 5 X 7 ins. stringers which are fastened by knees to ties. These latter have a six inch face and are laid four feet between centres. The rails are bonded for a return with cross connections between every fourth rail, and the joints are supported by plates. The overhead construction is span wire with wooden poles.

At the power station, which is situated at Woodhaven at about the mid point of the line, are two engines, one of which is a McIntosh & Seymour of 125 H. P. running at 225 revolutions. The other was supplied by the Putnam Engine Co., of Fitchburg, Mass., is 150 H. P. and runs at sixty-five revolutions. These are connected by Schieren belts, one directly, the other by a countershaft, to two generators of the Edison 100 kilowatt type, compound wound. In the power house there is also a Van Depoele generator, shunt wound, which is not in use at present. The power station has also a completely equipped repair shop.

The rolling stock consists of eighteen motor cars and five trail cars. Ten of the former are equipped with Edi-

son motors and eight with Van Depoele twelve H. P. motors, the latter being mounted in the open cars by removing a seat from the centre of the car, and connecting the armature shaft with one axle by means of a sprocket chain. The car bodies are mostly from the works of the Lewis & Fowler Manufacturing Co. and the Pullman Palace Car Co., but the company have also added several cars recently purchased from the West End Street Railway Co., of Boston. The company have also a Lewis & Fowler snow sweeper which is equipped with two Van Depoele electric motors.

The average car mileage per car per day is 108. The traffic on the road is constantly increasing. This can be seen from the fact that during the fiscal year ending June 30, 1891, 598,482 passengers were carried, while during the nine months ending March 1, 1892, the railway provided transportation for 666,058 passengers.

The capital stock of the company authorized and issued is \$197,480; \$410,000 5 per cent. bonds have also been issued. The officers of the company are: Samuel Spencer, president, 23 Wall Street, New York; W. S. Townsend, Secretary; Wm. T. Litson, Treasurer, and Wm. M. Scott, Superintendent.

VAN BRUNT STREET & ERIE BASIN STREET RAILWAY.

This line is two and a half miles in length and runs from the Hamilton Ferry in a southeasterly direction along Van Brunt Street to Erie Basin. The rolling stock of the company consists of fourteen cars of which six are box and eight open. Forty horses are employed. The fare is three cents. The stable and offices of the company are at 264 Van Brunt Street. The line is laid with a forty-five pound side bearing tram rail. The capital stock of the company is \$75,000 and the bonded indebtedness \$25,000, in six per cent. bonds. The officers of the company are president Michael Murphy; secretary and treasurer Wyllys Terry; superintendent T. J. Carey.

BROOKLYN, BUSHWICK & QUEENS COUNTY RAILROAD.

The line of this railway extends from the foot of Broadway, E. D. to St. John's Cemetery in East Williamsburgh. From the first mentioned point to the Lutheran Cemetery, a distance of four and a half miles, a double track is used, the rest of the distance being single track. The total number of miles of track owned by the company is eleven. The type of rail used is a centre bearing tram rail of from forty-seven to fifty-two pounds per yard. The rolling stock consists of forty-seven cars, of which twenty-two are box and twenty-five open. Fifteen of the box cars use fare boxes. The open cars have eight reversible seats each. The stables and offices of the company are at Metropolitan, a new name recently given to the portion of East Williamsburgh in which these new buildings are situated.

In October, 1891, the property of the company was put into the hands of a receiver. The officers of the company are George W. Van Allen, president; Wm. B. Wait, secretary; D. W. Binns, treasurer; F. Hartshorn, superintendent and receiver. An effort is being made to reorganize the company, and if this is done electric power will probably be adopted. When this is done the line will probably be extended to Jamaica.

ELEVATED RAILROADS.

The two companies operating elevated railways in Brooklyn are the Brooklyn Elevated Railroad Co., who also operate the lines of the Union Elevated Railroad Co., and the Kings County Elevated Railroad Co., who also operate the lines of the Fulton Elevated Railroad Co.

The Brooklyn Elevated Railroad Co. were organized May 26, 1874, as successors to the Brooklyn Elevated Railway Co., and on May 13, 1887 the company leased the Union Elevated Railway Co., which had been organized June 10, 1886, and consolidated October 27, 1890. The lines of the Union Elevated Railway Co. were opened in 1888. The total length of line operated by the Brooklyn Elevated Railway Co., including those leased from the Union Elevated Railroad, is 17.93 miles. The rolling stock consists of seventy-six locomotives, maximum

weight 45,000 lbs., built by the Rhode Island Locomotive Works of Providence, R. I., 230 passenger cars and twelve freight cars, most of the passenger cars having been supplied by the Gilbert Car Manufacturing Co. and the Pullman Palace Car Co. The number of passengers carried in the year ending June 30, 1891, was 34,424,708. The average earnings per train mile in same period were sixty-two cents, expenses thirty-five cents. The officers of the company are Henry W. Putnam, president; Elbert Snedeker, vice-president; Hugo Rothschild, secretary; Fred. Martin, general manager, and O. F. Nichols, Chief Engineer. The principal office of the company is at 31 Sands Street.

The Kings County Elevated Railroad Co. were organized on January 6, 1879, and the road was opened for traffic in November, 1889. The rolling stock consists of forty-two locomotives and 138 cars, of which 130 are passenger and eight freight. The manufacturers of the cars were the Pullman Palace Car Co., and of the locomotives, the Grant Locomotive Works, and the Rhode Island Locomotive Works.

The total length of line operated by the company is about nineteen miles, including the leased lines of the Fulton Elevated Railway Co. The number of passengers carried in the year ending June 30, 1891, was 15,992,855. The average profit per passenger carried was 0.146 cents. The offices of the company are at 346 Fulton Street, and the officers are James Jourdan, president; Wendell Goodwin, vice-president; James H. Frothingham, treasurer; H. J. Robinson, secretary; W. T. Goundie, general manager, and O. F. Balston, chief engineer.

THE BROOKLYN BRIDGE.

No article on the present status of transportation facilities would be complete without mention of the New York & Brooklyn suspension bridge over the East River, whose railway up to January 1, 1892, had carried a total number of 224,077,923 passengers, and whose footway up to June 1, 1891, when the toll was abolished, had been used by 28,171,839 persons. The general engineering data of this bridge have been already given in the pages of this journal, and, therefore, will not be repeated. The following details of operation, however, up to January 1, 1892, will not be without interest: Speed of cable, ten and one-third miles per hour; weight of cars, seventeen to nineteen tons; number of cars used during rush hours, forty-eight; largest number of round car trips per day, April 30, 1889, 2,159; next largest number of round car trips per day, December 31, 1891, 2,114; weight of each locomotive, twenty-two tons; number of locomotives in use during rush hours, five; shortest headway between trains, one and a half minutes; total number of railway passengers carried during 1891, 39,890,205; largest number in one month, October 1891, 3,623,016.

As the above figures indicate, the carrying capacity of the bridge has long been overtaxed, but owing to various complications the plans for improving the terminal facilities and increasing the capacity of the cable railway have not yet been put in practical shape. Some of the difficulties, however, have been removed. The bonds which were at one time unsalable, on account of low rate of interest, are now being readily negotiated, and as soon as the remaining difficulties, which relate mainly to proper connection with the Brooklyn elevated roads and the space necessary for the New York terminal, are adjusted the work of reconstruction will at once begin. The plans contemplate ornamental station buildings at each terminal, having wide incoming and outgoing platforms with a track on either side of each, and an additional track the entire length of the bridge. The new rails, however, are to be laid very near the line of the present track, the object of the double construction being to operate two cables while the grips remain, as at present, in the middle of the cars. Two reserve ropes will also be provided which can readily be put in service in case of the failure of either of the operating ropes. The power station building is nearly completed and the driving machinery, which is being manufactured by Robert Poole & Son Co., of Baltimore, is about ready for delivery. A new 1,000 H. P. engine which is being manufactured by William Wright, of Newburgh, is also nearly finished.

Cable Construction, Third Avenue, New York.

With the advent of spring, work has been resumed on the Third Avenue (N. Y.) cable construction, and the new contractor, Mr. Thomas E. Crimmins, of New York, is pushing the work with a vigor that insures its completion before another winter. The portion of the line which was left open during the winter by the former contractor has been closed, and the horse cars are now running over the new construction from the Harlem River to Sixth Street. The new work is being advanced on the Bowery below Sixth Street and will continue to the terminal near the Post Office. The new construction differs somewhat in detail from that previously finished. In

ard Street power station is progressing rapidly, and is one of the most interesting, as it is also one of the most expensive, features connected with the cable enterprise. The present status of the work is clearly illustrated in the accompanying engraving which gives a good idea of the difficulties which beset the work. The earth formation being quicksand, it is found necessary to excavate to a depth of nearly thirty feet, and in order to preserve the adjacent streets and buildings it has been found necessary to shore up the bank with very heavy timbers. About one-third of the foundation walls are already in place, and the work of excavating and extension of the walls is shown in the engraving. One of the most interesting features in connection with the excavation is the placing of new



EXCAVATION AT CORNER OF BAYARD STREET AND BOWERY, NEW YORK, FOR THIRD AVENUE CABLE RAILWAY STATION.

place of a concrete pedestal provided for the yokes a continuous concrete foundation is laid six inches thick which is brought to a perfect grade, and on this the yokes are placed, increasing somewhat the facility of adjusting yokes and rails.

In excavating the pits for the terminal sheaves at Sixth Street where the two divisions of the line meet, it has been found necessary to deepen the foundation piers of the elevated railway posts. Three posts on each side are being shored up, and the foundations increased to a depth of about fourteen feet. The preliminary work on the Bowery consists in changing the sewer manholes, which are about 125 ft. apart, and come directly in the line of the downtown track. The brick work of the manhole is being removed down to the line of the sewer and an arched transverse chamber is constructed of sufficient length to bring the manhole outside the tracks. This work requires an excavation at each manhole of about twelve feet in depth.

The work of excavating for the foundation of the Bay-

ard Street power station is progressing rapidly, and is one of the most interesting, as it is also one of the most expensive, features connected with the cable enterprise. The present status of the work is clearly illustrated in the accompanying engraving which gives a good idea of the difficulties which beset the work. The earth formation being quicksand, it is found necessary to excavate to a depth of nearly thirty feet, and in order to preserve the adjacent streets and buildings it has been found necessary to shore up the bank with very heavy timbers. About one-third of the foundation walls are already in place, and the work of excavating and extension of the walls is shown in the engraving. One of the most interesting features in connection with the excavation is the placing of new

foundations under three of the posts of the elevated road. The new brick piers, which are also shown in the illustration, are forty-five feet in depth, the foundation being ten feet below the water line. DeGenovese & Towle are the contractors for the excavation and foundation, and T. P. Galligan & Son have charge of the work of shoring the banks. The contractors have adopted a novel plan for assisting the horses to haul the loaded wagons up the incline. A half inch wire rope is provided, which is attached to the end of the wagon tongue, and being led around the stationary sheave at the head of the grade is operated by means of a stationary engine and reel. The wagons are loaded by means of a dump bucket and swing derrick, as shown in the illustration.

The work of tearing out the interior of the Sixty-fifth Street stable preparatory to the erection of the power plant is now under way. The original court is being enlarged by taking portion of the stalls from each side, but the exterior will remain intact. It is the purpose of the company, however, after the power plant is completed, to

replace the remaining portion of the stable with a more ornamental structure. When completed this will probably be the largest cable power station in the world, as it is to be equipped with four 1,500 H. P. engines.

The work of excavating for the pulley vaults in front of the Sixty-fifth Street station has not yet been commenced. In the construction of this vault it will also be necessary to place new foundations under six of the elevated railway posts.

The Laclède Car Co., of St. Louis, who have the contract for 200 closed cars, have twenty-six of the cars completed and are rapidly progressing the work on the others. These cars were illustrated in our March issue, but those recently constructed are more highly finished than the sample car which we illustrated.

New Track Crossing.

In the accompanying engravings are shown two views of a new girder rail crossing being put on the market by the Lewis & Fowler Girder Rail Co., of Brooklyn, N. Y. As will be seen, the crossing is not of cast iron, but the regular rolled rails are used in its construction. The rails are halved to fit into each other, and each of the four corners of the window frame are mounted upon a special type of cast iron chair with clips, making the construction as strong and durable as, if not more so than, at any other part of the line. Four intermediate chairs are also used between each two corners. The corner chairs weigh 100 lbs. each. A one-half inch filling piece is used in the groove as in the regular cast iron crossing, to provide smooth running for the cars while passing the crossing. Fig. 1 shows the crossing complete, and Fig. 2, has the rail on one side removed to show the method of construction.

The Lewis & Fowler Co. have also designed a new and important rail joint for their girder rail construction. The chair at the joint is of rolled steel, twenty-two inches long, and is fastened to each rail by four bolts as well as

The Broadway (N. Y.) Cable Railway.

The work of laying the conduit and rails for the extensive cable line on Broadway, which we have several times referred to in former issues, has been entirely com-

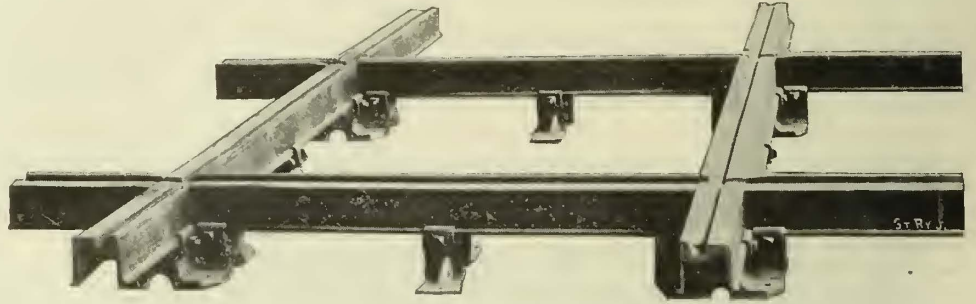


FIG. 1. LEWIS & FOWLER GIRDER RAIL CROSSING.

pleted for some time, with the exception of a short loop between Bowling Green and South Ferry, and the engineer in charge of the works is now engaged upon the final details of the two main power houses and other parts of the equipment.

The principal power station will be located at the corner of Broadway and Houston Street and will have a frontage of 127½ ft. on the former street and 200 ft. on the latter street. The building will be a handsome eight story structure, built in the Renaissance style, the lower part being of granite and the upper of buff brick with terra cotta trimmings. Mullioned windows extend from the third to the sixth floor, above which is a frieze extending around the building, and at the top is a second frieze and cornice. The architects of the building were McKim, Mead & White, of New York, the well known designers of the Madison Square Garden, New York.

The machinery for operating the cable plant in both stations will be below the level of the street, and it has been necessary to excavate to a depth of forty feet at the Houston Street station to obtain the room which will be required.

The power will be supplied by four Dickson-Corliss engines, built by the Dickson Manufacturing Co., of Scranton, Pa., thirty-eight inches diameter, by sixty inches stroke, running at sixty revolutions and operated in pairs (see accompanying illustration for plan of machinery). The frame of each engine is cast in one piece from cylinder to the end of the pedestal of the crankshaft; it is the style known as the trunk-bed; it contains the guide of the crosshead, which is bored out in a true circle and in true line with the bore of the cylinder, which is telescoped with the bed, and held in position by heavy bolts. The frame is flat on the base and rests the whole length on base plates which cope

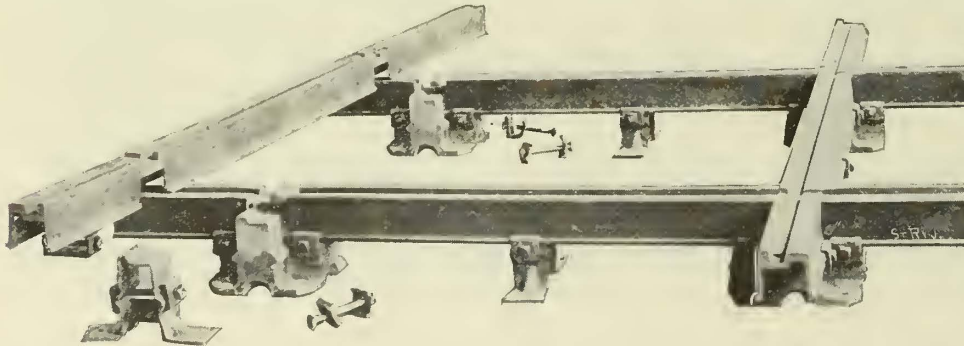


FIG. 2.—LEWIS & FOWLER GIRDER RAIL CROSSING WITH ONE RAIL REMOVED.

by four clips in the usual method. The chair is mounted on 5 × 7 in. ties. Any weight of rail can be used, and the joint seems most strong and durable.

THE Love electric conduit road, of which a description appeared in the March number of the STREET RAILWAY JOURNAL, is now operated by the North Chicago Railroad Co. The road has not been finally accepted by the latter corporation, but as the Love company had completed their tests of the road and had demonstrated that its operation was successful, as far as they were concerned, it was deemed best to allow the regular employes of the cable company to take charge of it in order that a still more severe practical test might be had of the workings of the system. Thus far the operation of the road has been entirely satisfactory to the North Chicago Railroad Co. Should the tests now in progress prove satisfactory in all probability the system will be installed on several lines now operated by horses.

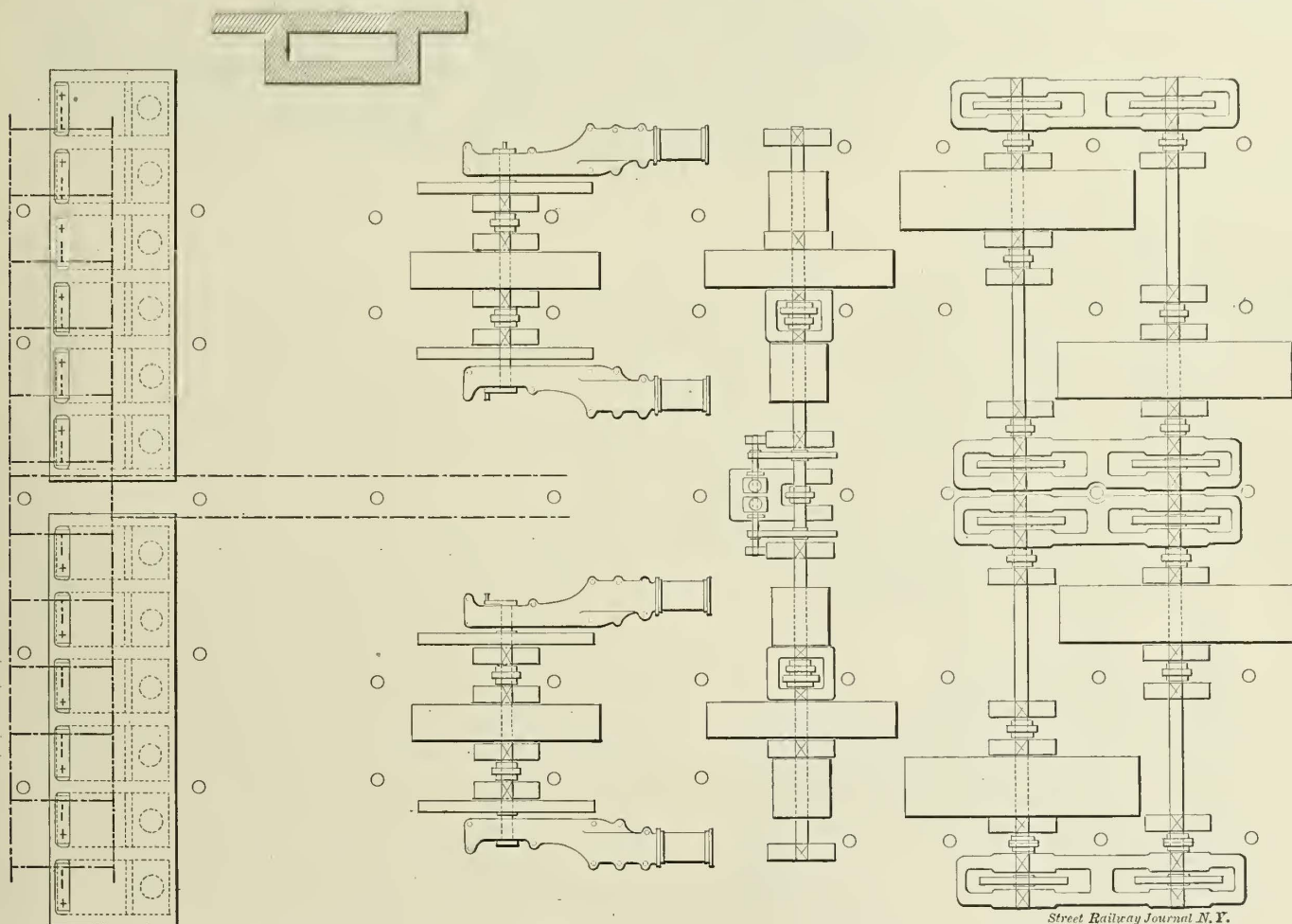
the foundation, and has a number of heavy lugs cast on for the foundation bolts. In the frame is also formed the bearing for the crankshaft; this bearing has side boxes, adjustable by wedge blocks extending the whole length of the bearing and held by bolts; the bearing boxes are all lined with the best babbitt metal. The crankshaft is of best hammered wrought iron, eighteen inches in journals, twenty inches diameter in body; the journals being thirty inches long; the crank is made of cast steel eleven inches thick and carries a steel crank pin eleven inches diameter, eleven inches long, made of best open hearth steel. The crankshaft carries a flywheel twenty-four feet diameter, made in nine sections; the centre is forced on the crankshaft, and the arms with a section of the rim cast in one piece with the arm, bolted to the centre. The whole wheel is turned true on its own shaft, and weighs 100,000 lbs., finished weight. The connecting rod is made of best hammered wrought iron, strap end for crankpin end, and a solid end on crosshead end. The boxes are of cast steel lined with best babbitt metal.

The crosshead is also made of cast steel, and has adjustable slippers sixteen inches wide and twenty-eight and three-quarter inches long with the faces babbited and turned to fit the bore in the frame. The piston rods are of best forged, open hearth steel six and a half inches diameter, keyed in crosshead and forced in the piston, with a large nut on the back to secure it. The piston is of cast iron, fitted with sectional steam packing.

The cylinder is made of hard cast iron; the Corliss valves are eight and a half inches diameter, worked from a wristplate, which in turn is worked by an eccentric on the crankshaft. The wristplate is an open wheel; the dashpots are bolted right to the side of the cylinder, behind all the connections and levers of the valve motion. The cut-off device is regulated by a Porter governor

weigh over 100 tons each, and have a face of eight feet three inches. The cable drivers are twelve feet in diameter, designed for five wraps and are eight in number, since, as stated in a former issue, a duplex cable system is used.

As has been seen, the station has been planned to reduce to the minimum the necessity of shutting down from accident to any part or set of parts of the machinery. In the first place, clutches between each engine and driving drum allow either engine to be disconnected if desired. The driving drums on the jack shaft are also arranged with clutches so that any one of the four engines can transmit power to any set of drums, and as each engine of each pair is of sufficient capacity to operate the entire plant, any three engines can be out of service without interfering with



PLAN OF HOUSTON STREET POWER STATION—BROADWAY (NEW YORK) CABLE RAILWAY.

which is driven by a belt, but is fitted with a stop arrangement; in case the governor belt should break, the engine cannot run away.

The steam nozzle on cylinder is twelve inches diameter, the exhaust fourteen inches diameter. The throttle valve is fitted with pilot valve, and is located below the floor, as steam and exhaust nozzles are arranged on bottom of the cylinder. The engine complete is built in a very substantial manner; only the very best materials are used, and in point of workmanship these engines can only be favorably compared with similar engines of the best makers, and no doubt they will make a good record, when put into operation.

Referring again to plan of machinery, it will be seen that each pair of engines operates a common shaft upon which is mounted a twenty-six foot drum, and that these drums are connected to drums of the same size on a jack shaft. This shaft drives the cable shafts by means of four nine foot drums which are each connected to one thirty-two foot drum on each of the cable driver shafts. Power is transmitted in each case by two-inch cotton ropes, twenty ropes being used between each of the engine and jack shaft drums and thirty-two ropes between each of the jack shaft and cable shaft drums. The largest wheels

the operation of either cable system. In addition to the engines mentioned above a small auxiliary engine will also be installed to turn the shafts when the power of the large engines is not available.

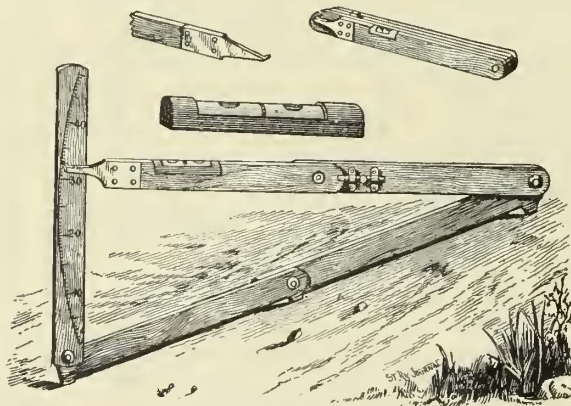
The cable drivers and rope drive drums will be furnished by the Walker Manufacturing Co. of Cleveland, O. The contractors for the entire power machinery are the Pennsylvania Iron Works of Philadelphia, Pa. The boiler equipment will consist of twelve water tube boilers of 250 H. P. each, supplied by the Heine Safety Boiler Co. of St. Louis, Mo. The three 1,000 H. P. feed water heaters, which will be required, will be supplied by the Goubert Manufacturing Co. of New York.

The second station of the company will be at the site of the present stables at Fifty-second Street, Seventh Avenue, Fifty-first Street and Sixth Avenue, but will occupy only one-quarter of the ground floor of the block. In the rest of the space will be the car houses, storage rooms and offices of the company. The engines, of which there will be two, will be of the same size and type as those used in the Houston Street station, except that the cylinders are thirty-six instead of thirty-eight inches in diameter, and they will have a capacity of 1,000 H. P. each, while 1,200 H. P. are used in the Houston Street

station. On the main shaft there will be two ten foot drums, driving two thirty-two foot drums with thirteen two-inch cotton ropes. The cable drivers are twelve feet in diameter, as in the Houston Street station, and have five grooves. The arrangement, as will be seen, is similar to that at the lower power station except that the capacity is a little less than half and there is no intermediate jack shaft, which, of course, is not necessary since there is only one pair of engines.

To Measure Grades.

While the exact determination of a grade may be necessary before actual construction is begun on a railway, an approximate figure may answer every purpose in a preliminary calculation. To obtain this approximate result quickly may be extremely convenient under some circumstances, and the pocket instrument shown in the cut was designed to serve this purpose. The illustration tells the whole story. It is composed of light strips which fold as shown. On the lower strip are three little projections which may be forced into the ground slightly so that the instrument can be made to assume very closely the line of the grade. The upright portion is divided as a scale; in the illustration it denotes per cent. At each division is a tiny hole into which fits the tooth at the end of the horizontal arm shown in detail. In the horizontal section is fitted a spirit level shown in the figure. It can be readily seen that with a reasonable degree of care a reading substantially accurate may be secured. The instrument when



HANDY GRADE MEASURER.

unfolded is about twenty inches in length; when folded it is just half that length. The illustration is reproduced from *La Nature*.

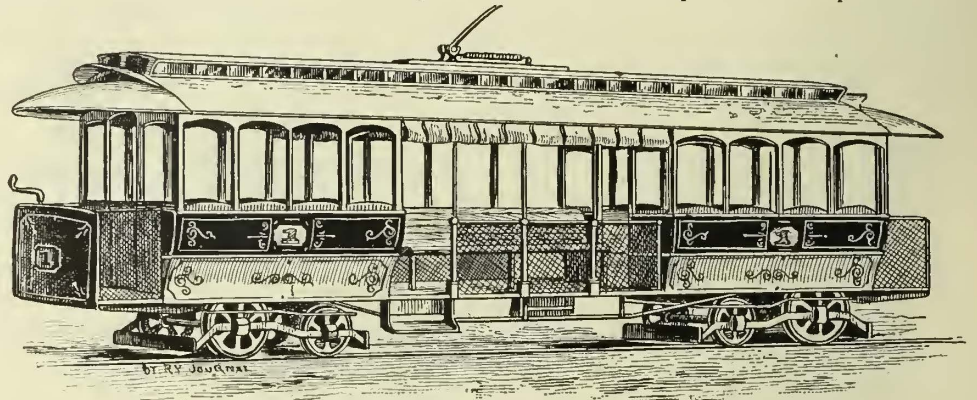
Gas Motors for Chicago.

The Connolly gas motor has recently been tried on the streets of Chicago, and the officials of the North Side Railroad Co. are well pleased with its operation. Practical tests have demonstrated the advisability of some changes in the motor for use in heavy street car traffic. In all probability two new motors will soon be built somewhat heavier in construction. If these prove satisfactory, as Mr. Yerkes anticipates, they will probably be used for drawing cars at night.

JUDGE TRUAX, in the New York Supreme Court, has dissolved the injunction recently obtained by the W. J. Johnston Co. against W. T. Hunt of the Electrical Age Publishing Co. The action was brought by the former company to restrain Mr. Hunt, a former employe of the Johnston Co., from acting in the employ of the latter company.

New Cars for Lexington, Ky.

The accompanying illustration shows a novel type of combination car which will soon be in operation on the lines of the Passenger & Belt Railway Co., of Lexington, Ky. The car body will be thirty-four feet in length and about thirty-nine feet over all to provide for a platform at



COMBINATION CAR FOR LEXINGTON, KY.

each end for the motorman. The only entrances will be at the sides by steps one, on each side, about two and a half feet in width, which are placed at one end of the open part of the car. The front and rear platforms will not be accessible to passengers. The open space in the centre of the car is fourteen feet in length and contains two rows of seats back to back ten feet in length, leaving two feet at each end of the open space for a passage way. The car will be mounted on two of Brill's No. 11, Maximum Traction trucks. If the first car of this pattern is a success the company will probably build several others of the same type.

The company are also contemplating the construction of a street sprinkling car with an open platform at each end of the water tank and an upper deck over the whole. The car will be supplied by the United Tramway Sprinkler Co., of Louisville, Ky., and the sprinkling devices and tank of their regular pattern, but instead of being eighteen feet over all the car will be from twenty-two to twenty-four feet over all to accommodate the platforms. The plan of the company is to use the car for street sprinkling purposes, ordinarily, but during rush hours and on extra occasions the tank will be emptied and it will be used for passenger purposes to draw trail cars and carry a few passengers. In this way the company will have both a sprinkling car and an extra motor car constantly available with only one electrical equipment.

Proposed Impracticable Legislation.

The following bill which has passed the Massachusetts House of Representatives and is now before the Senate, is of that class of unnecessary legislation to which we have referred editorially in this issue. It would be interesting to know how a street railway company can be operated if its employes are not allowed to "swing," as is now the practice on most lines. It is to be hoped that the members of the Senate or the Governor have enough railroad sense to prevent such a measure from becoming a law.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

SECTION 1. Ten hours' work, to be performed within twelve consecutive hours, shall constitute a day's work for all conductors, drivers and motormen now employed or who may be employed by or on behalf of any street railway company in any city or town. No officer or agent of any street railway company shall exact from its employes more than the said ten hours' work for a day's labor; *provided, however*, that in case of accident, or unavoidable delay, extra labor may be performed for extra compensation.

SECTION 2. Any person violating the provisions of this act shall be fined for each offence a sum not exceeding one hundred dollars.

SECTION 3. The act shall take effect on the first day of August in the year eighteen hundred and ninety-two.

Points on Power Stations.

BY WILLIAM LEE CHURCH.

Not the least marvelous feature of the extraordinary development of electric railway interests, has been the comparative freedom from disastrous mistakes. Looked at from the other side, this is equivalent to saying that street railways have paid from the start. As much as this can hardly be said for any other parallel industry. Electric lighting was notoriously prolific of financial disappointment for many years, and it is only at a comparatively recent date that capitalists have come to understand that electric lighting can profitably be conducted only under the direction of the highest grade of engineering supplemented by close business management. It is undoubtedly true that the experience gained in the exploiting of electric lighting has been turned to account in the development of electric railways, but the marvel still remains that an industry which three years ago was almost unknown, except as a curiosity, should in

one minutes. While following in general appearance similar charts taken from all railway service, it is noticeable that at several points the load entirely vanished for a few seconds. This was due to the fact that but few cars were operated on this extension, and the grades were numerous and abrupt in both directions. It would frequently chance that for an instant all cars would be on a down grade, and the circuits entirely open. The most abrupt change is seen to be from ten amperes to 135 amperes in less than one half minute. At 4-59 there was a change from 130 amperes to no load, occurring in three-quarters of a minute. It is worth remarking that under this violent treatment, which is never ceasing throughout the day, the change of speed of the engine and coupled generator could not be noted by any ordinary speed counter. So closely has instantaneous and complete governing been secured through the use of inertia as the governing force, that variation of speed can no longer be detected by the speed indicator and expressed in variations per minute, but must be searched for by the chronograph and expressed in variations per stroke.

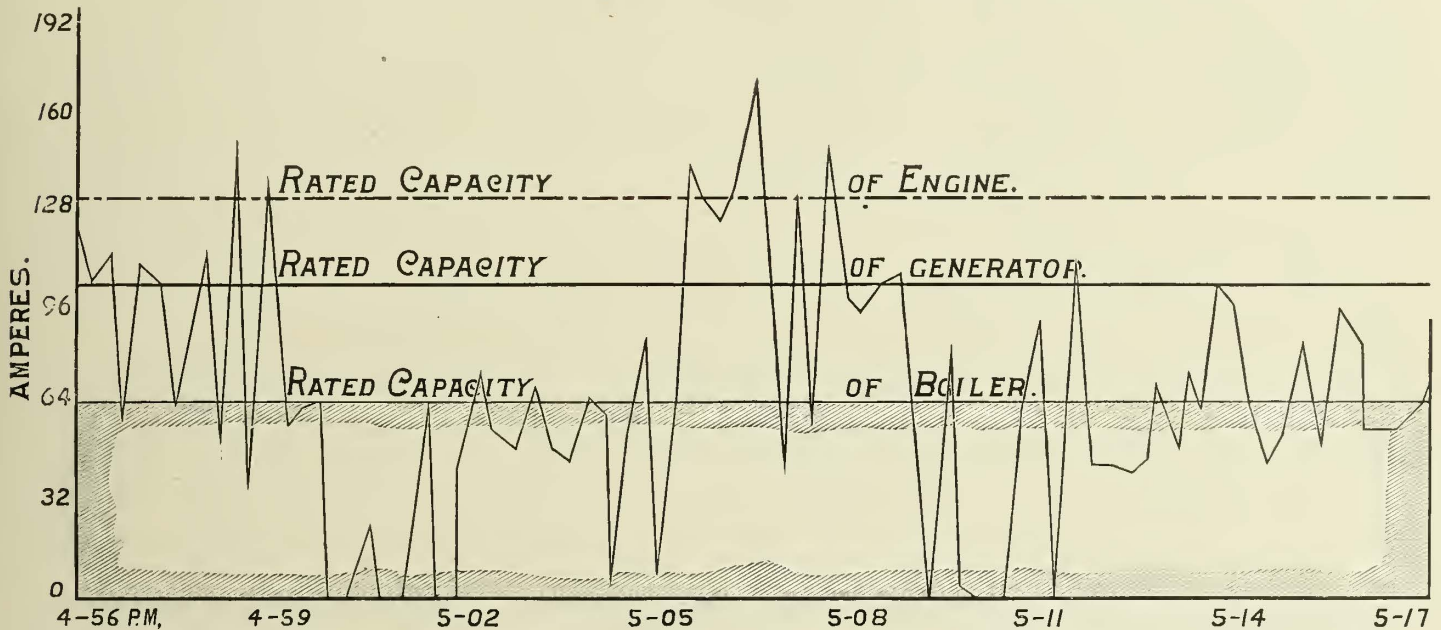


FIG 1—DIAGRAM OF AMPERE READINGS ON ELECTRIC RAILWAY WITH FEW CARS, TAKEN AT INTERVALS OF FIFTEEN SECONDS.

this short time have attained to a first magnitude among business enterprises, with so little to regret in the way of failure. It is also undoubtedly true, that there are many roads now doing well, which under still better engineering might have done better, and, indeed very notably better. Nevertheless, the disposition to let well enough alone, serves as an equalizer of what might otherwise be at least a relative disappointment.

It is a narrow mind which will attempt to keep to itself special knowledge on subjects of this nature. The broad education of the public leads through a general increase of intelligence to a greater certainty of success, which in its turn, redounds directly to the interest of the educator. The writer and his associates have, in the course of events, accumulated certain well grounded experiences which are of interest to the promoters of electric railways. It is our purpose to give the benefit of this experience as freely as may be to the railway interests at large, and random articles may be expected in the columns of this journal from time to time accordingly.

The subject under consideration at this moment is that of the relative capacity of engines, generators and boilers in the power station. To go at once to the root of the matter, we refer to the diagram which is the chart of ampere readings from a single generator operating an electric extension line to a cable railway. The generator in question was of the direct coupled, multipolar, slow speed type, popularly known as the "Kodak." Readings were taken at intervals of fifteen seconds, and the portion selected for the diagram covers a total time of twenty-

Passing to the question of capacity, we will take the generator as the unit of measure. This is, moreover, the natural unit, since the expression for the capacity of a station is in terms of electrical horse powers at the ammeter. In dealing with a problem of this kind, there has sufficient data been accumulated to insure a very close estimate of the nominal amount of generating capacity required to operate a certain number of cars, taking always into account in each special case the grades and curves of the road, nature of the special holiday service, frequency of stops and other governing considerations. In some respects it would be better if the maximum demand upon the generator could be known, as indicated by the summit of the curve occurring at about 5-06 on the diagram; but this is, in the nature of the case, hard to determine. But to facilitate our discussion of the problem, assume that the maximum capacity were known to be 175 amperes, as indicated. We would then locate our nominal generating capacity at some point as indicated by the heavy black line. The reason of this is found in the fact that an electric generator can stand an overload, or even an excessive overload, provided it does not have to stand it long. The question is simply one of heat. The overload here was seen to continue for only about one minute, during which time the generator could carry it with ease with no perceptible rise of temperature to injure the insulation. If this load had been continuous for an hour or so, as would occur in an electric lighting station, a much higher relative generating capacity would be required, approximating the maximum load.

In this connection it is well to point out that, generally speaking, a long, easy grade is more trying on the generating plant and will call for a greater capacity of the generator, than a short heavy grade. I recall an instance where the lowest point of the road was on a bridge crossing a stream, on either side of which was an abrupt, heavy grade for not over 100 yds. Beyond this, the grades were comparatively easy, but persistently uphill. Although not obvious to the untrained eye, it was the long continued and easy grade which governed the proportioning of the power, and the short grades at the bridge were practically ignored.

Having settled upon the capacity of the generator and located it in the relative position indicated, we next determine the capacity of the connected engine. I am speaking, of course, in this, of power stations in which the generation is in independent units, and I shall undertake to show in subsequent articles, what is rapidly becoming established, that a railway station can only reach its minimum capitalization and maximum earning capacity when so designed. Now, an engine has no such capacity for excessive overload as a generator. In other words, the element of time does not enter into the engine problem, but it becomes a question of how much the engine can actually lift by main strength without taking the governor to an extreme which shall slow down the speed. In general terms, the engine should not be called upon to perform, even for a short time, more than 20 per cent. or possibly 25 per cent. above its rating; this assuming, of course, that it is honestly rated. I append herewith

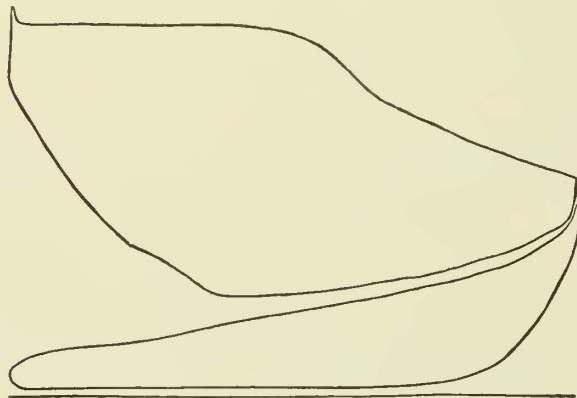


FIG. 2.—INDICATOR DIAGRAM.

three indicator diagrams from a non-condensing, compound engine, of which the intermediate size indicates about the fair load at which the engine would be rated, and the largest shows the ability of such an engine to meet excessive overload. I do not know that I have ever seen this latter card equaled, since it represents 33 per cent. overload with an absolutely perfect distribution of steam, and no loss between cylinders. The smallest card indicates the load which might occur a few seconds later in the performance of railway work.

The engine capacity, therefore, must be sized up with reference to the maximum load, and would have a nominal rating greater than that of the generator, being located at some point as indicated by the broken line. It will, of course, be understood that the ability of the valve motion of the engine to take care of momentary overload beyond its own rating is further supplemented by the value of the flywheel, although recent practice in connection with the inertia governor tends towards exacting less from the flywheel and more from the steam distribution. The final selection of the engine as to size will depend in every case upon the local conditions of steam pressure as the principal factor.

I will point out further that the capacity of the engine should be determined without reference to condensation. In the vast majority of cases water for condensation cannot be had, and compound engines of this type are now designed to yield an almost uniform fuel duty when non-condensing over the full ranges of load that occur in railway service. But even where it is determined to condense, the condenser should still be treated simply as an

adjunct of economy, and not as a part of the power. This is for the obvious reason that a condenser may become choked or disabled or leaky, and the vacuum may be poor or lost entirely under sudden fluctuations. The engine must by all means be of adequate capacity to walk away with the load without leaning upon its compara-

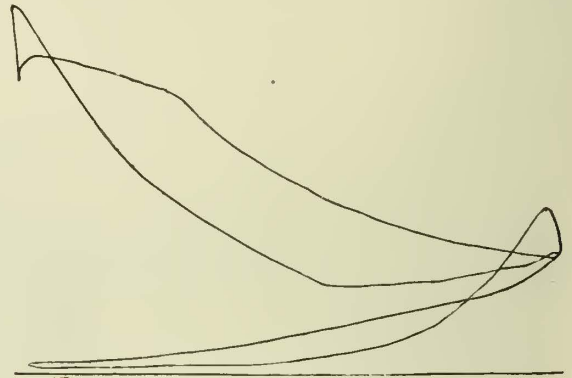


FIG. 3.—INDICATOR DIAGRAM.

tively uncertain assistant. This caution is, by the way, no discredit to condensers, but is simply a necessary consequence of the conditions under which condensers are generally called upon to operate.

We next reach the boiler capacity. It will be obvious that the boiler has to deal only with the *average* of the total load. In the diagram this average is indicated by the shaded rectangle, and is somewhat startling as compared with the apparent power of the remainder of the plant. In this particular, electric railways exactly resemble rolling mills, saw mills and kindred industries, where the load is spasmodic, with variations lasting but a few seconds, or at most, but a few minutes. The stored heat in the water of a boiler is enormous in quantity, and responds instantly to a release of pressure. That is to say, the boiler is an immense reservoir of power as to volume, and, provided the drain upon it is not continued too long, it will stand exactions far beyond its nominal capacity, and without any effect whatever upon the firing. In the earlier stations which we constructed, we did not give sufficient consideration to this fact which ought to have been obvious. The result was a boiler plant approximately equal to the engine capacity, a large portion of which plant is perforce lying idle and unproductive of anything but interest account. Having first encountered this relation as a matter of experience, it did not take long to arrive at the reasons lying back of it, and as a consequence all our stations are now designed with some

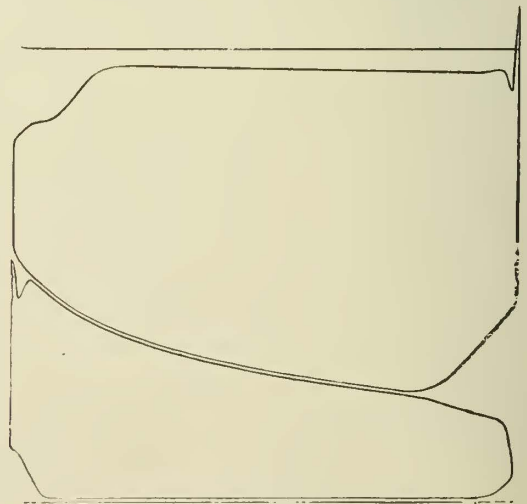


FIG. 4.—INDICATOR DIAGRAM.

such proportion of boiler power as is indicated on the diagram.

There has been altogether too much "rule of thumb" in electric railway work, as in other departments of engineering. For instance, "rule of thumb" says, in ordinary mill work, that there should be 20 per cent. more ca-

capacity of boiler than of engine. This rule applied without judgment to electric railways and without considering the characteristics of the engine used, would result in doubling the necessary investment in boilers and in the buildings to accommodate them.

In this discussion I would not be for a moment understood as advocating cheese paring in the matter of any of the items comprising the generating unit. I am referring only to a question of relative proportion. The intelligent engineer who knows the results of his work are to be interpreted in the light of dollars and cents earned, will follow the excellent advice: "While you are a gittin', git a plenty." The relative proportions, however, will be found very closely as indicated. We would introduce the caution that a relay boiler should always exist in every station. A large station will carry a relay unit throughout, but even a moderate station should show one relay boiler and a relay feed pump. The engine and dynamo can be fairly trusted to take care of themselves, since any ordinary repairing can be quickly made between running hours. Not so with the boiler, which is liable to occasional repairing or cleaning that will throw it out of service for one or more days, and this is not permissible in connection with street railways.

The actual size of the boiler will, of course, depend upon the type of engine used. With the compound engine above described, making such diagrams as are here shown, and running non-condensing, an allowance of thirty pounds of water actually evaporated for each indicated horse power will give abundant margin for all contingencies. It must be borne in mind that the duty under an average load is a very different thing from the duty under a variable load represented by the average. Under the uniform load twenty-three pounds of water would be the actual engine performance, and the boiler could be proportioned with reference to this figure. Under the violent fluctuations of railway service the average duty of the engine will rise to about twenty-eight pounds, and if the maximum average load is taken, and the boiler proportioned for thirty pounds, there will be a sufficient margin. These remarks apply only to the particular type of engine under discussion, as other compound engines, not possessing the feature which secures uniformity of duty, will range up to at least forty-five pounds under light loads and often to sixty pounds, and represent an average duty not better than thirty-five to forty pounds. The same is true of every form of non-compounded engine, whether high speed or low speed, both of which show a tremendous falling back of fuel duty under variable load. But, in the language of Rudyard Kipling, "That is another story," and is worth another article.

The Street Traffic in Berlin.

By Our Special Correspondent.

The first street railway built in Berlin was opened for traffic June 22, 1865. It was five miles in length, started from near the royal castle and extended to the neighboring city of Charlottenburg. During the next eight years no street lines were built in the city. In the year 1873, however, the construction of four lines was commenced, all of which ran from points just outside the centre of the city to the new suburbs. The authorities at that time did not allow the construction of street railway lines inside the "heart of the capital," as they were afraid that horse cars would impede the other street traffic, and might be dangerous to life. At present this heart of the capital is crossed by street railway lines in every direction without causing the trouble feared nine years ago.

At the beginning of the year 1871 the Berlin street railway lines had a total length of fifteen and a half miles. During this year, however, the great development of the Berlin street railways commenced, and in 1881 there were 107 miles, and in 1888 177 miles of road in operation in Berlin. The increase in passengers, rolling stock and horses during these seven years is shown in the following table:

Year.	Passengers Carried.	Cars.	Horses.
1881	58,675,576	558	2,424
1888	117,009,010	966	5,192

In 1888 each inhabitant of Berlin rode an average number of 87.3 trips per year. Corresponding statistics show an average number of rides in Vienna during the same period of only 42.6 per inhabitant, and in other European great cities a still less number.

It was supposed that this rapid development of street railways, by which 966 cars with 5,192 horses were introduced during a relatively short time, would cause a diminution of other vehicles engaged in the transportation of passengers. But statistics show that only an insignificant effect was felt, and that even this disappeared soon.

The following table shows the increase in Berlin from 1881 to 1888 of omnibuses, cabs and carettes. The latter are large 'buses used to make excursions to the country on Sundays and holidays:

Year.	Omnibus.	Cabs.	Carettes.	Horses to Draw these Vehicles.
1881	134	4,631	290	8,795
1888	217	4,695	378	9,531

The increase of cabs and carettes between 1888 and 1892 has been very small, and it is very probable that it will be equally small in future, because the development of the street lines and of the Berlin City Railroad (elevated) has diminished the call for this class of vehicles. But a very remarkable feature is the large increase in the omnibus traffic. During the seven years from 1881 to 1890, eighty-three new omnibus cars were put in service. This is equal to an increase of 62 per cent. The number of passengers carried by the omnibuses during the same period increased from 9,690,774 to 23,487,855. This increase shows that an omnibus service on a considerable scale is possible in cities in which an extensive street railway system exists, as in Berlin. This fact was doubted at the time that the first street railway lines were built, as it was supposed that the railways would ruin the omnibus business. The liberty in the movement of the omnibus, and the possibility of taking up or setting down passengers at any point, together with cheap fares, enable the omnibus to compete successfully with the street cars.

A relatively small number of passengers are carried by the little steamers which run on the river Spree, the number in 1888 being 394,134. As the course of the river Spree will be improved very soon, it is thought that this steamer traffic may be increased.

The development of the Berlin, City & Ring Railway (elevated) is shown by the fact that in 1881 1,802,287 passengers were carried, and in 1888 7,152,460 passengers were carried. From these figures may be deducted about 30 per cent. which do not belong to the real city traffic, as this percentage is composed of passengers passing through Berlin or going to or from the steam railway stations.

On February 22 an electric railway was opened in Gera a city of Germany. The total length of line is six and a half miles and the Sprague-Edison system is in use. The maximum grade is about 5 per cent. The rolling stock consists at present of fourteen motor cars and of the same number of trail cars. The fare charged is ten pfennigs or two and a half cents. Fare boxes are used, and consequently the American system of a single fare for any distance traveled is in force. The citizens of Gera seem to be very well pleased with the electric motive power, and in one day 15,000 persons were carried on the road, a high number considering that there are only 40,000 inhabitants in Gera. The line was built by the General Electric Co., of Berlin, the same company who installed the electric street railway in Halle, recently described in these columns.

The Tramcar Omnibus.

In a description of the street railways of Brussels, given in the February issue, mention was made of a type of vehicle differing from anything used in the United States, and called a tramcar omnibus. This vehicle is not peculiar to the Brussels tramways, as it is used in Hamburg and on the streets of several other European cities, and is adapted to run either on the pavement or on the railway tracks. The fifth wheel, shown in the view, is the only one provided with a flange, and when the vehicle

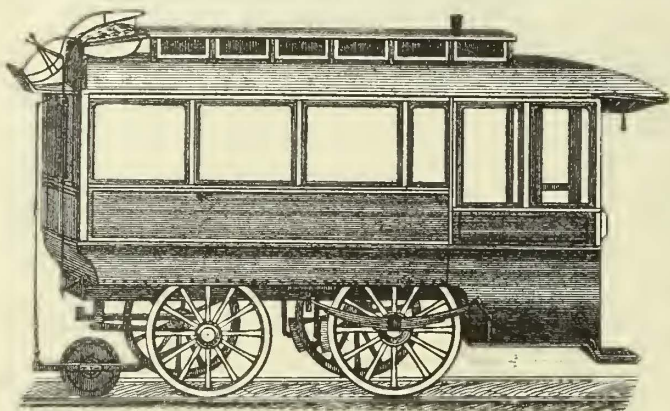


FIG. 1.—HAMBURG TRAMCAR OMNIBUS.

is operating on the tracks this wheel rests on one rail and its flange runs in the rail groove or slot, keeping the other four wheels, which are constructed to track gauge, on the rails. If, however, in the course of the route a narrow street occurs in which the authorities have not allowed the laying of a track, the tramcar omnibus turns off the track by raising the fifth wheel, and crossing the street turns on the track again by lowering the fifth wheel. The car is also useful in localities where a continuous street railway track is laid, but where there is only space for a single line of track. Here no sidings and switches are necessary, as one omnibus can turn off the track to pass a car or another omnibus.

In Fig. 1 is shown a tramcar in use on the Hamburg

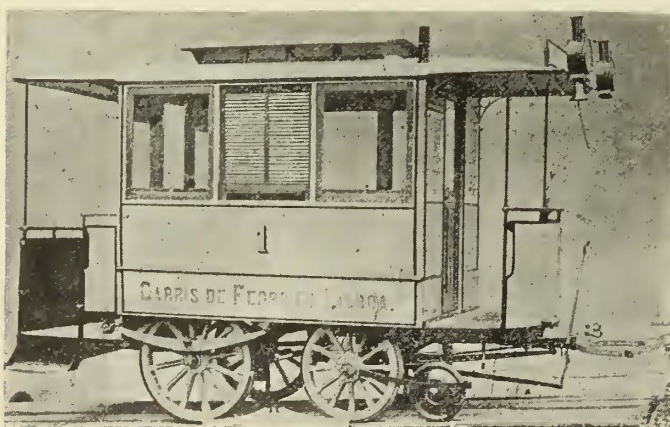


FIG. 2.—LISBON TRAMCAR OMNIBUS.

street railway. It has a seating capacity of thirteen passengers inside and standing room for seven outside, making a total of twenty. The handle of the lever for raising the fifth wheel and the handle of the brake lever, are illustrated very clearly. This car is to be drawn by one horse, but if grades on the road occur, another horse is connected in tandem. Fig. 2 shows a tramcar omnibus on the street railways in Lisbon, Portugal.

Progress in the East.

A French company are now building a street car line in Tashkend, the capital of Russian Turkestan, where, not very many years ago, any white man who visited the place would have lost his head.

Street Railways in Milan, Italy.

The Società Anonima degli Omnibus di Milano is the title of the stock company having a monopoly, practically, of the street transportation business in the city of Milan, Italy. The length of line operated by this company is sixty-two and a half miles, about two-thirds of which is laid with the Marsillon compound rail. During the past year the system has been extended about two-thirds of a mile, the Marsillon system being used.

The rolling stock belonging to the company consists of 501 vehicles, of which seventy-one are omnibuses, the service provided by these buses comprising an important part of the company's business. The total receipts during the last year from all sources was \$763,174. The total expenses during the same time, including fixed charges, but exclusive of dividends, was \$678,623, of which \$242,561 was for motive power.

The number of horses owned by the company at the end of the year was 1,304, an increase of nine over that of 1890. These were valued in the annual report of the company at \$73.25 each. During 1891 140 horses were purchased by the company at an average price of \$144.60. Ten were born, and ninety-one, including eight dead horses, were sold. The latter brought \$6 each. An average of 1,243 were in daily service.

The following statement, taken from the annual report of the company, shows the average consumption per horse per day for the last three years. In addition, each horse had six and a half pounds of straw per day for bedding.

	1889.	1890.	1891.
Hay.....	17.3 lbs.	18.8 lbs.	18.3 lbs.
Oats.....	9.7 "	8.4 "	8.6 "
Beans, etc	1.7 "	3.1 "	2.6 "
Vegetables.....	.4 "	.4 "	.3 "
Total.....	29.1	30.7	29.8

Overhead Wires in Washington.

By a resolution passed by the House of Representatives at Washington, April, 11, the Metropolitan Street Railway Co. of that city will be allowed to use overhead wires for the propulsion of their cars.

It will be remembered that in 1888 Congress enacted a law providing that from and after the date mentioned in the act no overhead wires should be erected within the limits of the city of Washington, and it was also ordered that all overhead wires then in existence should be removed. Congress followed this law with another passed a year or two ago providing that on or before July 1, 1892 every surface road in the District of Columbia should abolish horse power, and that no road should thereafter be chartered with authority to use horses for the movement of cars. The number of curves in the line of the Metropolitan Street Railway prohibited the adoption by them of the cable, and they have recently been to a great expense preparatory to the installation of a storage battery system. Finding that it would be impossible to have their storage cars in operation by July 1, 1892, they petitioned to Congress for an extension of time. It was during the discussion upon this point that the resolution was passed extending the time for one year, and permitting them to use overhead wires. The resolution also provided that within thirty days from the passage of the act the company should "increase their service to such an extent that it will no longer be necessary for any of the passengers to stand up, and no fare shall be collected for any passenger in any of the cars until furnished with a seat therein."

It is reported that a new company, in which Russell B. Harrison and Charles C. Upham, general manager of the Lincoln (Neb.) Street Railway Co., are interested, are negotiating for the street railway at Evansville, Ind.

Consular Reports on Local Transportation in European Cities.

The Department of State at Washington about a year ago determined to secure for the information of municipal governments and others interested a report on the status of local transportation in the principal foreign cities. With this end in view the assistant secretary sent a letter to various consular offices requesting information on certain points, the results of which have been compiled for a publication soon to be issued by the department. From advance copies of this report we are enabled to give the following abstract of the most important conditions noted in the principal cities of Europe:

AUSTRIA-HUNGARY.

Prague.—Local transportation is effected exclusively by street cars which were installed in 1875. The plant is owned by a Belgian capitalist, Edward Otlet, and the management is in the hands of his representatives. The franchise is for fifty-one years, for which a tax is paid to the municipality of about \$112 for each mile of track laid during the first ten years and of \$177 per mile during the subsequent years. A further tax of nineteen cents, to be paid every three months, is levied upon every square yard of ground occupied by stations or waiting rooms. The company also keep the pavement in repair between tracks and for a short distance on each side, and remove snow in winter. The zone system of fares is in force, the rates being two, four and six cents. Cars are run from 6 A. M. to 11 P. M. Conductors and drivers receive thirty-six cents for twelve hours work a day. The service is said not to be entirely satisfactory, and the cars are often overcrowded in spite of a regulation forbidding the carrying of more passengers than can be seated. The net profit of the property for last year was 100,000 florins on an investment of 3,000,000 florins.

Vienna.—Horse cars, omnibuses and, in the suburbs, several steam dummy lines and one electric line furnish transportation. The horse cars run in summer from 6 A. M. to 12 P. M. and in winter from 7 A. M. to 11 P. M. The cars are owned by two stock companies, the Vienna Tramway Co. and the New Vienna Tramway Co. Fares are on the zone system, and on the lines of the first company vary from three cents the minimum fare to seven cents, according to the distance traveled, with slight reduction if a number of tickets are purchased. Three cents entitle a passenger to a ride of from two to two and a half miles. The street railway companies pay as taxes 5 per cent. of their gross receipts to the municipality for their franchise, besides the regular taxes to the government. The franchise is granted for a certain number of years, at the end of which the railways become the property of the municipality.

The electric railway in the suburbs is operated on the overhead system, and the charge is ten cents for a ride of about five miles. The minimum fare on the dummy lines is two cents for one and a quarter miles.

The total number of cars of both horse railway companies is about 900, the aggregate mileage is seventy-two, and together they carry about 50,000,000 passengers a year. The cars are generally overcrowded in spite of a police regulation limiting the number of passengers carried per car.

The Vienna Tramway Co. paid a dividend last year of 10 per cent. The New Vienna Tramway Co. of 5½ per cent. It has been said that a transportation enterprise has not been known to fail in Vienna.

BELGIUM.

Antwerp.—There are seven street railway companies in Antwerp, the first horse cars being introduced in 1873. The zone system of fares is in use on most of the lines. The charges are prescribed by the city authorities, and must not exceed two cents for two-thirds of a mile. All the companies pay a considerable amount to the municipality for their franchises.

Brussels.—The street railways are owned by two companies, one line being about twenty-three miles long, the other two and a half miles. Rates of fare vary from two to five cents according to distance traveled, and an annual rent is paid to the municipality as well as general taxes. The profits realized by the companies are said to be only moderate.

DENMARK.

Copenhagen.—Rates of fare are from 1.34 cents for second class (outside) to 4.2 cents. The minimum fare is for a ride of about 1,700 to 1,900 yds. The fare most frequently charged is 2.68 cents for distances of from 2,000 to 3,000 yds. Discount is made where a number of tickets are sold. The franchise is granted upon consideration of the grantees keeping the pavement between rails and two feet on each side of the track in repair, and franchises as a rule are for thirty years. The cars are not allowed to carry more than a certain number of passengers, and this rule is strictly enforced.

FRANCE.

Bordeaux.—Public transportation is monopolized by an English stock company. Rates of fare, irrespective of distance, are: First class four cents; second class (on top of the car) three cents. Officers, soldiers and sailors are carried at half fare, and municipal officers and police free. Cars run from 6 A. M. in summer and 7 A. M. in winter to 10:30 P. M. The company paid the city for their franchise and pay taxes amounting to about \$34,000 annually. In 1890 the receipts of the company were \$585,000; expenses, \$483,000; car mileage, 1,794,741; average receipts per day per car, \$13.82; average number of horses, 1,212. Cost of forage per week, \$2.27. The service is satisfactory to the inhabitants, but is said not to be equal to that furnished in America.

Havre.—Rapid transit is furnished by horse cars, omnibuses and cable cars, divided respectively: 7.9 miles; 29.6 miles, and 12,000 ft.

The zone system of fares is in force. The fare is three cents per section first class, and two cents per section second class. Cars run from 6 A. M. to 11 P. M. in summer and from 7 A. M. to 10 P. M. in winter. The street railway company pay a yearly tax to the city of \$3,474, and declare a yearly dividend of 10.1 per cent.

Lyons.—Omnibuses, horse cars, and steam cars furnish the means of local transportation. Rates of fare for first class are four cents within city limits, and six cents beyond. Second class fares are half these. Police regulations are strictly enforced against overcrowding cars. The General Omnibus & Tram Co. of Lyons pay \$16,000 per year to the municipality for their franchise, which was received nine years ago, and was for twenty-five years. There are several surface steam lines within the city limits, but the locomotives are not allowed to make a greater speed than five miles an hour.

Marseilles.—All horse cars are owned by one company who charge fares of from two to nine cents. The municipality imposes a tax of 2¼ per cent. on gross receipts of the company for their franchise, and limits the fare to one and a half cents for each two-thirds of a mile. On several lines the company charge less than the prescribed amount. The investment is understood to be a profitable one for the stockholders, but the service is not good, and the cars are often overcrowded.

Paris.—Transportation is furnished by omnibuses, horse cars, dummies, compressed air motors, stored steam cars, storage battery cars and one cable road in the suburbs. Inside the city limits the rates of fare are six cents for first class and three cents for second class, irrespective of distance traveled. The first class rate also includes transfer to another line if desired. The General Omnibus Co., of Paris, who control a large number of the street railway systems, pay to the city \$400 annually for each vehicle. In addition to this the city has the right to one-half of the profits when stock dividends exceed 8 per cent. For the new lines of street cars a tax of six cents is collected for each round trip. The service is said to be, as a general thing, satisfactory to the public, but at certain hours of the day, and on Sundays and holidays the transportation facilities are sometimes insufficient. The companies are, as a rule, financially profitable.

GERMANY.

Aix La Chapelle.—The street railways in this city are owned by a corporation who pay a yearly license to the city of \$125. The company also pay 6¾ per cent. of their profits to the city and 3 per cent. to the state. The company charge three and three-quarters cents between any two points within the city or suburbs, except to one suburb about four miles distant, to which the fare is ten cents.

Berlin.—Berlin has street railways, omnibuses and one line of elevated railway. On the street railways the zone system is in force and the lowest fare is two and a half cents, with an increase of one and a quarter cents for each additional section. The rates of fare are subject to the approval of the local authorities. The companies are responsible for a certain part of the cost of widening the streets, paving, etc. and pay the city from 4 to 7½ per cent. of their gross receipts in addition. In 1890 the Great Berlin Street Car Co., who operate the majority of the lines paid a dividend of 12½ per cent.; the Berlin Horse Car Co. of 1 per cent.; the other two transportation companies, nothing.

Bremen.—In the cities of Bremen and Bremerhaven there are eight horse car lines and one electric line (Thomson-Houston system). The fare on one of the horse car lines is five cents for complete distance (five and a half miles), and two and a half cents for one-third of this distance. Another company charge seven and a half cents for five and a half miles, or two and a half cents for any distance not exceeding one-third of this. The companies are said to pay well.

Cologne.—Horse cars furnish the only transportation in Cologne, and are all leased to one company for a period of thirty years, after which the city comes into possession of the property, with the exception of the rolling stock, buildings and grounds, which it will have the right to purchase. The fares vary from 2.4 to .6 cents. The amount paid to the city annually by the company was, up to and including 1888, \$666; up to and including 1893, \$1,332; up to and including the year 1916, \$2,665. In addition, after payment to the managers of the company of a bonus and 5 per cent to the stockholders, the municipality receives 15 per cent. of the residue. In 1890 the company paid 5½ per cent. dividends.

Dresden.—The average number of cars in use in 1890 per day was eighty-six and a half; length of line, 28.6 miles, the passengers carried per day by all the lines averaged 38,496. The pay of conductors and drivers varies from sixty cents to seventy-five cents per day. (For profits see report on Hanover, where the street railways are owned by the same company operating here.)

Frankfort.—All the horse car lines are under the control of a single company, who operate about fourteen miles of line and own 128 cars. At present the zone system is in use, the least fare being two and a half cents, with an increase of one and a quarter cents for each additional section. Roughly stated, a five cent fare, which is the maximum, entitles a passenger to ride about two miles. The company pay the city a fixed yearly rental of \$7,040 plus 6 per cent. of the gross receipts and one-half the net earnings above 10 per cent. of the same. The gross earnings in 1890 were about \$338,112. There is also an electric line to Offenbach, a distance of five miles, which pays the city of Frankfort 3 per cent. of that part of its gross earnings which are proportional to the portion of its line within the city limits. There are also several steam tramways. The shares of the company sell on the local exchange at 142 per cent. premium.

Hamburg.—All the horse car lines are under the control of one company. On one route, which has a length of four miles, a uniform fare of two and a half cents is charged. The other routes are divided

into sections of about three-fourths of a mile, and the zone system is in force, the lowest fare being two and a half cents and one and a quarter cents charged for each additional section. All the companies pay to the city a tax of from one-quarter to three-eighths of a cent per passenger carried, and keep a certain portion of the street over which they run in repair, as well as paying the ordinary taxes. The dividends paid by the operating company are from 5 to 5½ per cent. annually.

Hanover.—There are 14.46 miles of street railway lines in Hanover, which are owned by two companies, one of which at present pays over 5½ per cent. on the company's capital (about \$614,000) as annual rent, and after 1894 will pay 6 per cent. during the lease, which lasts until 1917, at which time the property may be purchased by the city at a moderate valuation. The other company (the Tramways company), pay only regular taxes, but have a certain portion of the streets over which they run cars, and at the end of their concession all of their immovable property will pass into possession of the city without compensation. Fares range from two and a half cents to six and a quarter cents. The annual dividends of the Tramway company, which own eighty-nine cars in Dresden, have in recent years amounted to 6 per cent. This, however, has been rendered possible by large profits in Dresden, where the lines are owned by the same company, the profits in Hanover justifying a dividend of not more than 2 per cent.

Mayer.—Fares vary from two and a half cents for the first three-quarters of a mile to four and three quarters cents. An extra charge of from one and a quarter to two and a half cents is made, however, on trips after twelve o'clock at night. The company pay 1½ per cent. on their gross receipts to the city at present, and after 1895 will pay 2½ per cent. They also pay regular taxes, and 15 per cent. of all earnings over 6 per cent. on the capital. The franchise is for thirty-five years, and at any time after fifteen years the city has the right to purchase the property on one year's notice.

Nuremberg.—The street car mileage is twenty-three, most of which is double track. The maximum fare allowed for five-eighths of a mile is two and three-eighths cents, and for any distance, four and three-quarters cents. The company have to maintain and keep in repair clean the portion of the streets through which their cars run, and also pay to the government an income tax, which last year amounted to about \$1,220. Dividend paid by the company in 1890 was 5 per cent. The wages of conductors and drivers are from fifty to eighty-four cents per day. The receipts of the company during 1890 were 442,724 marks (about \$106,000). The company own 178 horses and seventy-six cars.

ITALY.

Florence.—Local transportation is furnished by omnibuses and horse cars, with one electric and two dummy lines in the suburbs. Fares on the horse lines are from three cents for one mile to eight cents for four miles, on the electric, fourteen cents for four and a half miles. The city is privileged to take possession at seventy-five years from date of organization of all immovable property of the street railway company without indemnity. The companies pay customary taxes and earn a gratifying return upon the capital invested.

Naples.—Horse cars, two dummy lines and two incline plane lines are in the city. The horse car company pay about \$161,590 to the city annually, and are required to employ not less than 100 cars in winter and 150 in summer. Rates of fare vary from one to six cents. The street railway company earn about 3 per cent. on money invested. At the end of a certain time the street railway property will pass to the municipality.

PORTUGAL.

Lisbon.—The street railway tracks are all owned by one company who pay considerable for their franchise as well as do certain paving. Rates of fare vary from two to eight cents, according to the distance. The tracks of the company are free to any individuals or companies who wish to operate their own cars upon them, and such cars are only required to turn out upon the pavement when they meet the regular cars. Street railway stock is reported to be considered a good investment.

RUSSIA.

Moscow.—The horse cars are owned by two companies, both prosperous. One line charges fare on the zone system, the sections being from two to three miles in length, and the fare for each section being three cents. The second company charge three cents irrespective of distance. There is a tax of \$3 per year per driver, and the companies keep the roads over which they run in repair, but make no other payments beyond ordinary taxes.

St. Pe'ersburg.—The street cars are owned by two companies. Fares on one are two and a half cents inside and one and a half cents on top for any distance; on the second, three cents for inside seats and two cents for outside seats. Payments are made for franchises.

SPAIN.

Barcelona.—Fares on horse cars are two, three and four cents within the city, and do not exceed ten cents to the most distant suburb for first class passage. New companies pay the municipality a tax of twenty cents per meter for their franchises.

Grav of Valencia.—Fares for the urban horse cars are two cents to any part of city. The suburban horse cars charge no more than one cent for each two-thirds of a mile and in some cases less. The corporations pay a certain tax to the city according to their length of track and also 10 per cent. of their net profits.

SWEDEN.

Stockholm.—There are two companies owning street railways in this city. Fares are uniformly two cents, with one or two additions of one cent on extra branches. No payments for franchises are made, but the usual taxes are assessed.

SWITZERLAND.

Berne.—There are 1.8 miles of track. Fare over the entire line is four cents; one-half the line two cents. The income during the last three months of 1890 was \$6,341, and the expenses \$5,058. Compressed air motors are used.

Zurich.—The horse railways are the property of a single company and comprise 8.4 miles of track. The fare consists of an arbitrary charge of one cent, with an additional charge of one cent for every two-thirds of a mile or fraction traveled. This makes the cost of an average ride from two to three cents. Discounts are made where a number of tickets are purchased. The company pay for certain maintenance of the streets when their net profits exceed 5 per cent. of their paid up capital, otherwise, there is no monetary return besides ordinary taxes to the franchise granting authority. The municipality has the right to purchase the property of the company at any time during the length of the franchise, which is fifty years, upon the payment of a certain price. The company pay about 5 per cent. dividends annually. There is also an inclined plane railway a quarter of a mile in length. The fare is two cents and the company paid in 1890 a dividend of 6.45 per cent.

TURKEY.

Constantinople.—There is only one system of horse cars in this city, and this is owned by a stock company. The rates of fare are three, four, six and eight cents, according to distance traveled. The municipality does not assess any taxes or share in the profits. The corporation pays about 5 per cent. on the present value of the shares.

UNITED KINGDOM.

Birmingham.—The horse cars and most of the omnibuses are in the hands of four companies, the most important of which is the Birmingham Central Tramways Co. The rates of fare on several routes are two cents per mile. The companies pay the municipality regular taxes, an income tax, and an annual license per driver, per car and per horse power for steam power. They also pay a certain rate as leases of roadway. Conductors' wages are from 85 to 97 cents, drivers' from \$1.09 to \$1.34, motormen's from \$1.15 to \$1.40. The Central Tramways Co. paid a dividend in 1890 of 5 per cent. on the guaranteed stock and 4 per cent. on the common stock.

Belfast.—The street railways are owned by one company, and horse cars are used except on one line where steam is employed. Fares are from two cents to six cents, depending upon distance, the minimum fare carrying a passenger from one and a quarter to one and a half miles. The company pay the municipality \$242 per year per mile of track, and the latter has the option of purchasing the lines at the end of a term of years. The company have in operation twenty miles of track and ninety cars, earn about 11½ per cent. on their capital stock yearly and declare dividends of 8 per cent. There are twenty miles of track and ninety cars. Drivers and conductors receive from 75 cents to \$1.00 for ten hours work.

Dublin.—The principal system of transportation is furnished by horse cars owned by one company. There are thirty-two miles of track and 156 cars. Fares vary from two cents to six cents, according to distance traveled. The average fare is about three and a half cents. The municipality receives no compensation beyond ordinary taxes, but a government tax is paid of \$19.46 per car. The receipts during the six months ending June 30, 1891, were \$296,581.48; expenses \$230,708.30. The company pay from 4 to 5 per cent. annually.

Glasgow.—The systems of public transportation are horse cars, omnibus lines and underground railways. The minimum rate of fare is two cents for street cars and for third class on the underground cars, which entitles the passenger to the ride of about one mile. First class underground fares are about one-half more. The municipality receives ordinary taxes and a fee of £150 per mile per annum for the franchise.

Liverpool.—The street car lines are laid down, owned and kept in repair by the municipality. Fares range from two to fourteen cents. The car company pay 10 per cent. on the cost of the rails to the municipality per annum. The facilities afforded are said to be satisfactory and financially profitable to the companies.

London.—There are ten street car companies, eight of which use horses, one storage batteries and one cable. There are about 950 cars in use on these lines. There are also three underground railways, two using steam and one electric power. The street railway and third class underground fares are generally two cents a mile. The car companies have to keep a certain portion of the street in repair, and pay ordinary taxes and a small license per car.

The monthly reports of the Melbourne Tramway & Omnibus Co., of Melbourne, Aust., show a large falling off in receipts during 1891. In the month of November the decrease in receipts was over \$18,000 as compared with the receipts of the corresponding month in the preceding year. The cause of the falling off in the number of passengers is attributed to the general dull times which cause the public to practice economy.

To meet this reduction in income the management of the Tramway company found it impracticable to discharge any more hands, since the lines are being worked with the smallest possible staff. The only other alternative was to cut down salaries, and this was done, the reductions being from 5 to 20 per cent.

It is thought that this reduction will be only temporary.

Report of the Boston Rapid Transit Commission.

The Boston Rapid Transit Commission, which, it will be remembered, was appointed in part by the governor of Massachusetts and in part by the mayor of Boston, submitted its report to the Massachusetts Legislature on April 5. This report is divided into several chapters, each treating of certain salient features. It recommends a radial system connected with a central circuit for distributing passengers in the central part of the city. The radial lines contemplated extend to South Boston, Roxbury, Cambridge, Charlestown, and to the East Boston and Chelsea Ferries. An elevated railroad is recommended for all parts of the city, except where tunneling is considered absolutely necessary.

The commission first discusses in their report the

SCOPE OF THE INQUIRY

and defines the Metropolitan district to include the towns and cities within a radius of ten miles from the Boston City Hall. It finds that the traffic within this district is constantly increasing, and that the conditions as to streets, steam railroads and street railroads are wholly insufficient to answer present requirements, to say nothing of the future. The congested district within the centre of the city is defined, and it is pointed out that, even with no change made in the street lines, these highways could be utilized to much better advantage if the city government of Boston were to adopt the street regulations that obtain in many cities of the old world.

RELIEF OF STREETS.

Speaking of London streets, the report says: "The streets were no wider, but they were more free. They were kept open, and the stream was kept flowing by the police. Why should we not be as capable of exacting their full capacity from our streets? We, accordingly, framed a code of street regulations embodying the features that no carriage should be allowed to stand longer than two minutes at a time on the sides of certain parts of specified streets; that certain kinds of heavy wagons should be excluded from traversing parts of certain streets during specified hours, and a rule to regulate the order of passage along some crowded thoroughfares. We think that wheeling through the city would be much improved if the street car rails, when worn out, were replaced by the Liverpool pattern of rail."

ELEVATED STRUCTURES PREFERABLE.

The advisability of adopting a system of tunnels which was urged upon the commission by a number of those who appeared before it is discussed at some length, and the conclusion reached that not only would the expense be too great, but the changes in this climate would render the use of deep tunnels exceedingly dangerous to the health of the community, since in the summer time there would probably be a variation of from thirty degrees to forty degrees between the temperature in the tunnel and the temperature in the outer air. This decision, however, referred only to deep tunnels, like the "Greathead," which are not believed comparable in anything like the same degree to light and well ventilated subways, like the New York Fourth Avenue tunnel, nor even to a short bit of tunnel which the apparent necessity of the situation in Boston forced the commission to adopt subsequently, as a short link in the system of otherwise above-ground transit determined upon by them.

STEAM RAILWAYS.

So far as location is concerned the commission finds that the citizens of the Metropolitan district, of Boston, possess in their steam railroads facilities without parallel in any other large city of this or any other country; and state that the possession of such terminal stations close to the heart of the city would be considered elsewhere well worth the expenditure of many millions of dollars. To properly use these facilities, the establishment of three union stations, one on the north and two on the south side of the city, was recommended.

STREET CARS AS OBSTRUCTIONS.

The consulting engineers to the commission were so much impressed with the unnecessary impediments to travel caused by the multiplication of tracks in streets not wide enough for teams alone, that they recommended the complete abandonment of all the surface tracks within the circuit of the elevated road, and the transfer of passengers from the surface system to the elevated wherever the former impinged upon the latter. Many citizens who appeared before the commission advocated the same idea. The commission, however, while believing that this suggestion was an ideal solution of the problem, and that, if the city had to-day no surface cars within the circuit route, there would be no reason for their introduction, were yet of the opinion that the public had been so long accustomed to direct street car connections with the retail shops and theatres as to render the change in question too radical for adoption. They, therefore, recommend such a readjustment of the surface system as shall, on the one hand, permit the cars to get through the congested district with greater speed than is possible to-day, and, on the other hand, land passengers within a few hundred feet of all the retail shops, if not at the door of each.

THE REMEDY.

The end can be accomplished, in the opinion of the commission, by the use on the part of the street cars in passing from the northern to the southern parts of the city of a double track tunnel under the Common from Park Square to Park Street, thence from Tremont Street to Scollay Square, and thence under and through private property to Adams Square (this tunnel to be built on the east side of the tunnel recommended for the elevated road), by creating two or more new and wide thoroughfares from north to south (on the lines of Tremont Street, Portland Street and Cross Street); by limiting the tracks on all

the streets to the number strictly necessary; by removing them altogether from all the cross streets except Causeway, Hanover, Eliot, and possibly, Cornhill; and by reserving some through streets exclusively for foot passengers and teams. Such a readjustment of the surface system supplemented by an elevated railroad and by a proper code of street traffic regulations, would, the commission thinks, not only facilitate travel for teams, carriages, foot passengers and cars, but would be profitable to the street railway company, and appreciated by the general public.

The commissioners declare that they are unable to specify with precision the exact changes that should be made in the surface lines, and think that at the proper time a careful and critical survey should be made by competent persons, to ascertain exactly what can be done in this direction, with due regard to the needs of the public and the reasonable requirements of the West End company.

Then follows the plan of the

PROPOSED ROUTE.

consisting of a radial system to the four suburbs, South Boston, Roxbury, Cambridge and Charlestown, with a line to the ferries to East Boston and Chelsea, connected with a circuit route, as already outlined. The location of the latter, as previously adopted by the commission, was illustrated in our February issue.

The length of the proposed system will then be divided as follows:

Circuit.....	3.30 miles.
Charlestown line.....	1.75 "
South Boston line.....	2.53 "
Roxbury line.....	2.05 "
Cambridge line.....	3.30 "
East Boston branch.....	0.49 "
	13.42 "

OPERATION.

The system, as proposed, may be operated in several general ways, viz:

- 1st. By running a certain number of trains continuously around the circuit in opposite directions upon the two tracks for the accommodation of the local traffic within the limits of the circuit.
- 2d. By running other trains from the several radial lines around the circuit in either direction and out again over the same radial line.
- 3d. By running certain trains from the several radial lines partially around the circuit in either direction and out over other radial lines.

Briefly stated, the

SUBWAY

recommended may be described as a brick and masonry arch, with its crown about five feet below the surface, having a width of thirty feet in the clear and measuring nineteen feet in height. The tunnel built of the same materials, will be of equal capacity, but carried down about twenty-five feet beneath the surface, measuring from the top of the masonry. The station on the Common would require a descent of twenty-five feet, and that at Scollay Square about twenty-seven feet.

THE ELEVATED STRUCTURE

is a skeleton platform of longitudinal iron plate and girders, supported upon wrought iron posts set in pairs at intervals of forty-five feet, connected by spanning girders of the same length. The structure has room for three tracks, and strength equal to the weight of the heaviest railroad cars. The platforms for shipping passengers are between the tracks, but the delivery platforms are on the outside. The elevated stations are, of course, covered in and planned to present a pleasing exterior effect. An attempt has been made also, by the addition of one or two architectural and ornamental features, to give a lighter and more agreeable tone to the roadway itself than that produced by that in New York and Brooklyn. In most essentials, however, it closely follows the latest built lines in the latter city.

Referring to the

COST OF BUILDING.

The report presents a mass of statistics and calculations. The mile or so of tunnel and subway is placed at \$1,500,000; the two and a quarter miles of iron structure at about \$1,050,000. For overhead stations they allow \$160,000; for subterranean stations, \$120,000; for storage track and grounds for cars, about \$400,000, making a total of what may be called the main lines of \$3,230,000. The ten miles and a fraction of branch lines at \$425,000 per mile amount to \$4,278,000, and twenty-five stations \$500,000 more. To which must be added about \$1,000,000 for equipment of the combined systems complete, and the total amounts to about \$9,000,000 for construction and equipment. Add to this an estimated land damage of \$4,000,000 and the grand total is \$13,000,000.

THE CAPACITY

of such a system operated as a circuit is largely determined by the capacity of the inner circuit. This is calculated to be 500,000 people per day. The radiating lines will, therefore, not need to be of equal capacity to the interior ones. The maximum equipment required for them would be sufficient to handle 300,000 people per day. The most largely used of the radial lines is assumed not to deliver over 100,000 people per day in the city.

COST OF OPERATION.

After analyzing these various items, and comparing, correcting and reconciling the results, the conclusion is reached "that the 13.42 miles comprised in the Boston project might be operated at a total yearly cost of \$870,152, assuming that it was carrying only

100,000 passengers per day, perhaps one-fifth of its capacity. This number of passengers seems a fair one to estimate upon. This is upon the assumption, also, that the system is operated as a circuit with branches.

INCOME

Upon the basis of 100,000 passengers per day, relying upon the figures derived from the Brooklyn lines, they find the calculation takes the following shape: "Operating expenses, \$725,000; taxes, \$200,000; total, \$925,000; and assuming, as before, that the fare is a uniform one of five cents for each passenger, it would give us a daily income of \$5,000, or a yearly gross receipt of \$1,825,000. This would furnish a net return of \$900,000.

Assuming that we were to carry 200,000 persons per day upon the system proposed in this report, operated as a circuit road at a five cent fare, this would give \$3,650,000 gross per year. Deducting from this the highest rate of operating expense which is found upon any elevated road in this country, and taking that to be, with taxes for a system of the length of ours, \$1,589,500, and we still have a net yearly return exceeding \$2,000,000.

If it be decided, as we now incline to think will be found more practicable and convenient, to treat it as two distinct lines of double track road from South Boston to Charlestown on the one hand, and from Roxbury to Cambridge on the other, with shuttle connections through Eliot Street on the south, and Causeway Street on the north, then the cost of operation is somewhat greater than that of the circuit plan, the difference arising mainly from the greater requirements for equipment. So that the account stated on this basis stands as follows: The operating expense for carrying 100,000 people per day increases from \$725,000 to \$870,000, including taxes in both cases, making your total expenses, including the item of \$200,000 for taxes, \$1,070,000, against \$925,000, according to the previous estimates, and reducing the net income upon the plant from \$900,000, as we stated it above, to \$755,000 yearly."

MOTIVE POWER.

The commission do not describe definitely the motive power which they think should be used to operate this road, yet think it should not be steam. They say: "The application of electricity to the propulsion of vehicles is yet in its infancy, the cable is not superseded, pneumatic power has its advocates. An entirely new motor is quite conceivable. We are, therefore, not ready to fix now what shall be the special kind of force or the exact method of application which should be selected to propel cars which, probably, will not start for two or three years to come. If in the meantime something better has not been discovered, we look for an electric locomotive as the coming offspring of the future; but the estimates of operation in this report have necessarily been made up on the basis of steam locomotion."

Regarding the

TERMS OF THE FRANCHISE.

to be granted to any corporation building or operating roads, the commission says:

"It would seem that the legislature considered it probable that the 'practical method' of rapid transit, whatever it might be, which the commission might agree upon, would be valuable and readily salable to some corporation which could afford to pay something for the franchise, and undertake to build and operate it upon terms which would return compensation to the cities or towns traversed by it.

If private enterprise saw its way clearly to a profit in the undertaking, it might still happen that it would insist upon such terms of immunity from interference and perpetuity of tenure, or other special franchise, that a prudent public policy must deny their concession. In that event there would seem to be no alternative between entire abandonment of the project or the direct intervention of the community in its own person and on its own behalf. We are quite alive to the dismay which falls upon a great body of intelligent citizens at the mere suggestion of such a thing. They instantly invoke a long procession of ghastly spectres to drive us from that path. And it may well be that, upon weighing all the arguments and remonstrances on either side, the legislature may conclude that until it can be done by private enterprise, it had better not be done at all."

A MINORITY REPORT

was also handed in by Commissioner James R. Richardson, who concurred in the report of his associates, except where they advise the construction of two lines, for three tracks each, through the old part of the city of Boston. To relieve the congested district in the centre of the city, which he thinks is not provided for by the circuit railway, he suggests one elevated, double track road, extending from north to south, as straight as practicable through the central part of the city, as near the main line of travel as possible, and so located as to draw off laterally at all points the great confluence of travel in the overcrowded section. The route of such a railway suggested is as follows: Coming from Roxbury down Washington Street as far as the vicinity of Waltham Street, thence through to Harrison Avenue, and extension to Bedford Street, through private property across Avon Street to Summer Street, crossing Summer Street through Hawley Street to Milk Street, down Milk Street to Post Office Square and Congress Street, through Post Office Square and Congress Street across State Street to Exchange Street and Dock Square, through New Washington Street or Union Street to Haymarket Square and Haverhill (or Canal) Street to Causeway Street with a station at the steam railway stations. A few other recommendations, differing in some particulars from that of the other members of the commission, were also made.

Public Rights in Private Property.

By R. M. FISHER.

The late Chief Justice Waite, of the United States Supreme Court, in rendering a decision in a case against the State of Illinois, made the following statement: "When one devotes his property to a use in which the public has an interest, he, in effect, grants to the public an interest in that use, and must submit to be controlled by the public for the common good to the extent of the interest he has created."

The "devotion" or dedication, is the setting apart of land for the public use. It is essential to every valid dedication that it should conclude the owner, and that, as against the public, it should be accepted by the proper local authorities, or by general public user. In this case dedication is a term applicable only to public ways. Neither the act of the owner nor the act of the public need be evidenced by any formal act. There are two kinds of dedication, statutory and common law dedication. (Elliott, Streets and Roads.)

The first is one made in conformity to the provision of a statute. It is generally held, that in order to constitute a valid statutory dedication, the provisions of the statute must be substantially complied with, and such acts as are required must be performed substantially in the manner prescribed by the legislature. This is necessary to give the dedication validity as a purely statutory dedication, but, in some instances, a dedication, invalid as a statutory one, may be a good common law dedication. Incomplete or defective statutory dedications will often be sustained as common law dedications, and if the streets marked on the defectively executed or recorded plat are accepted by the public, they will become public streets. *Gosselin v. City of Chicago*, 103 Ill., 623. Indeed it has been held that even where there is no acceptance on the part of the public, they will be regarded as streets, and will be kept open for the benefit of those who have purchased lots with reference to the location and existence of the streets and roads represented upon the maps or plats. *Common Council, etc., v. Croas*, 7 Ind., 9.

While the donor may vest the fee in the public by the statutory dedication, he is not bound to do so, unless the statute imperatively requires it, but may reserve the fee and grant only an easement to the public. (23 Ia. 248; 19 Conn. 250 and 13 Ill. 312.) A statutory dedication operates as a conveyance of an easement, except where the statute declares that a fee shall pass, and is, essentially a grant of interest in land, while a common law dedication generally operates by way of estoppel. (6 Ohio, 298 and 27 Vt. 265.) The one concludes the owner upon compliance with the statute, while the other concludes him upon the ground that he has suffered the public and individuals to acquire rights upon the faith that he devoted the land to the use of the public as a street. A common law dedication may be classified as an express or an implied dedication. In either case there should be an appropriation of the land to public use by some express or implied intent. No particular form is necessary; any language or instrument indicating an intent to devote the land to the public use would bind the donor from the time of acceptance by the public. Where the acts of a donor are such as would fairly and reasonably lead an ordinarily prudent person to infer an intent to devote land to the public use, and such intent is acted upon by the public, the owner cannot after such acceptance revoke the appropriation.

Applying this rule to cities which in turn grant franchises to private street railway corporations, such city and railway company claiming against the owner of the fee an easement in lands, must show either a grant, a continued user for twenty years or facts from which an intent to devote the land can be fairly inferred. The general principle which runs through all kindred cases is that the donor must bear the loss or burden, which his conduct has led the city to act upon in good faith.

Where land is devoted to the public it will pass to the corporation created for the control of that locality, and the law invests such government with title to the streets of the locality in trust for the public for the use to which they were set apart by the owners of the fee, when the land was devoted to the public. (118 Ill. 61; 11 Ala. 63.)

An owner may annex conditions and limitations to his gift, but he cannot annex any condition which will have the effect to take from the proper local authorities the power to improve the street in the same mode or dedicate it to the same use as other public streets are improved or dedicated in that locality. (31 Ohio, St. 506.)

A city has no right, however, to infer that one who devotes land to a street that the grant exceeds that which the public use of the street measures, for as the use is the foundation to the public right, it necessarily determines its extent. The title which the local authorities acquire in a street is in trust for the public, and they acquire this title, not for all purposes, but for one general purpose, that of a street over which all citizens have a right to pass and re-pass at pleasure. Under every just principle of law the one who devotes his property to such public use cannot be deemed to have devoted his property to a diversion of the one general purpose. But legislative power, as usually conferred upon municipal authorities, usually confers upon the latter the power to control and regulate the streets, and the power thus granted is generally very extensive. Just how far these powers extend, in any particular case, must be determined from the city charter; but it is safe to say in a general sense such power is sufficient to bind one who devotes land for public use to the extent of being controlled by the public for the common good, at least to the extent of the interest created. Cities usually have authority over the use of vehicles, and, may therefore, prescribe the routes to be followed by omnibuses. (*Commonwealth v. Stodder* 2 Cush 562.) So street cars may be regulated under authority to regu-

ate omnibuses. (*Railway Co. v. Philadelphia*, 58 Pa. St., 119. See, also, 6 Fed. R. 555.) Legislatures may authorize a city to permit street railways to make use of its streets (12 How Pr. N. Y., 187) but not to the extent of creating a monopoly. (20 Am. & Eng. Corp. cas. 263.) The general rule is well established that a city is not liable for consequential damages necessarily caused to the donor of land for public use unless so provided in the charter, and such donor "must submit to be controlled by the public for the common good to the extent of the interest he has created."

A street railway is a way constructed upon a street or streets for the purpose of passenger transportation. In this age of improvement and surprising genius, it will not do to designate a street railway as a "horse railway." The term "street" is also too restrictive for street railways, as they may be, and are often, operated upon suburban highways by means of the most improved mechanical power. A distinctive and essential feature of a street railway, when considered in relation to other railroads, is that it is a system for the transportation of passengers, and not of goods. Hence, it cannot be said that when the street or road was devoted or appropriated, that a private corporation should divert the way from its usual and appropriate use to an essentially different use, for the purpose of corporate gain. A street railroad is not, in a strict sense, a railroad. The view which generally prevails with the courts in following the weight of authority, is that an ordinary railroad constitutes an additional burden, which entitles the owner to withhold his submission and control without just compensation, but that the mere construction of a street railway does not impose any additional burden upon the land which he has devoted to public use. (See, *Rights and Remedies of Abutters*, chap. 25. *Eichels v. Evansville, etc. Co.*, 78 Ind. 261; *Jersey City etc., Co. v. Jersey City, etc., Co.*, 20 N. J. Ey. 61.)

Where an ordinary street railway is constructed in the usual way, and so built as not to materially impair the easement of access, such use of the street according to the adjudged cases do not affect the grantor, and the public interest created is paramount to any reserved rights he may have. But if the system is so constructed as to materially impair the rights and accustomed use of the grantor, it would place an additional burden, entitling the owner to adequate compensation; especially would this be true where the grade or elevation or alteration in any street is made solely for the necessary use and economy of the street railway company.

"When one devotes (or dedicates) his property to a use in which the public has an interest he, in effect, grants to the public an interest in that use and must submit to be controlled for the common good by the public to the extent of the interest he has created," is a doctrine within the principle recently asserted in the elevated railway cases and other kindred cases relating to the interests of street railways. This doctrine has been subjected to severe criticism, and private corporations have met stubborn resistance in their use of the streets of a city for their own benefit, but as this question is pretty firmly settled by authority it is useless to resist it. It is questionable, however, with many learned jurists if the doctrine ought to be further extended. Justice Mitchel of the Minnesota Supreme Court (see 35 Minn. 112) is inclined to hold that the maintenance and operation of a street railway constitutes a servitude additional to, and different from, the use for which the streets were acquired, or otherwise a new use of the streets, not contemplated at the time of their dedication. He said "that it was difficult to see that this road differs from any ordinary commercial railroad except that it uses the entire length of the street as its depot at which it receives or lets off passengers. As operated, it is, to a certain extent, in aid of travel on the street, but this is a secondary and incidental, and not its main and principal purpose." Even in this remarkable age of public improvement, courts have been censured for giving away to enterprises that seemed to promise great public good in a manner somewhat unmindful of the rights of the individual property holder, grantor or abutter, and have sacrificed his rights to a presumed public benefit without taking into account individual losses and discomforts.

It is quite true that in a great majority of instances, no injury is done the abutter or grantor by the operation of a system of street railways; hence, he must submit to be controlled by the public through its given franchises to the interests of a common carrier for passenger travel. But it does not follow, because there is no injury in a large majority of cases, that there is no injury by reason of the unexpected use of the street in any case. To what extent a grantor has devoted his property to public use, depends upon the facts of that individual case; hence, it is not just to turn the sufferer away by affirming that the occupancy of the street by a street railway, in a legal sense, does the owner of the fee no harm, and "must submit to be controlled by the public for the common good, to the extent of the interest he has created." It is unsafe to assume that whatever may be the fact as to actual loss, no compensation can be enforced by law, for the simple reason that a street railway in the eye of the law cannot injure the owner in fee. Until a limit is established regarding the interest of the public, this doctrine is not likely to inspire a man who knows what he has suffered, with a very exalted respect for the law that compels submission without, in many cases, just compensation for his loss and discomfort.

It is true, as history proves, that city councils are quick to grant important and valuable privileges without restriction, which they subsequently feel the necessity of limiting, but not until after it is too late; and it is undeniably true that courts have not been entirely free from the same general influence which moved the councilmanic bodies.

In a general sense, street railways are highways, but they are not in a strict sense public ways, because their owners hold a private proprietary right in the franchise, and where such railway is operated for private gain, it cannot be said that they are primarily for the public

benefit. While the public is incidentally benefited, this benefit is not the chief purpose of the organization and operation of a street railway.

While it is true that a street railway for the transportation of persons is for public use, it is also true that it is private property, and although the street or road over which it passes remains a public street or road, consistent with the unimpaired use of the street railway, the latter is, notwithstanding, in the use for which it was built, a private road for the accommodation of the public and the profits of its owners, upon which no one but its owners have a right to run a car. (51 N. Y. 295.) There are certain uses to which, in modern times, the street may be subjected to, uses not merely conducive to, but almost necessary for, the comfort, health and prosperity of the public, and the sanction by custom and approval by experience of such uses is sufficient to control submission for the common good of any interest created by the grantor. Among certain uses here referred to is the use of street railways upon the surface of a street. Property devoted to a street is simply an easement or servitude, carrying with it, as its incidents, the right to use and improve the soil for the purpose of the public good, and while the owner retains the fee and all rights of property not incompatible with the public enjoyment he must, in accordance with the weight of authority, submit to be controlled by the public for the common good to the extent of the interest he has created.

Strike in Chicago Averted.

A strike of conductors and drivers of the West Chicago Street Railway Co. was threatened in April, but the men, after considering the matter an entire night, decided not to abandon their positions. The trouble arose out of differences of opinion regarding "tripper cars." There are two organizations of employes of the West Side road, known as Union No. 1 and Union No. 2. The company have been putting on "trippers" who work during the rush hours. They are employed three or four hours, or perhaps more, and receive \$1.50 per day. Union No. 1 claimed that this employment of trippers constituted a violation of an agreement relating to wages which it had made with the company, and threatened to strike. Union No. 2 stood by the company and was prepared to furnish "trippers" from its ranks. The company, to the surprise of the men, assumed an aggressive position and posted the following notice in all the barns:

It has come to the notice of the management of the West Chicago Street Railroad Co. that certain persons are spreading mischievous reports to the effect that it is the ultimate intention of the company to lower the scale of wages to \$1.50 where \$2.10 is now paid. The management would not notice these reports but for the fact that, notwithstanding the idea is very ridiculous, yet we are informed that some of our employes really believe that such is the object of the company.

To leave no doubt in the mind of anyone, the management wishes to say that such reports are entirely without foundation and made only to mislead the credulous, and that no reduction of wages is contemplated in any department.

The management further says that it is the desire of the company that all such mischief makers as above noted should leave its employ at once so that their places may be filled by more honest employes. They are continually endeavoring to stir up strife between the employes and the company, and it will be a great benefit to both when such persons cease to be on its pay rolls.

Union No. 1 held a meeting to reach a final settlement, and after debating the matter from eleven o'clock at night until the time for running out morning cars, decided not to declare a strike.

Signs in Chicago Street Cars.

The North Side Street Railway Co. of Chicago, are continuing their fight against those who indulge in the habit of tobacco chewing in the street cars. They have posted placards in the cars calling to the attention of tobacco users the enormity of the offense of polluting the floors of public conveyances. It requires a brazen front to persist in the violation of decency with signs like the following staring one in the face:

Pigs do not chew tobacco. Query: Is a man who does and spits on the floor, neater than a pig?

You don't wear dresses, do you? If you did you would not spit on the floor—as a matter of self-protection.

Track Construction.

From *Advanced Sheets of "Street Railways" (Trams)*.

By C. B. FAIRCHILD.

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A prime requisite in all street railway operations, is permanency, and in the long chapter of expense items that inevitably accompany mechanical traction a large percentage (as high as fifteen on some electric lines) is

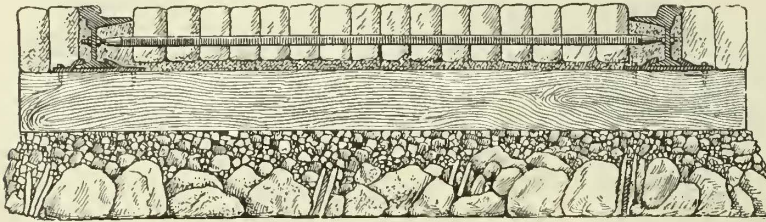


FIG. 1.—CROSS SECTION OF TRACK ON BALLAST FOUNDATION—GIRDER RAIL SPIKED TO TIES.

due directly or indirectly to defects in the tracks. Hence, it is desirable to reduce this percentage to the smallest possible limit, and roads that are designed to do a large amount of business must advance their tracks to such a condition as will allow of cars being run on short headway and at a high rate of speed, or they will imperil their very existence by defects inherent in the permanent way.

Among the many depraved traits that inanimate matter possesses none have caused greater surprise or reflected more severely on the skill of engineers than the behavior of rails and joints since they were made to do service

it is not so with the new power; for any defects in the joints, which are usually the weakest places in the track, rapidly grow worse, so that, not only are the rails worn, but much greater damage is inflicted upon the trucks and car appliances. The problem from a street railway point of view would seem to be easy of solution, but, unfortunately, it is complicated, usually, with conditions named in the franchise, which relate to paving, rail sections and care of tracks.

In treating the subject it is necessary to consider the preparation of the foundation on which the tracks are to be laid, the selection and adjustment of rails or their equivalent, the fastening of rails to ties, the type of rail, the connections between rails, the proper laying of rails on curves, the construction of turn-outs, frogs, switches, crossings and paving.

SURVEY.

In case a new line is to be constructed a survey of the route is first necessary, but this requires some knowledge of elementary geometry and other mathematical sciences, and great care is necessary in taking the measurements, recording the data and general conditions; hence, this work is usually delegated to specialists in this line, and since it is a custom with rail makers to employ men well versed in this work who make all necessary surveys and estimates free of charge to parties ordering a rail equipment it is not essential that the details of the work be treated in this connection. It is important, however, that the street railway companies for whom the work is being done direct that spiral transition curves be employed in laying out the work for turns, in order to lessen the danger of derailment and reduce the strain and shock to cars and motors, which with mechanically propelled cars is very great on circular curves. In case, however, one wishes to

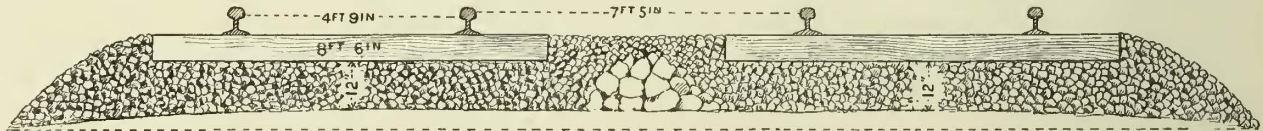


FIG. 2.—CROSS SECTION OF STEAM RAILWAY CONSTRUCTION WITH STONE BALLAST.

under electric cars, and notwithstanding that a great amount of inventive genius and experimental effort have been expended in improving the details of foundations, ties, rails, and joints, street railway companies everywhere feel more or less solicitude lest they fail to secure the highest standard of excellence desired.

Although no construction with which we are acquainted meets all requirements in a fully satisfactory manner under all conditions, great advances have been made, and this line of engineering, which heretofore has been considered a humble branch of the profession, is now receiving the attention of the best engineering talent of the country, and some of the modern arrangements represent notable and important improvements over former practice; still the possibilities of improvements are not yet exhausted, and when more practical knowledge shall have been acquired and disseminated, and engineers discover by failures what not to do, track construction will doubtless be advanced to a more creditable condition, but it cannot be expected, in spite of all that will be done, that incessant labors will not be necessary to keep the best of construction in first class condition.

Were it not that the significance of the above points is frequently ignored by street railway companies, an apology should be made for presenting them; but some street railways have been built for sale rather than for use, and others, on account of lack of funds, are sometimes constructed in a manner known to be imperfect, in the hope and expectation that they will gradually be improved after earning power is attained. Such expectations will never be realized in electric traction. Although it was possible with horse traction for cars to be operated with little danger for long periods over defective tracks,

study this subject, a little pamphlet entitled "The Railroad Spiral" will give the desired information.

FOUNDATION.

In no class of roads is it so essential that there should be a thoroughly good roadbed as with electric lines. In the absence of a proper foundation it is useless to expect good results from the superstructure no matter what the type or weight of rail may be. Differences of opinion formerly prevailed in regard to this matter, but positive conclusions have now been reached, and these are that it is just as essential as in steam practice to have a ballast of clean broken stone, gravel or furnace slag, at least a foot deep under the ties, with the space between the ties filled

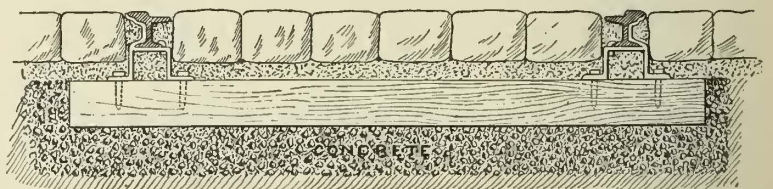


FIG. 3.—CROSS SECTION GIRDER RAIL ON CONCRETE FOUNDATION.

up evenly to the top, and provided with tile drains at proper intervals to remove any excess of moisture that may percolate through the pavement. In placing the ballast coarse, large stones, set edgewise, may be placed at the bottom in order to provide for drainage, but care should be taken to keep the coarse stone from coming up to the bottom of the ties, as these should rest only on gravel or finely broken stone (Fig. 1). Those who have experienced trouble from the paving blocks being forced from their beds by the churning action of the ties, accompanied by a flow of soft mud, will appreciate the importance of the

above drainage requirements. In some cases proper ballast has been provided, but provisions for drainage being neglected unsatisfactory results followed, as is likely to be the case, especially where the formation is of clay; hence, the suggestions for drainage are emphasized. Fig.

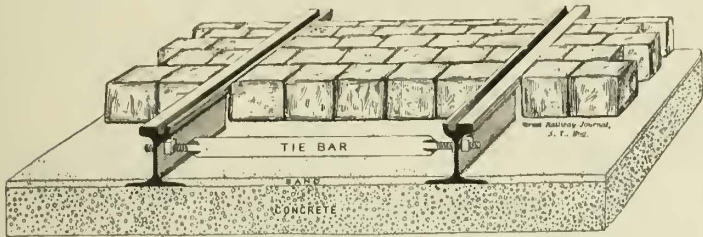


FIG. 4.—BIRMINGHAM TRAMWAY CONSTRUCTION.

2 illustrates one method of ballasting employed on the steam lines of the Pennsylvania railway. The term ballast is applied to material employed in this manner, because stones that had been used for ship ballast were first employed for this purpose on steam lines near Newcastle, England.

Another important factor in securing an enduring roadbed is the track laborer, and special attention should be given to the selecting and drilling of the men employed and to impressing upon them the importance of *thorough* and *conscientious track work*, especially in tamping, for much defective track is due to careless and insufficient tamping. In some sections it may be difficult to secure the services of men who are willing and competent to perform this part in a reasonably correct and efficient manner, but the importance of strict thoroughness should be understood by the contractors and section foremen at least.

We are aware that a foundation of concrete has been provided on some lines in place of stone ballast, and that in a few instances a creditable service has been secured (Fig. 3), but disastrous results have usually followed the use of concrete in this form or as pedestals under joint chairs. Especially will it be found imprudent to lay concrete on soft or newly made road bottoms. These remarks refer to electric lines. Concrete foundations have been quite generally employed on foreign lines employing animal power, and in most cases have proved quite dur-

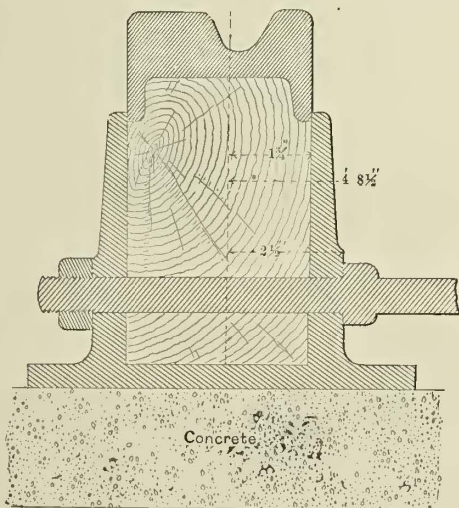


FIG. 8A.

SOUTHPORT TRAMWAYS.

markets. A number of varieties of wood are used, and different methods of preparing it are adopted, some being sawed, others hewn; the latter are generally considered best, for the rounded edges allow of thorough tamping, but in all cases the bark should be removed before the ties are placed on the foundation. Yellow pine is generally considered best for ties, but adverse elemental forces frequently bar the use of certain woods in some localities, in which case it is necessary to be governed by experience had on old lines. The dimensions of ties for electric lines should be 5 ins. x 7 ft., or better, 6 ins. x 8 ft., and they should be seven feet long for standard gauge, and not less than sixteen should be used for each thirty foot rail. The spacing at the joints may be determined by the width of the ties employed, as shown in Figs. 12 and 13, but the type of rail will govern the spacing of ties somewhat. In case the rails are spiked directly to the ties, the use of a Servis tie plate, or the ordinary steel tie is recommended, as they prevent the cutting of the rail into the tie (Figs. 14 and 15).

Metal ties have been employed in electric service to a limited extent in place of wood, and considerable inventive effort has been expended in this direction, but no very satisfactory results have been obtained, so far as we are

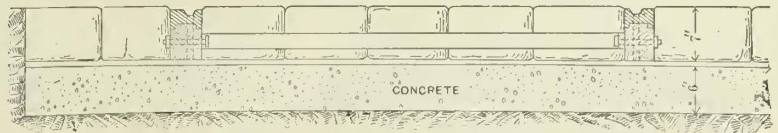


FIG. 5.—EDINBURGH TRAMWAYS.

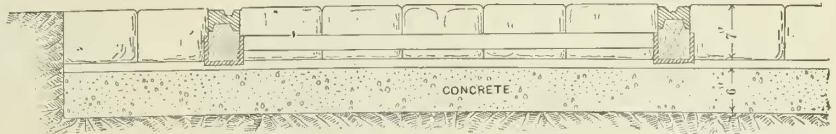


FIG. 6.—DUNEDIN TRAMWAYS.

informed. There is also a system designed to obviate the use of ties which employ broad based metal chairs with specially prepared foundations; of this we will speak later on.

RAIL FASTENINGS.

The method of fastening rails to ties will, in many cases, be governed by the local requirements in regard to paving. The best results, by far, are obtained where the rail, be it a Tee or girder type, is spiked directly to the ties. In locations where low wooden blocks, vitrified brick or asphalt are employed as paving material, rails of the ordinary height, of four and a half or five inches, may be thus secured. In case the pavement is to consist of granite sets of ordinary depth, it will be necessary to

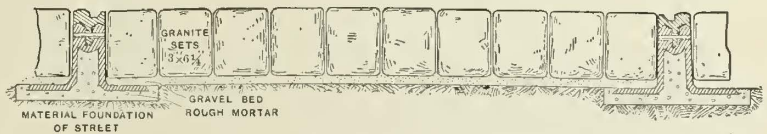


FIG. 7.—MANCHESTER TRAMWAYS.

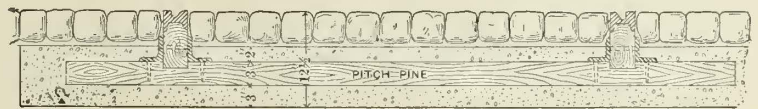


FIG. 8.

able, but there are many conditions that militate against such construction in this country. Some of these are the climate, the condition and care of streets, first cost, paving requirements, etc. Figs. 4 to 11 illustrate English practice in this respect and show the different methods of fastening rails.

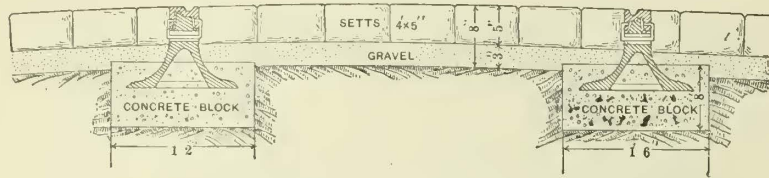
TIES.

The selection and adjustment of ties will be governed somewhat by the kind and price of material in local

support the rail upon chairs or wooden stringers, or employ a specially designed rail of sufficient depth to allow it to rest directly upon the ties. In case chairs are used (Figs. 16 to 18), those of wrought metal are preferable to those of cast iron, as the latter are apt to break, especially in cold climates, and it is also of advantage to have the rail and chairs united by electric welding. Both from a street railway point of view and that of the local authorities, the employment of chairs for supporting the ordinary

types of rails on electric lines is undesirable, as it will be difficult to keep the rail in position, and a frequent disturbing of the pavement will be necessary. As a substitute for chairs the best results have been secured in some localities by the employment of a longitudinal stringer on which a girder rail of the ordinary depth is placed

20) are preferable, as they cut the fibre of the wood better than the chisel pointed spikes and have better holding qualities. Double headed spikes (Fig. 21) may be employed to advantage for fastening chairs and tie plates, for when driven there is sufficient space left between the plate and second head to readily admit the claw bar when it is necessary to draw the spike, so that the head is not as liable to come off, as is the case with the common spike.



SECTION THROUGH CHAIRS.

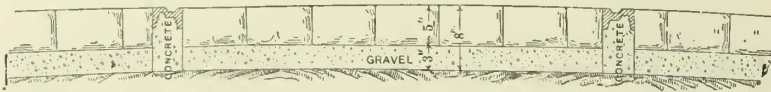
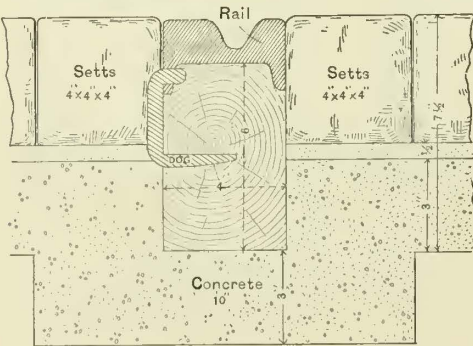


FIG. 9.—BRISTOL TRAMWAYS—SECTION BETWEEN CHAIRS.

(Fig. 19). In case the stringer is employed, care should be exercised in selecting the kind of wood that is known to be the best to resist decay in any particular soil or climate, as in the case of ties, and the stringers should be cut in as long and uniform lengths as possible. The stringer may be secured to the ties by means of cast knees, as shown in the figure. While this construction

Service has demonstrated beyond question, thus far in the history of electric traction, that the Tee type of rail, when of proper dimensions, and spiked directly to the ties, has given the best satisfaction from the operator's point of view wherever its use has been allowed. Hence, for suburban lines, and lines operating on paved streets in small cities, the use of the Tee rail is recommended. It may be questioned, however, if its use on paved streets, where there is a good deal of vehicular traffic is economical, on account of the rapid wearing out of the pavement next the rails.



When this rail is laid in streets paved with wood or stone blocks, it is necessary to chamfer off the corners of the blocks next the gauge side of the rails to provide a channel for the wheel flange. Some of the claims made for this type of rail are its vertical and lateral stiffness, durability, ease of draught and small first cost. When used it should be modeled after the designs employed on the leading steam roads, one of which is illustrated in Fig. 21, which shows the standard rail and connections at present employed on the Pennsylvania lines; but should this type be employed for electric service the nearer it is copied in weight as well as design, the more satisfactory will be the results.

The use of the Tee rail, however, is necessarily con-

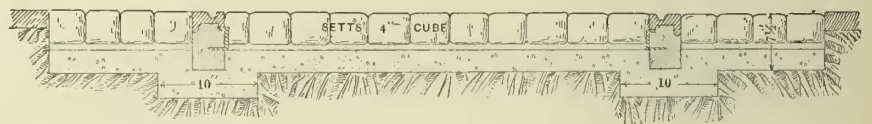


FIG. 10.—WIRRAL TRAMWAYS.

has given satisfaction in paved streets having a moist soil, it has not proved to be desirable in unpaved streets where the soil is sandy.

It is proposed in certain localities to employ a girder rail having a broad base and of sufficient total height (ten inches) to allow of its being spiked directly to the ties, and yet provide space for the paving blocks and

finned to a limited field in street railway service, owing to local requirements and conditions, so that for the larger service, unless a new type should be developed, some form of the girder rail must be employed, on mechanically operated lines at least.

From the shape of the head, girder rails may be divided into three kinds, designated centre bearing, side

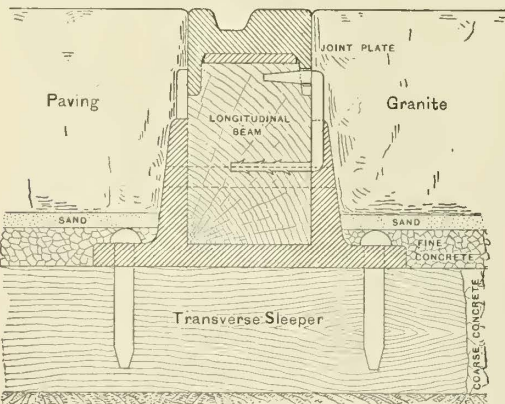
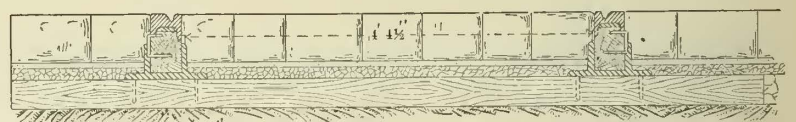
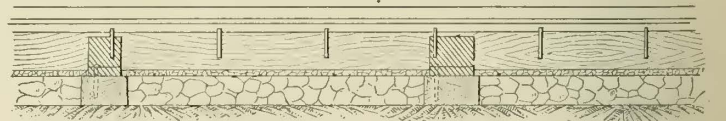


FIG. 11.



CROSS SECTION.



GLASGOW TRAMWAYS.

LONGITUDINAL SECTION.

gravel bed above them. This, theoretically, is an ideal construction, but it remains for service to demonstrate if the first cost and increased surface wear, because of the increased stiffness, are not prohibitory.

Attention should be given to the type of spike employed for rail and chair fastening. For fastening the rail directly to the tie or stringer railroad hook spikes not less than four and a half inches long are recommended. Those having specially designed points (Fig.

bearing and grooved (Figs. 23, 24 and 25). Each of these forms may be rolled with or without a base flange, or the web may terminate in a bulb. Only those having a wide base, however, are suitable for electric traction. There are other forms designated by variations in the web; one is known as the double web or box rail (Fig. 26); another as a split or duplex rail, which is rolled in two parts, with the head and tram each provided with a web and designed to be laid with broken joints (Fig.

27). Neither of the latter types, however, requires a base flange.

In reference to the form of the head, the centre bearing head is the most desirable from the operator's standpoint; because, from the shape of the head, it readily sheds dirt and offers less resistance to the wheel than

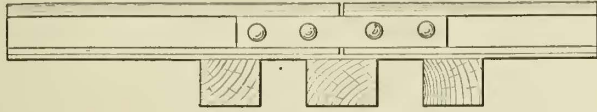


FIG. 12.—THREE TIE JOINT.



FIG. 13.—SUSPENDED JOINT.

other types, but its use is prohibited in many localities because it is difficult for the wheels of vehicles to mount the head in getting in or out of the track; hence, it is necessary to employ the side bearing or grooved rail, or a compromise between them, something that will give reasonable satisfaction both to wagon owners and the operating companies.

Exactly the best width of head for a given weight of

The tram or flange of a girder rail should be so designed that it will last as long as the head. As the part next to the head is the most subject to wear, it may be thickened at this point and allowed to taper away to the extreme point in order to economize in weight. The flange of the rail under electric traction is not liable to wear out before the head, as is the case with animal traction, unless the street traffic should be extremely heavy; hence, not so much attention should be given to its design as formerly, except in the direction of width. In regard to the width, most companies will be governed by local requirements, and if they must provide for wagon travel the tram should be as narrow as the requirements will allow (as narrow as two inches if possible), both to reduce the tendency of the rail to cant inwards, by reducing the leverage, and to add to its paving qualities. The latter is an important consideration, for if the tram is very wide the adjoining paving blocks, when they settle, are apt to cant under the tram, making a dangerous trap for horses' feet. This tendency, however, can be provided for to a certain extent by filling the pocket of the rail under the tram with concrete before the paving blocks are put in place.

The web of a girder rail is usually pared down to from one-fourth to seven-sixteenths of an inch. So far, no web of any of the leading patterns has broken down from being too thin. Any variation from the above is of little importance, for no one can say whether a sixty-fourth should be added or removed unless an unusually high (ten

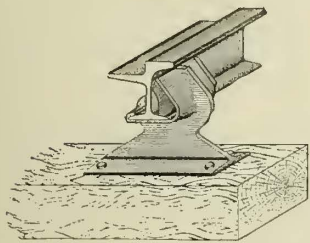


FIG. 14.—STEEL TIE PLATE.

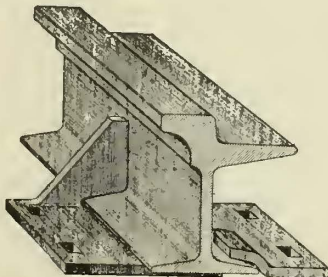


FIG. 15.—BRACE TIE PLATE.

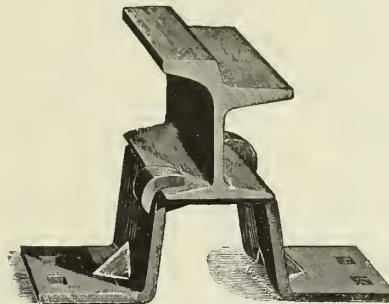


FIG. 16.—CLIP TIE CHAIR.

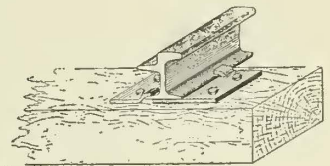


FIG. 18.—ROLLED STEEL CHAIR.

rail can hardly be determined. A wide head reduces, theoretically, the pressure per square inch of wheels, but on account of the slight coning of the wheels their actual contact is only from one-half to three-fourths of an inch. If the head is wide it must be thin, with a given weight of rail, so that its side presents less surface, with a higher rate of flange wear, and a greater variation in the gauge of the tracks. The heads must be deep enough to allow of a reasonable amount of wear, before the wheel flange will come down upon the tram.

Practice has determined that the best average width of head, for anything above a fifty pound per yard rail, lies between two and two and a half inches, with a depth of one inch or an inch and an eighth at the gauge line. Every possible fraction of the remaining half inch in the width has been adopted, but no one can prove that each is not the best. In any case the head should be so designed that the weight of the wheel will come directly over the web, to prevent any tendency of the rail to cant over, which will be the case if the slightest leverage is given to the weight. In designing rails for animal traction it may be necessary to so place the web that it will bear the weight imposed upon the head as well as that imposed upon the tram from vehicular traffic; but for electric traction this is not necessary, for the car service is first to be provided for; and since this is usually so much harder than the wagon service the latter may be ignored.

inch) rail is to be employed, when a bead may be added along the centre of the web on each side. The height of the web, however, is quite important; and were it not for paving conditions it would be easy to perfect the rail as a beam and establish a standard height for given weights because the stiffness of a beam increases as the cube of the height; and it has been found in steam practice that a well proportioned rail of about four and a half inches

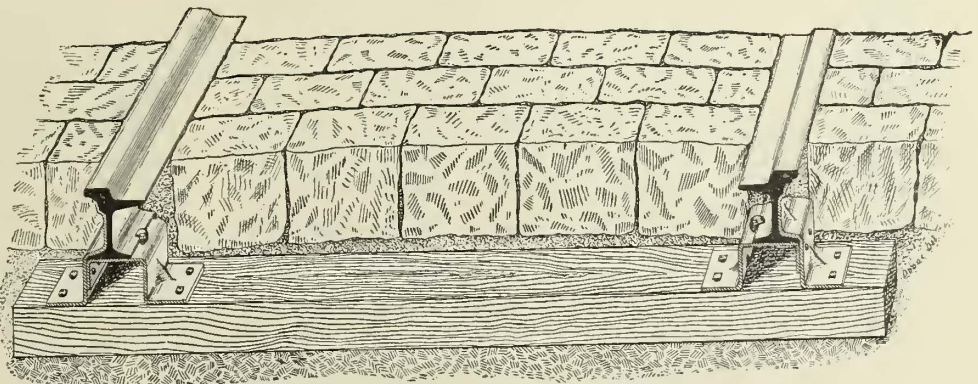


FIG. 17.—CROSS SECTION STREET CONSTRUCTION, GIRDER RAIL, WRUGHT BRACE CHAIR, MARSHALL CLIPS.

in height will carry loads of five or six tons per wheel to the best advantage. But it has also been ascertained that rails only half an inch higher wear out more rapidly on the surface than the lower rails of the same quality. This is explained by the fact that the higher rails, being more rigid, decrease the time of impact of the hammer blow of the wheel (whose destructive effect is as the square of its velocity) and so increase the power of the blow. As before stated, it is yet to be determined

whether this increased wear, due to increased stiffness, will militate against the employment of a deep rail to obviate the use of chairs or stringers. Of course, where the ties, or yokes in cable lines are placed quite a distance apart, and it is thought desirable to suspend the joints, a deep rail will, theoretically, carry the load without much deflection out to the end and impose less

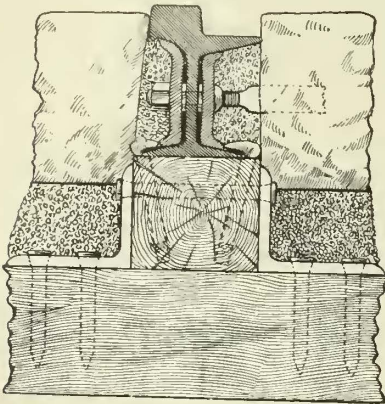


FIG. 19.—GIRDER RAIL WITH STRINGER SUPPORT.

service upon the joint connections, and the rail, being deep, allows the use of deep connecting plates. The relative advantage of a deep beam even under these conditions, when the first cost and value of scrap are considered, is a difficult question to determine, and must be left until new conditions of roadbed, load and manufacture shall have indicated further improvements in the weight and proportion of steel rails for street railway service.

The width of the base of the ordinary girder, which is designed to be spiked directly to the ties, is not so difficult to determine as the height, and the best practice makes the base and the height the same. With a wide base the tendency of the rail to turn over is not so great, and it is not as liable to cut into the tie or stringer. When employed with chairs it should also be wide, and the base of the chairs should be spread to correspond with the total height.

The grooved girder rail (Fig. 25) was an importation from English practice, and where the conditions are favorable it has given excellent results. Its use, however, is recommended only in mild climates and on streets that are kept scrupulously clean, for the reason that, ordinarily, the groove will become packed with dirt, bits of ice, snow or mud, thus causing the wheel to rest upon its flange, and increasing the resistance and tendency to derail the car. It must be laid to a close gauge; and it is estimated that it requires, ordinarily, from 30 to 40 per cent. more power to operate cars upon it than on the side bearing or Tee rail. The flanges of the wheels wear rapidly on both sides, and there are other minor objections to its use, so that it is an imposition on the part of city authorities to require that it be used except where the conditions are favorable, as above noted. It is, no doubt, a desirable rail from the point of view of the public, for it offers little or no obstruction to wagon traffic, as the pavement can be laid flush with the surface on both sides; and where the streets are paved with asphaltum it can be driven over in any direction without its presence in the street being detected. If, however, the pavement is not carefully maintained and is allowed to settle irregularly, the rail becomes exposed, wagon wheels form ruts, and

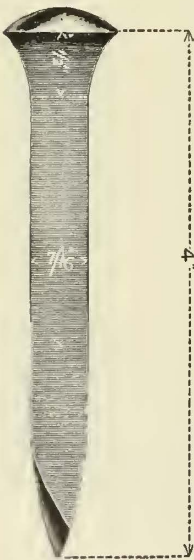


FIG. 20. SPECIAL POINT CHAIR SPIKE.

its obstructive features soon exceed those of other types. In some cases, where the use of this type of rail has been insisted upon by state or city authorities, a compromise has been effected by forming the groove with an inclined or dishing wall on the inside, or terminating the point of the tram a little below the level of the head (Fig. 28). With this arrangement the flange of the wheel tends to cut through and crowd the obstructions out of the groove, and the pavement may be laid flush both with the tram and the head.

Fig. 29 illustrates a high (100 lb.) girder rail before referred to, and which has been designed for use on some of the Boston lines. The engraving shows the rail at the joint, and also a section of the girder or "standard" joint which is designed for use with this and other types of girder rails. Between the ties the rail is to be spiked directly to the ties, as it is of sufficient height to allow of paving with regulation granite sets without any blocking up.

The box or double web girder rail, illustrated in Figs. 26 and 30, has been designed to obviate some of the alleged defects inherent in the ordinary patterns of girder rails. Some of the claims made for it are that it has great vertical and lateral strength with a minimum amount of metal; excellent paving qualities, in that the vertical sides offer ample support to paving blocks and prevent their tilting over even though they settle below the level of the head; facility of adjustment to chairs or ties (Fig. 31), without any bolt holes through the webs, and admits of employing durable joint connections, in that the rails are rolled with the flanges slightly flaring and terminated with a bead at the lower edge, having an inclined top which is designed to engage with the inclined bead of the clamp, and, from the natural tendency of the web to spring outward, holding the rail and chair firmly together, thus taking up any wear that may occur at the point of contact between them.

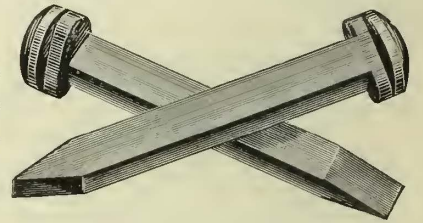


FIG. 21.—DOUBLE HEADED SPIKES.

The head may be rolled to correspond with any of the forms employed in the other types of girder rail. Designs for special construction to accompany the use of this rail, including curves, switches and chairs for uniting this rail with other types have been quite fully worked out, and the promoters are competing in the market for a share of the street railway business.

The designs of a duplex rail shown in Figs. 27 and 32, illustrate a commendable effort to obviate the troublesome joint defects which to a greater or less degree are in-

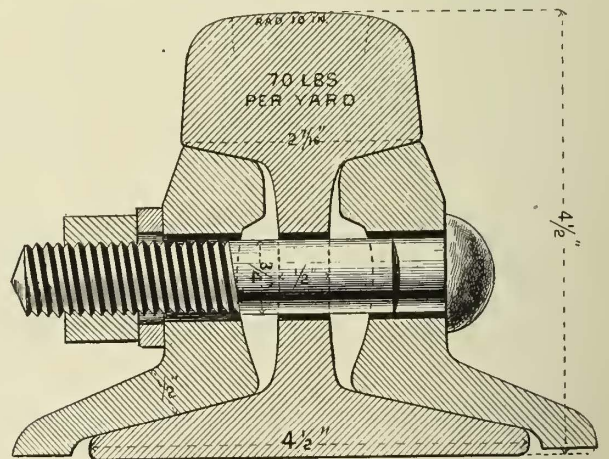


FIG. 22.—TEE RAIL—PENNSYLVANIA STANDARD OF 1889.

herent in every type of rail, and to provide an all metal structure. This is a comparatively new system, and it has not yet demonstrated its wearing and staying qualities by long and hard service which is the only test that can recommend any system for general adoption. Theoretically, the mechanical principle on which it is constructed—that of under and overlapping connection—is correct, but what depraved traits service will develop cannot be anticipated. It would seem, however, to be worthy of trial.

The system as shown consists of a split rail having two members which constitute the head and tram, which are rolled separately, so that each is provided with a plain independent web. When in position the members overlap, forming semi-joints, so that they give to each other mu-

tual support, and form in cross section a box rail which has excellent paving qualities. When worn either member may be replaced without rejecting the other. The top may be rolled to correspond with any of the standard forms, either side bearing, grooved or semi-grooved.

In order to obviate the use of wooden cross ties and stringers, provision is made for supporting the rails on

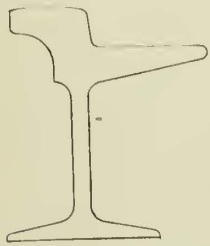


FIG. 23.—SIDE BEARING GIRDER RAIL.

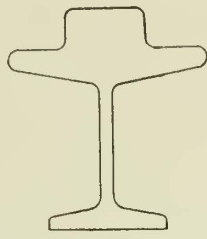


FIG. 24.—CENTRE BEARING GIRDER RAIL.

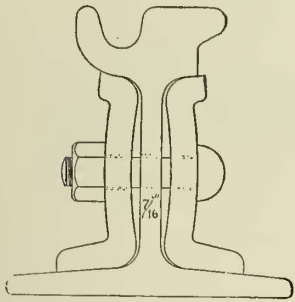


FIG. 25.—GROOVED GIRDER RAIL—WASHINGTON TYPE.

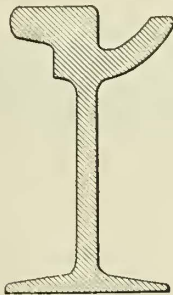


FIG. 28.—GROOVED GIRDER RAIL—NEW YORK TYPE.

deep metal chairs which have a broad concave base, and are designed to rest upon the soil where it is sufficiently firm, or upon pedestals formed by tamping broken stone, sand and gravel firmly into a pocket which is excavated for the purpose. The chairs are spaced two feet eight inches between centres, with stout tie bars at every alternate chair, and wedge keys at every chair. Designs for all special work are provided, making a complete system.

A method of track construction which has been designed with a view of employing a tram or flat rail, so as to obviate the joint defects that usually accompany this type of rail, is illustrated in Fig. 33. The essential features of the system consist in placing a flat bottom, heavy

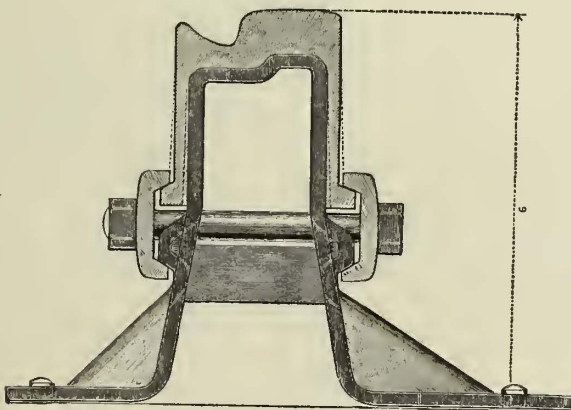


FIG. 26.—BOX GIRDER RAIL.

rail, having dependent flanges, upon a longitudinal stringer which is faced on each side at intervals with metal plates which are so bolted as to break joints with each other, the rail and stringer. The independent flanges and plates are pierced with oval hobs, through which spikes are driven so that rail, plates and stringer are held firmly together. The stringer is thoroughly protected on the top by the rail and plates, and may rest upon ties or a tamped ballast foundation. How far this arrangement tends to a solution of joint defects remains for service to demonstrate.

THE RAIL JOINT.

The establishment of proper connections between the ends of rails so as to form a continuous line without permitting them to touch each other, except when the highest temperature prevails, and at the same time avoid the damaging effects of the space left at the ends which is necessitated because of expansion and contraction, is one of the most difficult problems that confront the street railway engineer, although it seems comparatively simple.

The space required for expansion at the end of rails is in proportion to the length of the rail, and should always be exact, for if too close the rail would be torn from its fastening by the force of expansion, which is estimated to be from six to nine tons per square inch of section, which corresponds to ten pounds per yard, or in a seventy pound rail, from forty-two to sixty tons. The expansion of a thirty foot iron or steel rail is .252 in. or one-fourth of an inch for every 100 degs.

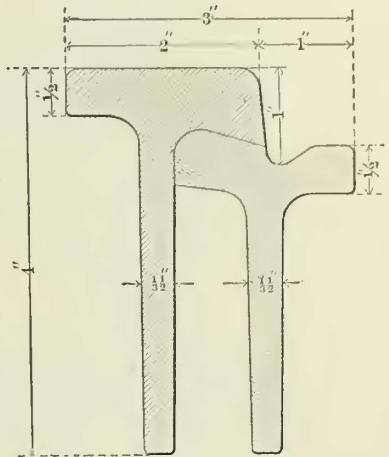


FIG. 27.—DUPLEX RAIL.

of temperature, and the highest temperature of a rail in summer is about 130 degs. Fah., or about 100 degs. above the freezing point, so that when thirty foot rails are laid at a temperature near the freezing point a space of at least one-fourth of an inch should be allowed, and half as much with a fifteen foot rail. At eighty degrees, or fifty degrees below the highest temperature, only one-eighth of an inch is required. When the highest temperature prevails, the rails should be laid so that their ends touch each other. The matter has undergone a long series of experiments at the hands of steam railway engineers, the

experiments ranging through various forms of chairs, bridges, fish plates and angle bars, with a tendency favorable to the latter, because they afford additional strength as compared with most other devices; and yet, those who have had the longest experience in the service express the belief that it is practically impossible to provide a joint that will not need constant attention. This is a rather discouraging statement for the street railway manager, for the rails of his lines are hid away under the pavement where they are not readily accessible; hence defective joints may be accepted as the "social evil" of the street railway system. By employing a properly designed heavy rail (not less than eighty pounds per yard), joint defects do not develop so readily as with a lighter rail, but even with the heaviest rail they still exist to an extent not generally realized.

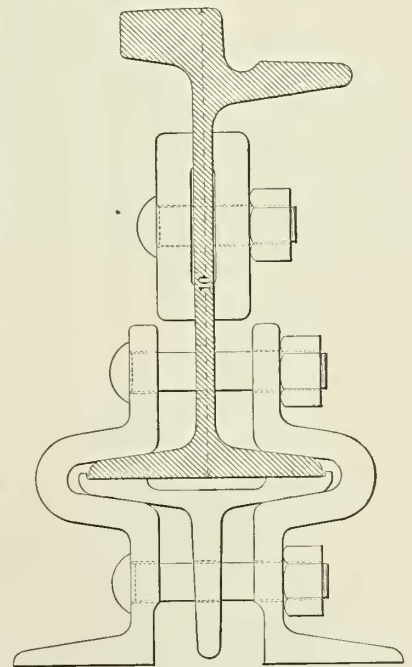


FIG. 29.—PROPOSED HIGH GIRDER RAIL.

The nearest approach to a solution of the problem, which long service has demonstrated, is the employment of slightly curved steel channel bars on both sides of the rail where the ordinary types of girder or T rails are employed (Figs. 25 and 34). The curve in the channel bar allows them to spring slightly when the bolts are tightened

up, causing the plate to wedge in tightly between the head and base of the rail, while at the same time it acts as a nutlock which prevents them from working loose.

In order to secure good results with such connections, it is necessary that the rail be so rolled that ample space under the head and tram and on the base be provided on which the bars may rest, and so drilled as to allow for

and every bolt set up as closely as possible. Almost any type of joint will stand for a time, perhaps a year, without attention, but after a certain period the parts will become worn from constant chafing due to changes in temperature, when they will require readjustment; and that type which requires the least attention is, obviously, the most desirable, without reference to the first cost. The

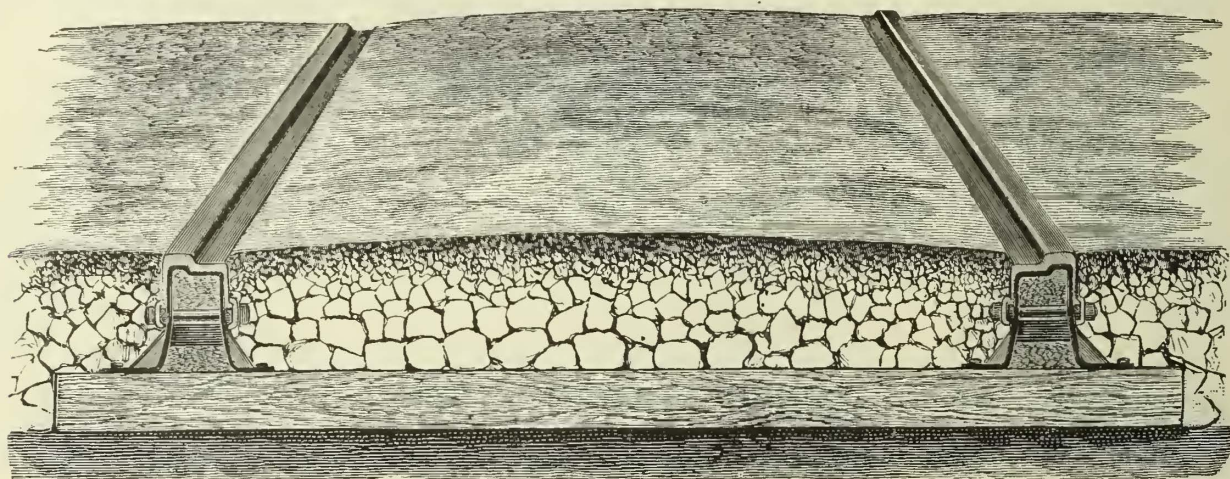


FIG. 30.—BOX GIRDER RAIL IN MACADAM PAVEMENT.

expansion and contraction. Heavy lock nuts or grip bolts must also be provided, and the nut should have an enlarged chamber on the inside to protect some of the unused threads of the bolt, so that when it becomes necessary to tighten up the bolts new and clean threads may be brought into service (Fig. 35). Opinions differ as to the proper length of channel best for this purpose. As

repair of joints usually necessitates the removal of a portion of the adjacent paving, and, if this is of asphalt or of stone sets grouted with cement or mastic, the difficulty and expense of removing them is quite considerable. In this case it will be found economical to provide at each joint cast iron boxes with a removable lid through which access may be had to bolts, so that they may be tightened

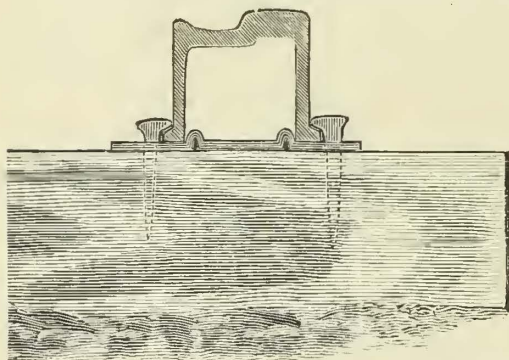


FIG. 31.—BOX GIRDER RAIL SPIKED TO TIE.

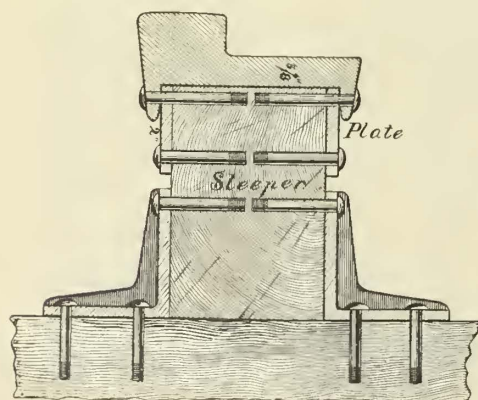


FIG. 33.—TRAM RAIL WITH DEPENDENT FLANGE SUPPORTED ON REINFORCED SLEEPERS.

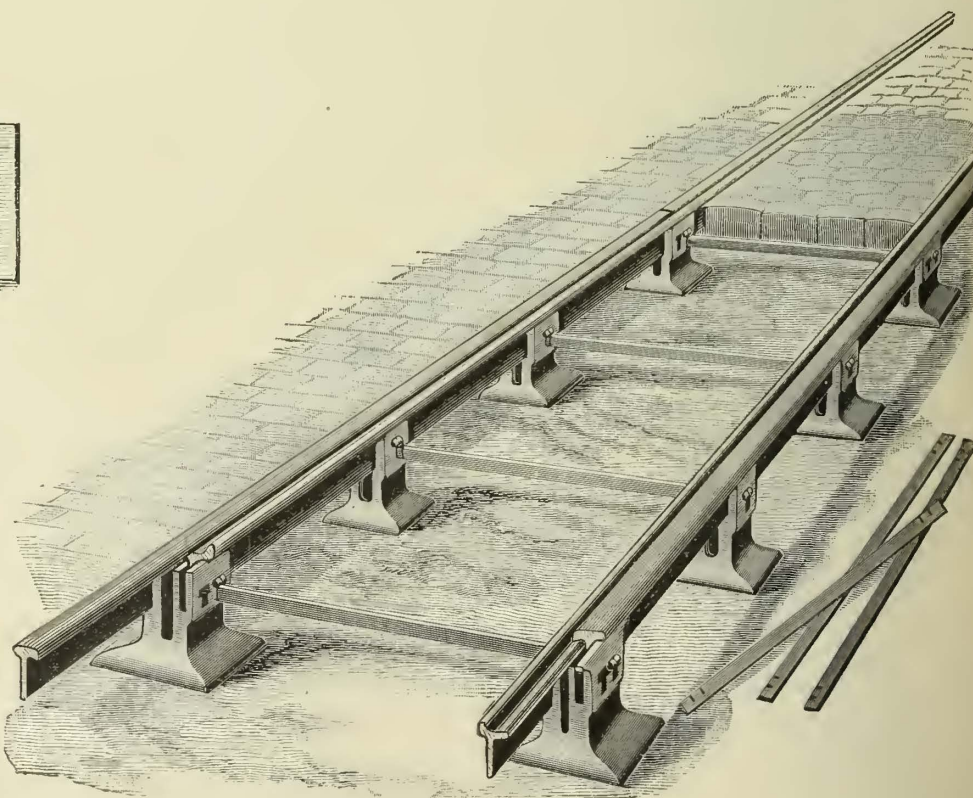


FIG. 32.—DUPLIX CONSTRUCTION.

the ends of the rails go up as well as down, there would seem to be nothing gained by the employment of an extra long bar, and the ordinary length of twenty-eight or thirty inches, with four or six bolts, will doubtless give as good results as the thirty-four or thirty-six inch bar. When the nut is being set up, the bolt should be continually struck with a heavy hammer, and just before the paving blocks are put in place the wrench should be applied

up at frequent intervals without disturbing the pavement (Figs. 36 and 37). In case a joint tie settles, the boxes are of no advantage as it will have to be tamped up, and this will necessitate the removal of the pavement, but for taking the "stitch in time," which is highly important in track maintenance, the boxes are very convenient.

It may be stated as a rule that low joints should never

be allowed with mechanical traction, for in addition to the damage inflicted upon the rolling stock as before noted, if the rail becomes arched vertically from depression at the ends it will be difficult to ever again maintain it in a level position after the joints are raised, owing to the constant effort of the metal to assume the arched form, resulting in the loosening of the connections under the middle of the rail.

posite each other; neither is it a good plan to break joints with the middle of the rail; but where joints are broken about one-third the length of the rail, good results usually follow.

Besides the channel bar joint illustrated above, there are devices in the market which combine the splice bar and bridge principles, some of which have given excellent service. Among these are the standard or girder joint

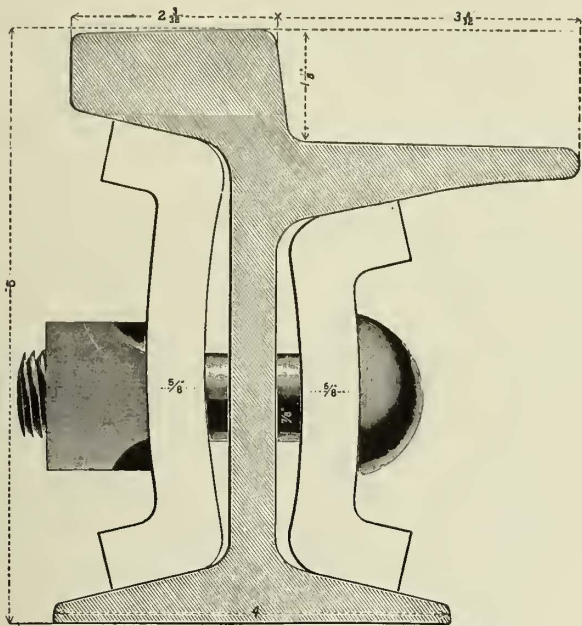


FIG. 34.—CHANNEL BAR CONNECTION.

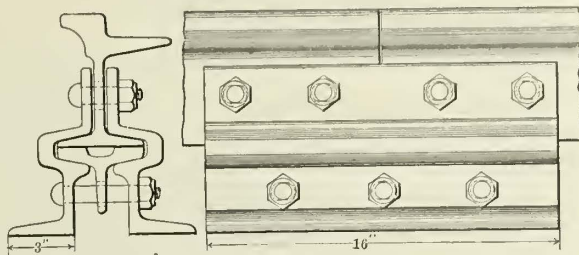


FIG. 38.—STANDARD GIRDER JOINT FOR HIGH RAIL.

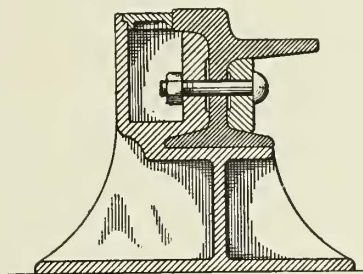


FIG. 37.—COMBINED JOINT BOX AND CHAIR.

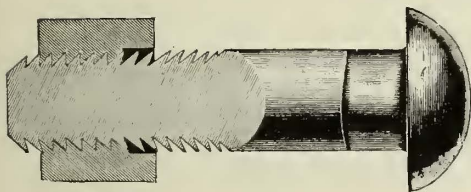


FIG. 35.—GRIP BOLT.

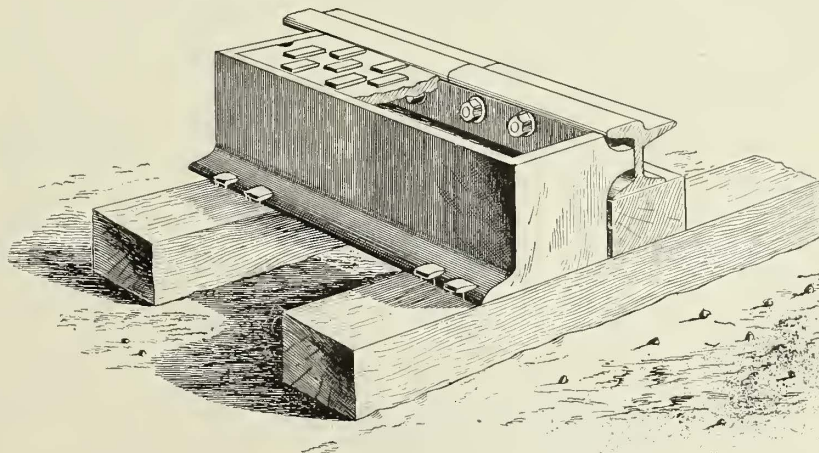


FIG. 36.—JOINT BOX.

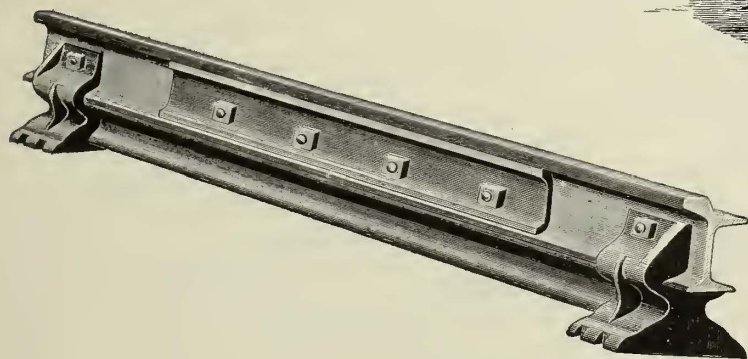
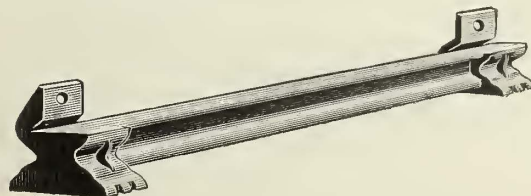


FIG. 39.—SAMSON JOINT.



The relative advantage of supported or suspended joints where wooden ties are employed need not be discussed. In treating on track construction for cable lines in the second chapter, we recommended supported joints, as the yokes are usually spaced quite a distance apart, but with ties laid closely, as shown in Figs. 13 and 14, no one can tell which is best. With the adjacent ties so placed that they come entirely under the ends of the channel bars, as shown in the last figure, the joints may be suspended, otherwise a tie should be placed immediately under the joint, except when some form of bridge joint is employed.

The position of joints with respect to each other is an important consideration. They should never be laid op-

illustrated in (Fig. 38). This consists of two side clamps of rolled steel, each a girder of great strength, and supporting a Tee bar on which the ends of the rails are seated and the whole clamped by nutlocked bolts above and below. The Tee bar or bridge may be extended so that its ends reach to the adjacent ties upon which it is supported by small two-bolt clamps, making what is termed a three-tie joint which is apparently stronger than the solid rail.

A second joint, which has been designed for the same purpose and known as the Samson bridge joint chair, is illustrated in Fig. 39. It is made by casting steel chairs upon the ends of a three foot section of inverted Tee rail. In cooling, the metal shrinks upon the end of the rail,

forming a bridge chair in one piece so that nothing can work loose. The chairs are provided with brace portions having holes which provide for securing them firmly to the rail by means of bolts, which resist any tendency of the rail to cant over. Between the chairs the splice bars are adjusted to the rail in the ordinary manner.

A similar bridge joint is shown in Fig. 40, which consists of an inverted T rail, to the ends of which chairs are secured by means of clips. This arrangement also al-

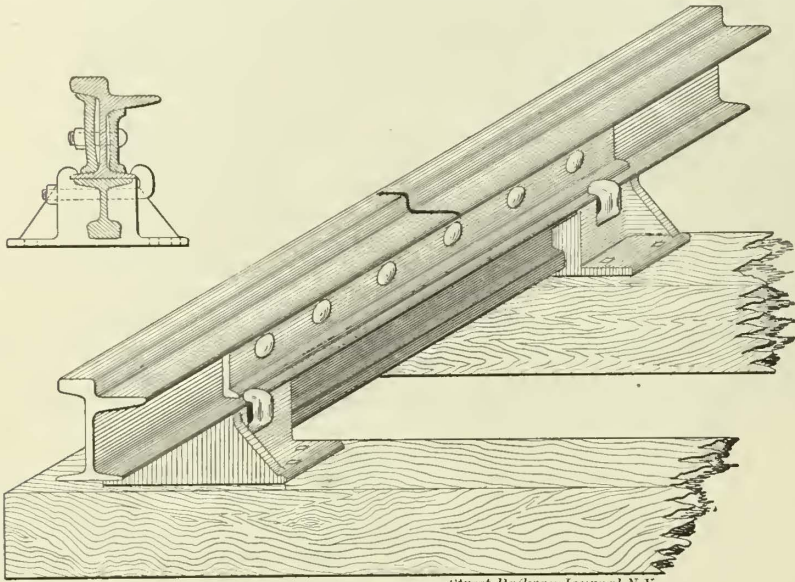


FIG. 40.—CLIP BRIDGE JOINT.

lows of the use of channel bars, the girder being entirely supplementary thereto.

A long joint chair (Fig. 41) has also been designed for use with the box girder rail. This may be extended to cover two or more ties as desired. Its construction is clearly indicated in the engraving.—*To be Continued.*

New Elevated Road for Chicago.

The most promising plan ever formed for providing rapid transit for the residents of the West Side, Chicago, is that proposed by the Metropolitan West Side Elevated Railroad Co. The incorporation was mentioned in the last number of the STREET RAILWAY JOURNAL. The

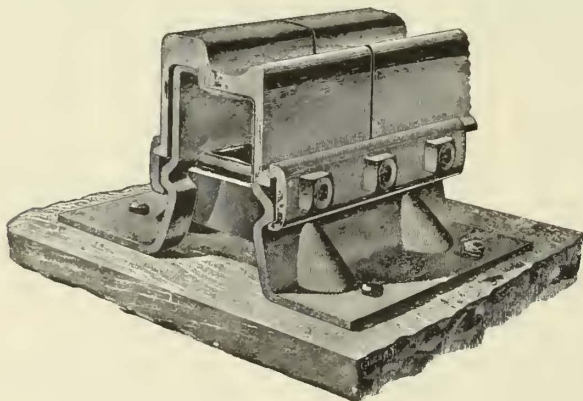


FIG. 41.—JOINT CHAIR FOR BOX GIRDER.

company are thoroughly sound financially, and those interested are substantially the same as the capitalists who have invested in the South Side L road. The company mean business, and while their plans have been before the public but a short time they have made very decided progress.

At the meeting of the City Council, April 7, a franchise to construct the road between Van Buren and Harrison Streets, with branches running Southwestward and Northwestward west of Ashland, was granted. The ordinance requires that eight miles of road be constructed within two years with double tracks, and the company are required to pay an annual license fee of \$50 per car.

The Proposed Paris Underground Railway.

The underground railway projected by Mr. J. B. Berlier for the city of Paris has been several times referred to in this journal, and we present in the following article a summary of the latest report on the subject, prepared by Mr. P. Chevillard and published in the *Revue Industrielle*, from which the accompanying plans are taken. The road starts from the Porte de Vincennes, and passes through the Cours de Vincennes, Place de la Nation, Boulevard Diderot and Rue de Lyon to the Place de la Bastille, where it enters an open cutting as far as the Rue St. Antoine. There it again enters a tunnel which continues through the Rue de Rivoli, Place de la Concorde, Les Champs Elysées, Place de l'Etoile, Avenue Victor Hugo, Place Victor Hugo and Avenue Bugeaud to the Bois de Boulogne. As will be noted, this route passes through the most important sections of Paris in an easterly and westerly direction along the north bank of the river Seine.

The total length of the line is 36,852 ft., of which 31,844 ft. are tangents and the remainder curves of from 164 to 820 ft. radius. Of this length 6,604 ft. are level. The rails, weighing 40.3 lbs., are laid on wooden ties at a three foot gauge.

Two sections have been adopted for this railway. The first is a metal tunnel nineteen feet in exterior and 18.21 ft. in interior diameter provided with two tracks. The tunnel consists of cast iron rings formed of a series of segments bolted together in the same manner as on the now well known City & South London Electric Railway. The minimum radius where this section is employed is 328 ft., which will give a proper clearance between the cars and the side of the tunnel. A cross section of the tunnel showing method of ventilation is shown in Fig. 1.

When a greater radius is necessary, or where the grade approaches the level of the ground, a rectangular section has been adopted, consisting of two masonry walls and an iron or steel roof, the clear width being 2,297 ft. Of the whole line 30,935 ft. are to be circular in

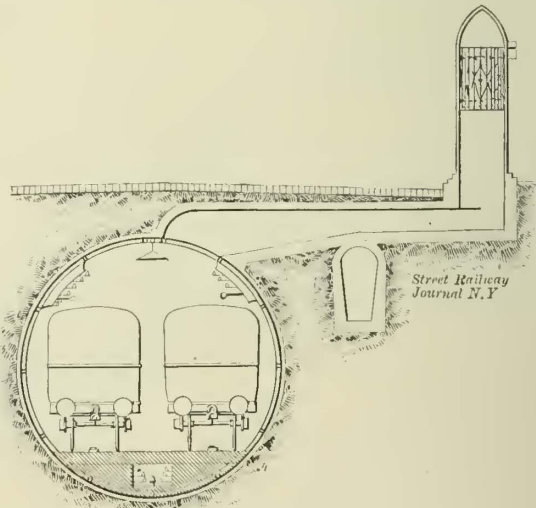


FIG. 1.—PROPOSED PARIS SUBWAY—SECTION.

section, 1,287 ft. will be rectangular, and the remaining 4,630 ft. will be taken up by stations and sidings.

The sewerage system of Paris naturally causes some inconvenience at places. Where the main Sebastopol sewer, or collector, is crossed, a bridge is thrown across the sewer at a sufficient height (5.9 ft.) to allow the workmen to pass along the banquettes on each side of the central drain, while the two water mains (3 ft. 7 ins. and 2 ft. 8 ins. in diameter) carried in the upper part of the sewer, are to be carried under the track by means of inverted syphons. See Fig. 2.

For operating purposes, the line will be divided into two sections, one about 1.86 miles and the other about

4.97 miles long. The current will be supplied at 450 volts by means of a central rail laid between the two rails of each track and carefully insulated, metallic brushes being used to take the current from this rail. The return current will pass through the ordinary rails and the metallic part of the tunnel. A central drain will collect whatever water may accumulate along the line and conduct it to the low points, where it will be removed by electric pumps.

The trains will be made up of four cars each, two provided with motors and two without. The cars will be

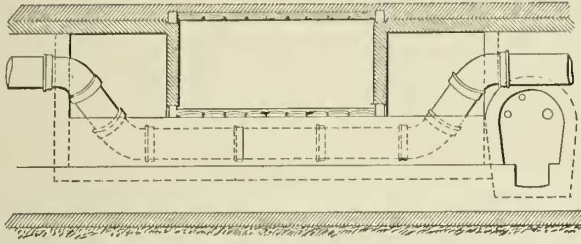


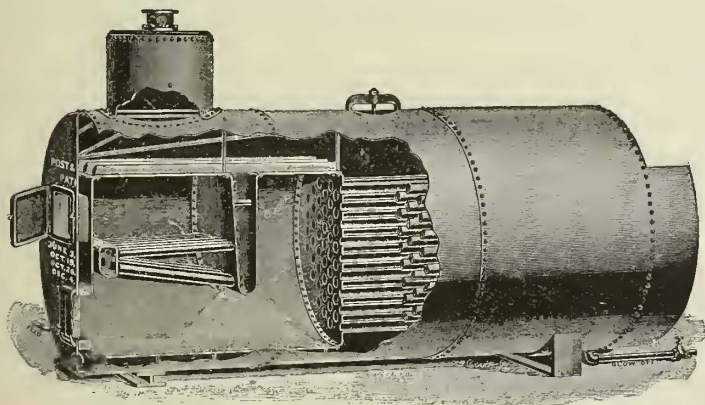
FIG. 2.—ARRANGEMENT OF SUBWAY AT SEBASTOPOL SEWER.

mounted on bogie trucks for greater ease in moving around the curves. The motor cars carry two motors of twenty-five H. P. each, connected directly to the wheels and controlled by a rheostat, the change in direction being effected by a special commutator. The electric connections will be so planned that the motorman on the front platform of the train, controls all the electric apparatus, including that for locking the doors of the cars while they are in motion. The speed of the trains has been set at twelve and a half miles, rising to fifteen and half miles when necessary to make up time or for other reasons. The total cost of construction of the line is estimated at 41,000,000 francs or \$8,200,000.

The Complete Combustion Boiler.

The problem how to best utilize the heat given off by coal in combustion for the generation of steam has taxed the ability of engineers ever since the invention of methods of utilizing steam for power purposes. The number of boilers which we have illustrated and described in these pages has been large, and below will be found a type of boiler which possesses a number of novel features.

As will be seen, the boiler is of the horizontal cylindrical, multitubular type, and does not differ materially in design from the ordinary form of tubular boiler except in the furnace. At the back of the grate a hanging water leg of steel plates, riveted to the crown sheet of the furnace,



THE COMPLETE COMBUSTION BOILER.

extends downwards towards the ash pit. The grate is formed of water tubes entering the front side of this water leg at a moderate inclination from the horizontal and at the front of the furnace entering a gun metal box just below the furnace doors. Return tubes, also inclined, extend from this box back to the water leg and insure circulation of water through the shell and water leg through the grate tubes. Boilers with this type of grate have been

in use for more than five years without requiring the outlay of one dollar for repairs.

The space below the grate, ordinarily the ash pit, is the combustion chamber, the air for combustion being admitted through the fire box above the grate and drawn down through the grate bars by the chimney draft, where it becomes highly heated during its combination with the hot gases of the coal. As the combustion chamber is completely surrounded by the water heating surfaces of the boiler, and as the heat after leaving the combustion chamber passes through the tubes which form a large absorbing area directly to the uptake chimney, it will be seen that the boiler will have a high efficiency.

Another valuable feature of the boiler is its strength and durability, since, having a tube let in its centre, stayed and strengthened by an adjacent water leg, both riveted to the fire box and the whole securely bolted to the outer shell, the boiler is especially strong.

So long as water in the boiler is kept above the upper ends of the grate bars it is impossible for them to burn off, and no necessity for renewal of grate during the life of the boiler is probable. If, however, through negligence or failure of pump or injector, the water should fall below the grate bars, the latter would soon burn off and the steam would quickly extinguish the fire, making the boiler automatically and perfectly safe. It has been practically demonstrated by complete combustion boilers that the passage of the gaseous elements of fuel down through a very hot fire solves the problem of burning smoke, or, in other words, prevents the formation of smoke. This not only is an economical feature of using all the fuel but prevents the formation of any soot in the tubes, a point whose advantages will be readily recognized. The circulation of water and steam in every direction is unimpeded and perfect and the steam obtained is very dry. The boiler can burn either hard or soft coal, wood, dry tan, shavings or any other kind of fuel which may be burned in any steam boiler.

No brick walls being required in the setting of the boiler, it is easy to install, and as no cold air is admitted in the interior of the boiler below and beyond the firebox, the chief cause of leakage in the tubes, extremes of expansion and contraction, are wholly avoided. It might also be added that as the heat generated in this boiler is drawn away from the fuel doors, the boiler is an easy one to fire, and the temperature of the boiler house is kept low. The latest designed boiler differs somewhat from that described and illustrated above. The water space about the firebox is of uniform space, three inches, and provision is made for steam by means of a large drum on the top of the boiler, with openings to admit free circulation of steam.

The following figures of some results of tests will illustrate a number of the points already referred to. At a test of a twenty-five H. P. boiler at Bishop Bros., East Somerville, Mass., by Francis A. Galloupe, the evaporation from and at 212 degs. was found to be equivalent to 11.53 lbs. of water for one pound of combustible. Another test of a seventy-five H. P. boiler made at Smith & Carleton's iron works, South Boston, by Geo. H. Reynolds, showed equivalent evaporation of 12.21 lbs. to one pound of combustible, the water evaporated from and at 212 degs. per square foot of heating surface per hour 2.85 lbs. Tests of three 100 H. P. boilers at the Chicago City Electric Light Plant, made by J. M. Stroder, gave equivalent evaporation per pound combustible from and at 212 degs. 11.75 lbs., and combustible consumed per H. P. 2.924 lbs. In all of these tests the horse power developed was considerably in excess of the rated horse power, and the temperature of the boiler room was remarkably low. We were present last month at a test made of this boiler, under ordinary working conditions, at the factory of McGuire & Clark, at 68 Madison Street, New York. The measurements were made by Peter Backus & Son, engineers of New York, and the results obtained by them were even better than those mentioned above.

The manufacture and sale of this boiler are controlled by the Central Complete Combustion Co., of 13 Park Row, New York.

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

Address all communications to

*Street Railway Publishing Co.,
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The Plans for Electric Equipment in Brooklyn are so extensive and are being pushed forward so vigorously by the energetic men in charge of the different railway companies that in a short time Brooklyn will be hardly recognizable with its new equipment. It is owing to the fact that these improvements will soon be made that the article in another column on "Street Railways in Brooklyn" will have a special interest. It at once records the condition of the Brooklyn street railways in the spring of 1892, and outlines the way in which they will be equipped with electric power.

Attention is Called to the correspondence in this and the two numbers preceding relating to the taxing of street railway corporations by state and city authorities. The interest now awakened in the matter suggests a review of the papers entitled "Public and State Treatment of Corporations," which were presented at the last three meetings of the American Street Railway Association, by G. Hilton Scribner. If the statement, of our correspondent, J. B., prove correct, then the street railway companies of New York should unite and institute proceedings to recover the excess of taxes already paid, and prevent the assessment of too high a rate in the future.

The Municipal Management of Street Railways is frequently urged by writers of a socialistic turn of mind. We do not believe that any city ever cited as an example can run street cars as well as a private corporation. The socialists of Chicago recently demanded, in a set of resolutions, that the city solve the transportation problem by going into the street railway business. It is not necessary yet to argue the matter from the point of view of the political economist. As long as municipal authorities are wholly unable to grapple with so simple and easy a task as street cleaning, they can scarcely be trusted safely with the business of intramural transportation which requires for its satisfactory conduct talent of no mean order.

The State Department has performed a meritorious service in the collection of statistics upon foreign transit facilities, and an abstract of the principal points in a report recently published by this department upon this subject is given upon another page. We think that every one of our American readers will be satisfied after reading this report that the American system is the only one for our conditions, and if he has been abroad he will be more than ever of the opinion that the zone or graduated fare system, the plan limiting the number of passengers per car and other devices of our European cousins to nominally aid the general public, are in reality burdens on both the public and railway company, and cannot but result in a contraction of transit facilities.

The Street Railway Situation in Chicago is far more satisfactory to the residents of that city than it was a few months ago. The operating companies are increasing their mileage, and their extensions this year will probably aggregate over sixty miles. Several companies, recently granted franchises, promise to have cars in operation before snow flies again. There is a probability that the South Side elevated road will be carrying passengers within a few weeks at the outside. With such an increase in intramural transportation facilities, and with such an evident desire on the part of the companies to meet the demands made upon them, the problem which has seemed so serious to Chicagoans within the past few months should be very satisfactorily solved.

Of the Many Absurd Methods devised for taxing street railway companies, the most unreasonable and illogical is that of demanding a special tax or license fee for every car owned or operated by the railway company. Strangely enough this seems to be one of the most common methods adopted by city governments to raise money from street railway companies. But if we look at the result, we will see the absurdity of a law of this kind. It immediately puts a premium upon the running of a small number of cars by the railway company. If no such law exists, it often pays a street railway company to have a large number of reserve cars, which need only be run during the few morning and evening hours of greatest traffic. Impose a tax, however, on each of these extra cars, equal in amount to that paid by the all day cars, as is usually done, and the license fee paid to the city for the cars will more than counterbalance their slight additional earning capacity. The company will therefore prefer to add no more cars at these hours or during the day than is absolutely necessary, and will run with crowded cars. If a great deal of the energy expended in aldermanic and other circles over the advocacy of "no seat, no fare," and similar bills, intended to give every passenger a seat were devoted to lightening the burdens already carried by street railway companies, and the repeal of laws similar to the one mentioned here, we think that the consummation devoutly wished for would be sooner attained.

The High Rank which the street railway business of this country is taking in comparison with other pursuits is gratifying to all who are interested (and who is there that is not?) in the growth of this comparatively young industry. That it is becoming an exceptionally profitable and popular business is evidenced by the class of men who are now controlling large interests of this

kind in New York and other large cities. Among these are the names of persons who now hold, or until recently held, positions in the highest council of the nation. Their names are familiar to all and need not be mentioned in this connection, but the fact confirms one prediction repeatedly made during the last three years, that this business was likely to develop in the near future to proportions far beyond all preconceived notions regarding it, and that its *personnel* would improve accordingly. The prejudice is being overcome that formerly existed against the business, because of the peculiar manipulation of stocks that was practiced in some localities in the early history of the industry. There is no place for trickery in the street railway field and, fortunately, the number is growing less and less, and no one is more rejoiced at the fact than the veterans in the business. No one from the inside can survey the field without feeling an impulse of exultation, while at the same time he resolves to place his individual share of the business on a still higher plane towards perfection. We are proud to claim relationship to an industry that is vital to the well being of so great a mass of people and propose to do all that is in our power to assist in its further growth.

The Negotiable Value of a street railway franchise depends not only upon the earning capacity of the lines which are operating under it, but also upon its permanency. This fact is strikingly illustrated in the experience of the Union Railway Co. of Providence, R. I., in attempting to float its bonds in the leading money markets, and fully set forth in another column. Although the company has great financial strength, having done a profitable business for many years with its present appliances, yet its proposed bonds are unsalable because the franchise, which constitutes the essential element of security, is not perpetual, nor has it any fixed life, but it is dependent upon the pleasure of the City Council, upon a notice of ninety days. The company is justified, we think, in its action to secure from the legislature a modification of the objectionable features in its charter, and common justice demands that the measures receive favorable consideration. The history of the case will serve as a caution to new companies seeking franchises; for while they may be willing to concede to the city authorities the right to order the rails out of the street whenever the service is unsatisfactory to the citizens or a majority of the City Government, and while the exercise of such right will be most improbable, yet the practical effect will be to deprive the company of any vested rights in the streets whatever. The lenders of large amounts of money require absolute security, and while it is not supposable that a city with society as it is now constituted, would take advantage of a railroad company and on short notice order them out of the streets, it is well known that there is a growing class in every community that would not hesitate, should it ever come into power, to cripple a company, or even to confiscate its plant; hence the wise caution on the part of the moneyed investors, and the necessity of securing permanent and liberal concessions from city authorities.

Sharp Practice is Readily Detected by street railway companies, and those who resort to it are almost invariably the losers. This somewhat trite statement is suggested by the complaints of several operating companies who have recently been making heavy purchases for extensions of their systems. An officer of one of them

relates that he ordered a number of armatures for his generators of a company who instead of supplying the materials honestly sent him armatures that had been condemned as unfit for use. The latter company subsequently had to redeem all the parts, pay the incidental expenses, and excuse themselves by a variety of elaborately prepared apologies. In another instance a lot of worthless poles were sent to a company who, of course, promptly rejected them and squarely refused to transact farther business with the dealer. Still another illustration was recently called to our attention when a manufacturer tried to palm off a lot of cheap car fixtures instead of those called for by specifications. But why enumerate instances? They are coming to light too often in these days of active demand in the street railway field. It would be interesting, however, to ascertain the motives which actuate those who endeavor to secure in this way a dishonest advantage of a railway company. It is certainly our opinion, based on rather extended observation, that street railway men are not less shrewd and wide awake than the smartest men in the community, and those who seek to take them in by such silly confidence games as substituting worthless for good material are bound to suffer in the transaction. The old saw about honesty is as fully in force to-day as ever. It would be manifestly unfair, however, to cite these instances of sharp practice without expressing at the same time our confident belief in the honesty and integrity of the vast majority of those engaged in selling supplies to railways. Facts are coming to light repeatedly to show that blunt honesty and fair dealing characterize all their dealings. Honesty has paid, and it retains for them their customers. The only curious fact is that some few seem to think they can outwit their customers and that they suffer no loss when detected in their game of misrepresentation.

The Cost of Operating Street Railways is not as easily ascertained as it should be. Figures are obtainable, to be sure, which purport to settle the question definitively; but, unfortunately, they prove upon examination to be unsatisfactory; in fact, statistics coming from different sources are comparatively so few and so conflicting, that after considering them one is utterly unable to form any sort of a consistent opinion. Those engaged in introducing the several systems of street car propulsion are certainly generous in the matter of data; but from the very nature of the case their statements do not always inspire confidence. Every prospective purchaser discounts their statements, and in many instances figures are prepared with the knowledge that a margin must be allowed for the discount. It will always be true, however that any prediction, no matter how confident, regarding the operation of a certain machine will never be considered so reliable as the impartial statement of the man who carefully watches its daily performance. Tabulated statements of this kind are urgently needed in the street railway field at the present day. As many companies are contemplating extensive improvements and changes of motive power, the statistics are of peculiar value just now. Where shall we look for them? Here and there a street railway manager may be found willing to give us figures showing the cost of operation with his particular plant, but the great majority of those competent to furnish data guard them very jealously. The reasons that influence them in withholding the data are well known, but we believe that in almost every case the policy is a mistaken

one, and we incline very strongly to the belief that they should be less chary in furnishing the results of their experience, costly though it may have been. When data of the kind referred to are generally available it will be possible to dispose of questions which at the present time we cannot settle for the simple reason that facts are not forthcoming in a sufficient number of instances to warrant a general conclusion. Should the policy of withholding statistics be abandoned, companies generally would be the gainers, in our opinion, as in that event each one would be afforded the means of ascertaining by comparison whether they were securing proper returns for their expenditures.

The Report of the Boston Rapid Transit Commission, of which we publish an abstract in this issue, contains matter which will be read carefully by all interested in the rapid transit problem as it is presented in Boston. The system proposed by the Commission, instead of being designed to act as an auxiliary to the present transportation system, as was expected by some, is intended to take passengers directly from the main points of departure in the principal suburbs which are accessible to the system and to land them within a short distance of their destination in the business district, making the surface lines act as feeders to the transit system and largely reducing the surface tracks in the centre of the city. It was even proposed to recommend the entire discontinuance of surface cars in the district included within the proposed central circuit, but this was considered by the commissioners too radical to be incorporated in the final report, though recommended by the engineers. The disposal made of the steam railroad terminals in the city was no less summary, involving, as it does, the transfer of valuable properties from one company to another for the intended benefit of the general public. But it is a question whether the vested interests in both the steam and street railway directions can be arranged and satisfactory terms can be agreed upon for carrying out such important changes to say nothing of the question as to whether capitalists can be found who will carry out the extensive projects of the Commission, for it is very sensibly decided that such a scheme if carried out should at least be under the management of, if not built by the capital of private individuals. For this reason we think that many months will elapse before the plans proposed are consummated. Turning now to the engineering features of the proposed system, it is interesting to note that, contrary to the example of the corresponding body in New York, an elevated has been chosen in preference to an underground road. To be sure, a short section of the proposed Boston system is below the surface of the earth, but this, under the conditions, was unavoidable, and it is only a short link in an otherwise complete elevated system. The deep subway, such as in use in the City & South London railway, was rejected although it afforded the only method of reaching the extensive suburbs of East Boston and Chelsea, which are necessarily left without direct communication with the system selected. If both this and the New York system, as outlined in the reports of their Rapid Transit Commissions, be constructed there will be an opportunity for an interesting comparison between these different methods of urban railway construction. But neither, we think, will permanently reduce, still less eliminate, the demand for the present surface transit fa-

ilities, even on the routes covered by the more rapid transit systems.

The Magnitude of the Task that confronts the executive officers of a large street railway company when a change in motive power is contemplated is seldom fully realized at first by the parties interested, and *never* appreciated by the public. Only those who have grappled with the problem and have gone through to the finish, or are at present engaged in the work have any proper concept of the difficulties, the myriad of details and the petty annoyances which are inseparable from the undertaking. As no one is fit to be an officer in war who has not heroic blood in his veins, so no one should undertake to manage the business of installing a cable or electric plant, who has not a heart full of love for his profession combined with sufficient energy and enthusiasm to make him willing to confront all its responsibilities. It requires great courage, skill, patience, untiring industry and a fidelity to duty seldom called for in other lines of business. That these qualities are possessed to a large degree by the street railway fraternity in general is evidenced by the fact that very few, if any, have shrunk from the task when it was presented, and that success has generally crowned their efforts. The business at large appears to be in the hands of a class of valiant men who seem to have been raised up to steer the bark of mechanical progress, as are statesmen and skilled generals when the safety of the state is imperilled. In order to aid the public to appreciate somewhat the responsibilities that must be met by the few individuals that control the affairs of a street railway corporation we give in order the leading details. First, there is the work of renewing the franchise and securing from the local authorities and property owners the necessary permits. This settled, the securing of the necessary capital is a no less important question. A competent engineer must now be selected, and a choice of systems decided upon. The source of power and the relative merits of different types of engines, and other station equipment; the awarding of contracts; the design of cars and the placing of their construction in the hands of competent builders; the type of rail and character of the street construction; the selection of competent men to superintend the details; the disposition of old material and the training of employes so that they shall handle the new appliances skillfully. All this is to be done by the manager, and at the same time he must study the interests (often conflicting) of the moneyed investor and those of the public whom he is supposed to serve, while he listens to all the mean and buzzing grievances of offended patrons, and not infrequently bears the sneers and unrecognizing look of friends who fancy he is engaged in a scheme that will imperil the lives of themselves and families or affect unfavorably the value of their property. Others are so bound to custom that they oppose all progress, invoke the law and even attempt to make the truth lie for them. It will thus be seen that the position of executive officers at the head of a company engaged in making improvements of this kind is not an enviable one, and we cannot better express our admiration of their courage than by quoting the words of Hampden in his colloquy with Cromwell:

“ When I read o'er the bitter lives
Of men whose eager hearts were quite too great
To beat beneath the cramped mode of the day,
And see them mocked at by the world they love,

Haggling with prejudice for pennyworths
Of that reform which their hard toil will make
The common birthright of the age to come,—
When I see this, spite of my faith in God,
I marvel how their hearts bear up so long.”

An Extension of Time for one year has been granted to the Metropolitan Railroad Co. of Washington, D. C., by Congress, in which to complete the equipment of its lines for mechanical (storage battery) traction. The passage of this bill furnished an occasion for the enactment of two other measures; one, as is noted in another column, repeals the act prohibiting the use of overhead wires, and the other requires that the Metropolitan company shall not collect fare from passengers not provided with seats. The first is a wise measure, but the other is more unwise than the old law which the first repealed. The new law has not even the redeeming feature that is a part of the same practice on foreign lines which this law is supposed to copy, for on lines abroad where the “no seat no fare” practice is in vogue, the companies are prohibited from receiving more passengers than can be provided with seats. But under the Washington provision the company must receive all who come, while they are restrained from collecting fare from those standing. This requirement furnishes a good opportunity for unscrupulous persons to beat their way with the company, for they have only to wait at proper localities till a loaded car approaches, when they will board it and avoid the payment of fare. The repeal of the law relating to overhead wires confirms what we said at the time the measure was before Congress, that “when law making bodies assume to enact laws that are not called for by public demands or needs they are likely to be absurd and contradictory,” and we think it is only a question of time when the measure relating to fare will be repealed. We are charitable enough to allow that it is because of ignorance regarding the situation that restrictions of the above nature are constantly being placed upon the street railways operating in the District of Columbia, and not until there is more enlightenment along these lines can anything better be expected. It is clearly the duty of street railways in all parts of the country to undertake to inform their local representatives regarding the fundamental principles of the street railway business, or to agree to look to it when nominations are being made that only men who have some practical knowledge of this business be put forward for the important position of a representative to Congress. In other words, use their political influence, which is not small when properly organized; for it is only a question of time when city authorities will be aping the action of the more prominent body and seek to introduce like measures in local requirements. If the individual congressman and the *personnel* of municipal authorities everywhere would learn something of the practical operation of street car lines, they would discover the many difficulties in the way and be more reasonable in their requirements. In connection with the above enactments we expected to see the few practical street railway men in the present Congress come to the defence of these interests in Washington, but so far as we are informed none of them raised their voices in debate either in favor of the one or in opposition to the other measure. It would seem that the enactment and subsequent repeal of such measures as that relating to the use of overhead wires would tend to teach the average legislator that he is not so much

wiser than other people, and he would feel somewhat humiliated when the absurdity of such measures was fully demonstrated. Not so, however; they all seem to remain in the unintelligible state so peculiar to the average politician, which Lowell humorously portrayed in one of the Biglow Papers:

“Wal, sposin’ we hed to gulp down our perfessions,
We were ready to come out next mornin’ with fresh ones;
Besides, ef we did, ’twas our business alone,
Fer couldn’t we du wut we would with our own?
An’ ef a man can, wen provisions hev riz so,
Eat up his own words, it’s a marcy it is so.”

In this connection we take occasion to express our sympathy for the Washington companies that they are required to do business under the severe restrictions imposed upon them, while the burdens of the situation are aggravated by the constant fear of new and still more hostile regulations.

Correspondence.

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

Car Builder vs. Car Buyer: What is the Proper Relation Between Them?

ST. LOUIS, April 22, 1892.

EDITORS STREET RAILWAY JOURNAL:—

The above question was suggested by the following quotation from a letter written by the general manager of a railroad company to a car builder, who had made a proposition to him for cars: “I am sorry to say that I cannot trade with you on the street cars, as your price is so much above others that I have received. I would not feel justifiable in giving you the order at the difference in figures.”

As the majority of street railroads are controlled by men thoroughly conversant with the purchase of stocks and bonds of various kinds and the ways of Wall Street, perhaps it would be suggestive if they would in their imagination substitute bonds for cars, and so send out a proposition like this:

SPECIFICATIONS.

OFFICE.

MESSRS.

BANKERS & BROKERS.

We wish to purchase \$500,000 in bonds of a street railroad. Bonds to be each for \$1,000, payable in 20 years.

Interest 6 per cent., payable semi-annually. To be printed on finest paper and executed in highest style of the engraver’s art.

We have no further specifications, but party offering bonds at lowest prices and on best terms will have preference.

You are respectfully requested to make a proposition.

Yours respectfully,

..... Bankers.

If, in reply to such request, they were offered \$1,000 bonds ranging in price from \$500 each, bearing 7 per cent. interest, principal and interest payable in gold, up to \$1,200 each, bearing 5 per cent. interest, the probabilities are they would be able to discriminate to within one-tenth of one per cent. of the exact value of each respective offer, and get full value of their money in any case, *because they would know what they were buying*. On the other hand, it would be a dangerous thing for a novice to undertake to buy bonds under such specifications and be governed entirely by price. Such a proposition would strike the average banker or broker as being too silly and ridiculous to deserve serious comment, but is it, after all, more so than the every day efforts of some men to buy cars? For certain buyers look over the different offers, and having ascertained which is the lowest, give the order accordingly.

This being a common method of procedure, what is the result? Certain car builders reduce the price next

time, so as to be the lowest bidder, and in order to save themselves, make their cars to suit their price.

In the opinion of the writer, it is unfortunate for that car builder who has had the experience of many years, and who in that time has tried conscientiously to treat his customers fairly and to improve the quality of his work, that so many of his prospective patrons are so poorly posted about cars. It being conceded that some purchasers of cars are ignorant as to materials and those other details that are requisite to make a good car, the question naturally arises, Is there any way by which they can make an intelligent discrimination between different builders? I would say YES. By applying the same rules they would use in buying and selling bonds.

First.—What is the general reputation of the car builder? Is he a straightforward, upright man, or is he known to be shrewd, keen and given to sharp tricks in securing orders?

Second.—Has he had experience in the business? If so, how much?

Third.—Is the concern owned and managed by men who are mechanics, and who have had long training in their business, is it a combination of capitalists (who are always the managers, and who can see only the money in the job)?

Having carefully investigated the character and reputation of the car builders it is proposed to buy from, the next step would be to select one or two good mechanics who have been employed by the railroad company long enough to know what is required for best service. Take them on a tour of the shops of the different bidders, care being taken not to express any preference, otherwise the mechanics will be prejudiced in their judgment in order to meet what they fancy to be their employer's ideas.

Other important points to be considered are: What are the elements that go to make up the cost of a car? How much for material? How much for labor? How much for profit? What is the difference in bids? Does this result from a difference in the labor or material of different builders? If so, to what extent in each case? Can one manufacturer get the same material for less money than another maker, or can he procure his labor for less? If so, does he get as good, or do you believe all mechanics are good and the work of one no better than that of another, or that it makes no difference whether a mechanic is good or not? Do you want less costly material used or a cheaper class of labor? Do you think it practicable for a manufacturer thoroughly versed in his business and who has an honest pride in his work to make a high class and low class of work with the same mechanics? If any manufacturer agrees to do this, look out for him.

In conclusion, the writer would suggest that the correct relation of car builder to car buyer is the same as that of employe and employer. In other words, you make up your mind to select a certain manufacturer who will engage to look after your interests in the building of your cars, allowing him so much for labor, so much for material, so much for profit for his compensation; then the question would arise, Can this manufacturer be trusted to do as he agrees, or will he at once go to work to see where he can take advantage by using material of an inferior grade, and skimping labor, to the end that his profit may be increased?

It is safe to say that when an order for cars is placed the buyer is at the mercy of the builder. If the former has been wise in the selection of the latter, all may be well; if not, advantage may be taken of ignorance, notwithstanding subsequent efforts to guard against it. B.

Street Railway Taxation.

March 25, 1892.

EDITORS STREET RAILWAY JOURNAL:—

In a careful examination of the three papers by Mr. G. Hilton Scribner, read before the last three meetings of the American Street Railway Association, the conviction is forced upon me that some of our street railways have been paying more taxes to the State of New York than the law calls for, and by inference, as the laws in the par-

ticulars to which we refer are somewhat similar in all the states of the Union, the idea is somewhat justified that street railways have been bled by somebody contrary to the spirit of corporation taxation. Mr. Scribner in his second paper said: "Now, one street railroad company owning but \$344,000 of personal property all told, paid, besides its real estate tax, \$38,000, which is a little more than 11 per cent. in one year upon its entire personal property, not estimated at a low valuation, but computed at cost, without any allowance for wear or depreciation. All other companies are paid at about the same rate without any deduction for indebtedness, bonded or otherwise."

If Mr. Scribner states the truth, and I do not doubt his word, the street railways of this state have largely overpaid their taxes; I say largely, but that word hardly meets the situation; they have overpaid what the laws call for by an excess of nearly 400 per cent. The street railway companies of this state cannot do better than look up this subject and put in a claim for rebates, if they have been paying taxes at the rate of 11 per cent. on the actual valuation of their plants. In truth, this assertion on Mr. Scribner's part, is so extraordinary that when explained to the tax office officials they derided it, saying, it was preposterous. The tax laws of this state, and nearly all other states, tax corporate property only once; and the New York laws put the figures at \$16.86 on each \$1,000 of the net valuation of the capital stock (less all stock securities on hand representing other corporations, in or out of the state, and less real estate and government bonds), for the municipality and county of New York, which tax is to be added to the state tax, an amount which brings the whole tax up in the neighborhood of \$20.00 on the \$1,000, for recent years. But that is only one-fifth of the sum which Mr. Scribner mentions as being paid right along by New York's street railways; yet why they pay a five-fold tax, he fails to explain. He accuses the law makers of gross injustice, in requiring street railways to pay such an exorbitant tax, and if his figures are correct, certainly he is justified in charging extortion somewhere.

The suspicion is reasonable that this overtaxation is a part of the method of making up the tax papers in the tax office, rather than any direct intent to overtax street railways. It is a habit of some of the clerks, when they do not know what amount is proper to put in an assessment, to put down almost anything, always putting it high enough, and trust the company taxed to rectify errors. Now, it may be that some of our street railways take the assessment literally just as it reaches them, and pay it without examining the law, or the justice of the assessment applied to their particular case. I have no other explanation of Mr. Scribner's statement, so long as such excessive overcharges have been the rule. If this is the true interpretation of the matter it may be money in the pockets of street railways if they hold a meeting on the subject to compare notes, and to learn exactly how much tax they have overpaid during past years. Besides that they could engage service to examine the tax laws for all concerned, as the laws are nearly the same for all cases, and such searchers could correct each tax assessment, if it contained errors, and see that a proper assessment is made out for each case. There is no double taxation in this state, except as before explained in these columns, in the case of real estate; in that instance real estate is taxed, as well as the mortgages upon it, the excuse being that the assessed valuation is, as a rule, so low that the mortgage only makes up the difference in value. But this excuse is not very good, for the great majority of real estate is mortgaged pretty well up to its auction, if to no other, value. Therefore, some real estate is, under the law, bearing a far heavier burden than street railway corporations, which Mr. Scribner energetically asserts are so outrageously overtaxed.

The real and personal tax laws of the different states are no easy matter to analyze; in the case of this state all personal property is taxable, no matter what its value may be with certain inconsiderable exceptions. The assessor, however, exempts all small properties, such as house furniture and small accumulations of anything having a commercial value, but this is wholly voluntary

on his part. The law exempts nothing in the shape of property (less the above exception) and all household effects as well as any other property, are taxable. It is an extraordinary power thus wielded by the assessor, but I do not hear that he abuses it in the case of people in ordinary circumstances.

If street railways receive any tax assessment notices which in amount exceed 2 per cent., for this year, of the net value of their plant and resources, although the tax takes the form of a tax on the capital stock, they can take the assessment to the tax office, if promptly attended to, and have any excess of tax corrected. I do not understand why every street railway does not know this, and if they do, I do not understand how all of them—according to Mr. Scribner—have been paying so much more than they ought to pay. A corporation can deduct from the assessment of personal property all stocks representing other stock companies, which means in practice, curious as it may seem, that one corporation by investing its personal resources in another corporation, and that other corporation investing all of its personal resources in the first corporation, neither, under the law, is liable for any taxes; because by means of the mutual investments, there remain no taxable assets.

It may be that Mr. Scribner considers a corporation is taxed twice when it is taxed separately by city and county, then by the state; if he does, he should note that all other forms of taxation include the same three divisions of government. All personal taxation includes the three forms, as is likewise the case with real estate; only in the latter case, in this state, the three are united in one sum, while with some corporations they are divided into two, but the total amount comes to about the same thing. There is no double taxation except that described.

Since the above was written, before reading Mr. Scribner's kind criticism, published in the April issue of this journal, of my remarks made the month before, and because he makes specific charges against the New York State taxation law, which, if correct, wholly upsets my former argument, I placed all the papers before the attention of the proper authorities, with a view to have this subject carefully straightened out. And among these authorities I am particularly indebted to George S. Coleman, Esq., assistant corporation counsel of the city of New York, for most kindly aid.

Just as stated above, taking Mr. Scribner's figures of what some street railway companies have paid in taxes for granted, the existing laws require no such taxation; and so long as these taxes have been paid, the present investigation shows these overpayments are the result of errors somewhere, which ought to be rectified. The principle and aim contained in the present system of taxing street railway corporations is to tax a company's resources, that is, their capital or capital stock and surplus in excess of liabilities. And such taxation occurs only once on any part of such resources, that is, once each for the state, the city and the county. As we have repeatedly said, in the case of street railways there is no double taxation of the same thing under the law. There is, as Mr. Scribner says, \$50 collected on each car as a license fee for doing business, but this is not a tax, as the word tax is used; it is a fee given by the company for its franchise; that is, the franchise has a value, and its owners sell it for the price named in the franchise. The street railway company also pays a small sum annually to defray the costs of the railroad commissioners; but this likewise is a part of the cost of the franchise, and not a tax for the purpose of defraying the expenses of the government; merely a cost which in the public estimation is for the general good. Whether right or wrong, it is not our purpose to discuss here. The point is enough in remembering that the public get no direct benefit from the expenditure of this money; it all goes for the proper management of the railway interests of the state.

Mr. Scribner says that only 75 per cent. of the value of any real estate is deducted from the assessment, and that the remaining 25 per cent. is taxed over and over again as personal estate. That statement is correct, except in the

particular of repeated taxation of the 25 per cent. surplus of real estate. It makes no difference to the railway company what may be the assessed valuation of the real estate, whether it be 75 per cent. or 50 per cent. of its real valuation; for whatever the amount, it is only assessed once, and it matters nothing to the company if that once is on real estate or on personal estate, except in a secondary particular, which we will hereafter describe. If the 25 per cent. surplus value of real estate is not taxed as real estate it is taxed as personal, or *vice versa*, if taxed as real estate it is not taxed as personal. Mr. Scribner goes on: "The tracks are again assessed and taxed by themselves, although wholly included in the stock assessment." This statement is an error; the tracks are assessed in the different wards of the city as real estate, say, at the value of \$10,000 per mile of double track, which is supposed to represent its market value. Being assessed as real estate it is deducted from the companies' personal estate, precisely like any real estate. So there is no double taxation here. If the tracks are worth more to the company than \$10,000 per mile, whatever that excess is, is paid in the personal assessment and not in the real estate assessment.

Mr. Scribner continues: "The capital stock even, including as it must and always does the full value of the real and personal estate, is again assessed and taxed on the basis of the dividend it pays. Again, a heavy state tax is levied, based on gross earnings." As this statement reads it is entirely wrong; there is no such double or triple taxation of the same thing as is here implied; the two mentioned ways of taxation are either one or the other, and adopted by the state as its form of taxation, and a proper allowance in the official tax rate of each year is made to allow for one of these methods. In this way: For the year 1891, the tax levy on real and personal property was at the rate of 1.90 per cent., which amount embraced the taxation for the city, county and state; and the local tax levy on the personal estate of such corporations, joint stock companies or associations as are subject to direct state taxation was 1.686 per cent. This means, that the county and city of New York separated their tax from the state tax for such cases, which include street railways, and the state taxed them in one of the two ways Mr. Scribner describes. The reduction in the per cent. of taxation from 1.90 to 1.686, is an allowance for the state's taxation of these corporations. Not that the allowance is exactly equivalent to the separated state tax rate, but in the making up of the annual rates that allowance was made, and no part of the 1.686 per cent. goes to the state. It may thus be understood, that when the state assesses corporations in one of the two methods Mr. Scribner describes, it is not a double taxation as his words imply. Neither does the state tax street railways under both the methods he mentions, but it selects one of the two, as accords with certain provisions of the law which are too long to relate here.

In summary, we repeat what we have before said, that there is no double taxation of the resources of street railway corporations in this state, if the assessors themselves, and the counselors connected with them, know anything about the subject; and I know of no better authority. As I do not question Mr. Scribner's statements regarding the sums of money he says certain street railway companies have paid in taxes, I am only able to explain it by attributing the overpayments to errors. I above alluded to an exception of difference, which might prove a profit or loss to a street railway company, according to the amount of the surplus of real value in its real estate assessment; that surplus, in the form of personal estate, might be assessed less under the state tax than under the tax where the city, county and state were combined; or it might be more, according to what the state's independent tax might be. But this point has no connection with the question of a double taxation on the same thing. J. B.

It is sometimes said that scientific men have never invented anything, but this is not true of Dr. Otto, who is known all over the civilized world as the inventor of the first economically and commercially successful gas engine.—*Exchange*.

Dissected Short Generator and Motor.

The accompanying engravings (Figs. 1 and 2) illustrate very clearly the shape and relation of the individual parts of the 150 H. P. generator and the gearless motor, as now manufactured by the Short Electric Railway Co., of Cleveland, O. This generator, which was fully described in our last September issue, has rapidly worked its way into popular favor.

Some of the interesting features of this machine are the field magnet frame, which weighs over 8,000 lbs.; the shape and position of the eight poles, which are provided with both shunt and series coils; the large ring armature, and method of mounting upon the shaft; the self centering and self oiling bearings, the oil rings being

reserved any control over the conduct of the former in executing the work.

2. That the evidence warranted the recovery against the contractor, and the judgment is affirmed to that extent, but reversed as to the railway company proper.

F. C. Street Ry. Co. et al v. McConnell, Georgia, S. C., Nov. 19, 1891.

STREET RAILWAY CO.—LIABILITY FOR PAVEMENT ORDERED BY CITY—VALIDITY OF ORDINANCE—CHARTER POWER OF CITY. In an action by plaintiff against defendant company to recover the expense of certain paving, wherein plaintiff had judgment and defendant appealed, it is
Held, 1. That under the laws of New York (c. 501,

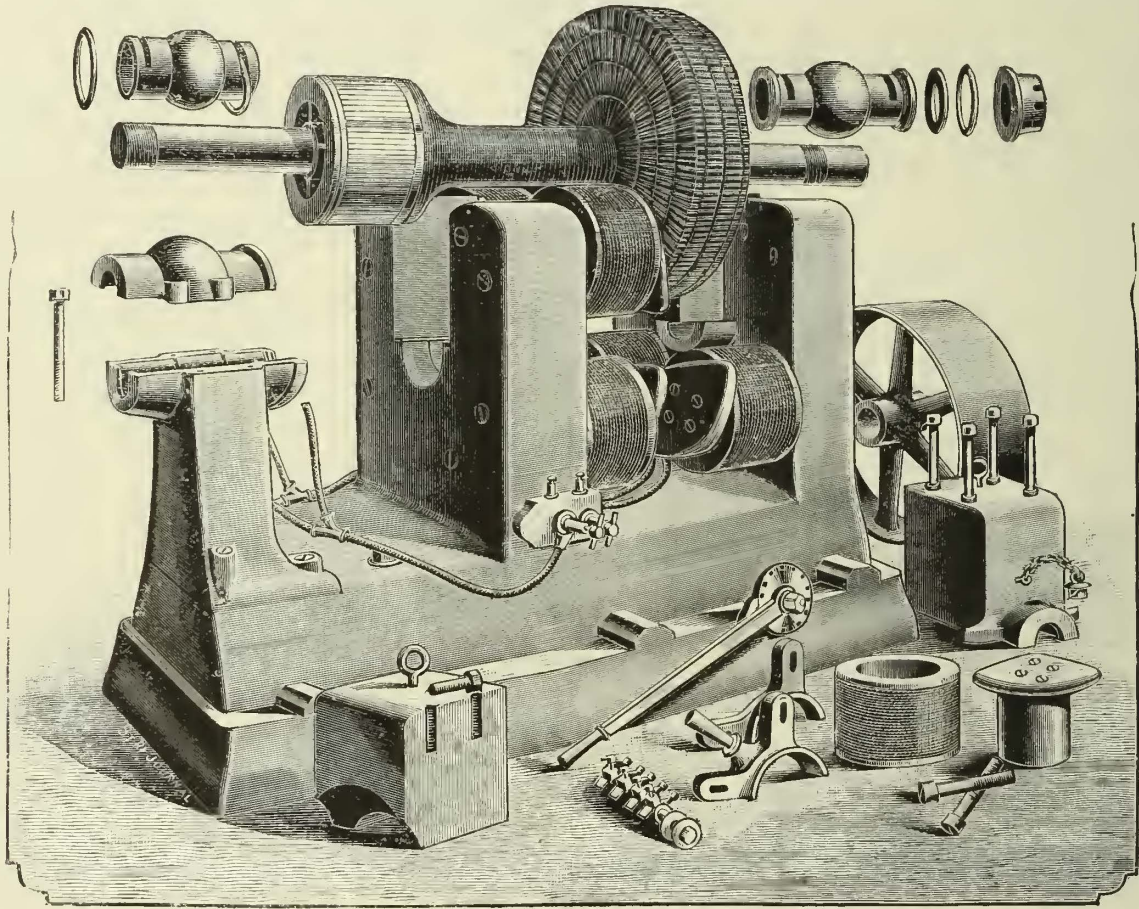


FIG. 1.—PARTS OF THE SHORT GENERATOR.

clearly shown; the unusually large commutator and the brush holder.

The gearless motor having been described previously, and again fully by the inventor in another column of this issue, does not require further notice in this connection.

Legal Intelligence.

CONSTRUCTION OF STREET RAILWAY—NEGLIGENCE—LIABILITY—CONTRACTOR—COMPANY. This action was brought by plaintiff for damages resulting by reason of personal injuries, against the defendant street railway company and the Thomson-Houston company, contractor, and had judgment against both defendants jointly. The defendants appealed.

Held, 1. That where a street railway company, having authority under its charter to construct a railway in the public street, does the work by an independent contractor, and an injury to a person passing along the street is caused by the negligence of a servant of the contractor, which negligence consisted in unnecessarily and improperly laying down loose iron rails in advance of the workmen engaged in constructing the track, the contractor is liable for the consequences of such negligence, but the railway company is not, the latter company not having

1868), authorizing and directing the plaintiff (city) to grant permission to the street railway company (defendant) to construct a railroad upon certain streets, provided that the company should keep the surface of the streets within the rails, and for one foot outside thereof, and to the extent of the ties, "in good and proper order and repair," but, when the railroad had been operated for about eighteen years without any pavement between the rails, the city could not recover the cost of paving with asphalt that portion of the street, it not appearing on the trial that, at the time the city ordered the pavement, the space occupied by the railroad was not in good order and repair, or that the pavement was necessary.

2. That the enactment by the city of an ordinance requiring the pavement of the portion of the street occupied by the railroad was not presumptive evidence of the necessity for such improvement.

3. That the acceptance by the railroad company of the charter created an obligation in the nature of a contract, which could not be modified by the city without express provision therefor by statute.

4. That the city had no power by ordinance arbitrarily to determine what repairs or improvements were necessary. Judgment reversed.

City of Binghamton v. Binghamton St. Ry. Co., N. Y. S. C., Nov. 1891.

INJURIES AT CROSSING—NEGLIGENCE—EVIDENCE. 1. In a suit against the defendant street railway company for the death of plaintiff's husband, it was shown that he and plaintiff had stopped near defendant's south track at a street crossing to await the passing of a cable car on the north track, and that as soon as it had passed they attempted to cross, but were scarcely over the first rail of the south track when they were struck by a car thereon, which was almost upon them when they started, and the husband suffered injuries of which he died. The street was straight and well lighted, the night clear, and the car by which they were struck had a headlight with a reflector. The only evidence that the husband looked in the direction from which the car was approaching was given by plaintiff, who, however, only inferred that he did so, because it was the natural thing to do.

Held, that the accident was due solely to the negligence or misfortune of the deceased.

of defendant's rule against riding on the front platform. Judgment affirmed.

Highland Ave. & B. R. St. Ry. Co. v. Donovan, Ala. S. C., Nov. 5, 1891.

Note: The many judgments rendered against street railway companies on account of accidental injuries to passengers while riding on platform has occasioned a serious agitation of the question of crowded cars. There appears but little doubt that a street railway company has the right to adopt rules prohibiting the riding on platform, but if there is slight negligence upon the part of the management, courts (especially the jury) generally hold it to be sufficient to support a finding in favor of the complainant. It has become so common for one to ride on the platform, of a car, sometimes by preference, but more often by necessary compulsion, that it is no longer considered negligence as a matter of law, for one to ride on the platform notwithstanding the well-known rule of prohibition. In this case (as in many others) the evidence

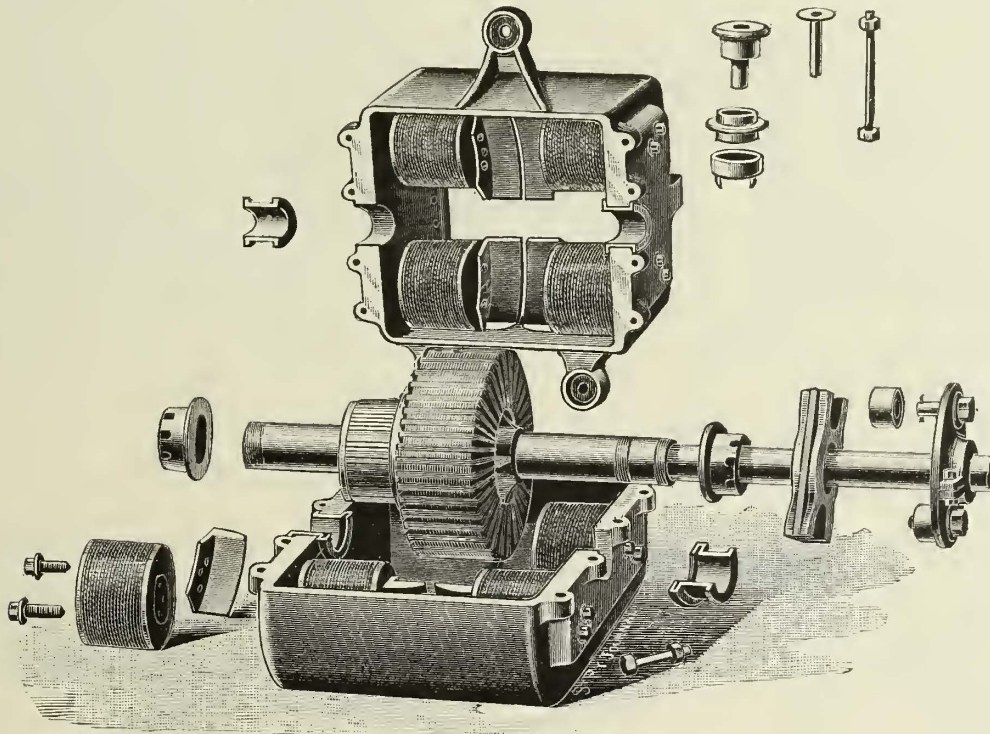


FIG. 2.—PARTS OF THE SHORT RAILWAY MOTOR.

2. The fact that the gripman of the car that struck deceased was at the moment of the accident looking to one side, is not sufficient to show him guilty of negligence, when he had immediately before seen plaintiff and deceased standing by the side of the track, apparently engaged in conversation, and so had no reason to anticipate that they would attempt to cross in front of his car. Judgment for plaintiff reversed.

Scott v. Third Ave. St. Ry. Co., N. Y. S. C., Nov. 13, 1891.

INJURY TO PASSENGER ON STREET CAR—CONTRIBUTORY NEGLIGENCE—JURY QUESTION. 1. When the plaintiff was riding on the front platform of a street car, and, while passing around a curve was thrown from the car. He testified that the rear platform was crowded, and he had to get on the front; that he had to stay there because the car seemed full. There was evidence for defendant that there was ample room to stand inside the car.

Held, that an instruction was proper which authorized the jury to find plaintiff free from negligence in riding on the front platform if there was a reasonable necessity, real or apparent, for his doing so.

2. Where the evidence tended to show that riding on the front platform was not obviously dangerous, that the accident would not have happened if the defendant had used due care in operating the car; the question of plaintiff's negligence was for the jury, to be considered in connection with his knowledge of the curve in the street, and

tended to show that if the driver had exercised due care in swinging around the curve, the accident might have been averted. Interesting questions relative to the presumed danger of riding on the platform may be reviewed by reference to the following cases: *Railway Co. v. Walling* 2 Am. and Eng. cases, 20; *Willis v. R. R. Co.*, 34 N. Y. 670; *Nowland v. R. R. Co.*, 3 Am. and Eng. cas. 463; *R. R. Co. v. Miles*, 13 Am. and Eng., R. R. cas. 10; *R. R. Co. v. Worl.*, 21 Am. and Eng. cas., 429 and *R. Ry. Co. v. May* 5, Atl. Rep. 276.

INJURY TO PASSENGER—BOARDING MOVING CAR—CONTRIBUTORY NEGLIGENCE—REVERSAL. Where plaintiff boarded defendant's car while it was in motion, by getting on the sheet iron covering of the steps of the last platform, and maintained himself in that position by holding to the iron gate that barred entrance there until struck by a structure near the track and knocked into the street below.

1. *Held*, that he was negligent, as a matter of law.

2. *Held*, that a railway company is not liable for failure to take steps to avert injury from one who has placed himself in danger, where it has not omitted to discharge any duty towards such person.

3. When a passenger without the consent of the carrier selects a place to ride which is obviously not intended for that purpose, and is hurt by reason of hazards peculiar to that position, he has no cause of action.

Judgment reversed, new trial denied.

Carroll v. Interstate Rapid Transit Co., Mo. S. C., December 7, 1891.

The Bates-Corliss Engine.

The engravings accompanying this article show front and rear views of the Bates-Corliss engine built by the Bates Machine Co., of Joliet, Ill.

stems being eliminated, the only loose pieces being the hooks on wrist plate. No springs of any description are used in connection with the valve gear or governor, neither does the governor require any water or oil pot to steady it. The governor, which is very sensitive, is of the

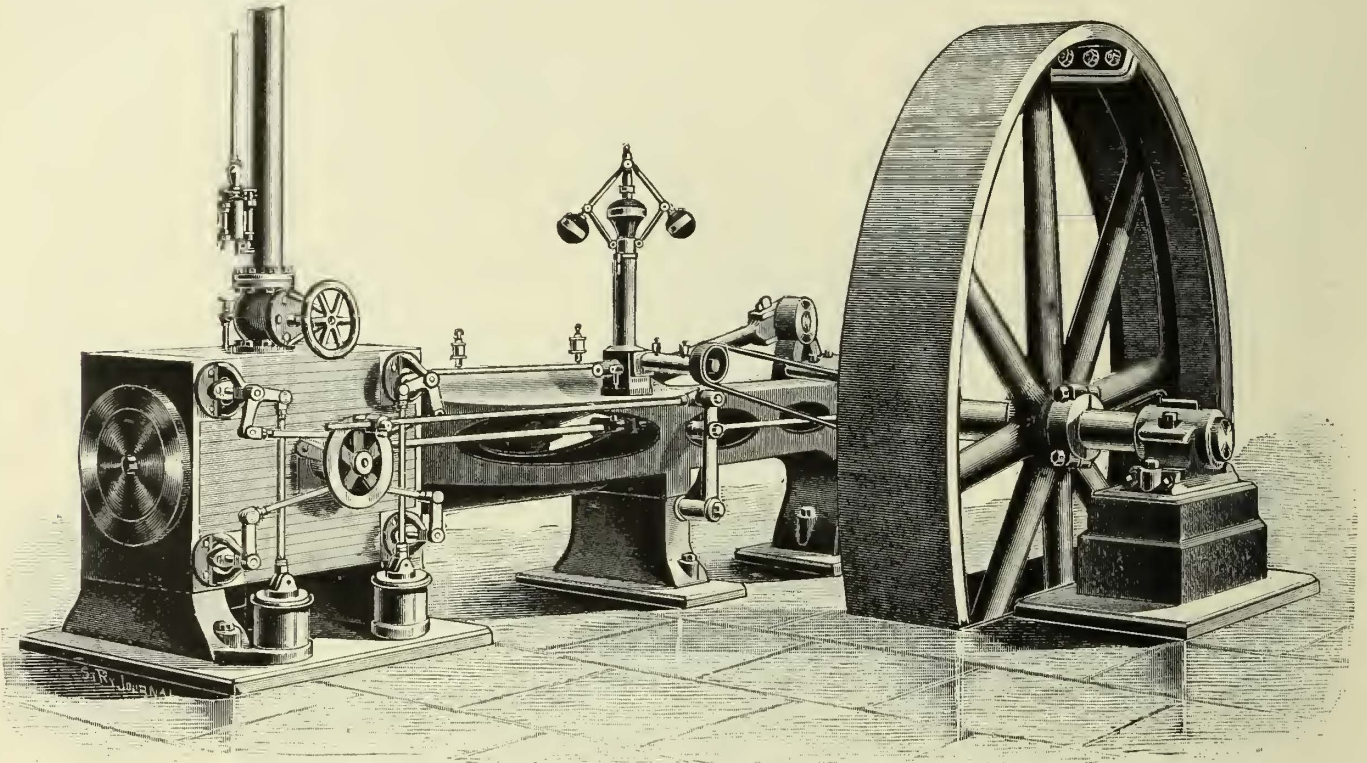


FIG. 1.—BATES-CORLISS ENGINE—FRONT VIEW.

Some of the important features wherein these engines differ from the ordinary Corliss engine are the valves, governor, frame and proportions of the different parts. Besides the ordinary rotary valves, special flat side admission valves are provided to which the power is applied,

flyball pattern and is provided with all necessary connections to automatically control the releasing gear; it is also provided with automatic stop motion. On extra large engines a separate eccentric is provided which enables the cut-off to take place at any position of the stroke, and is

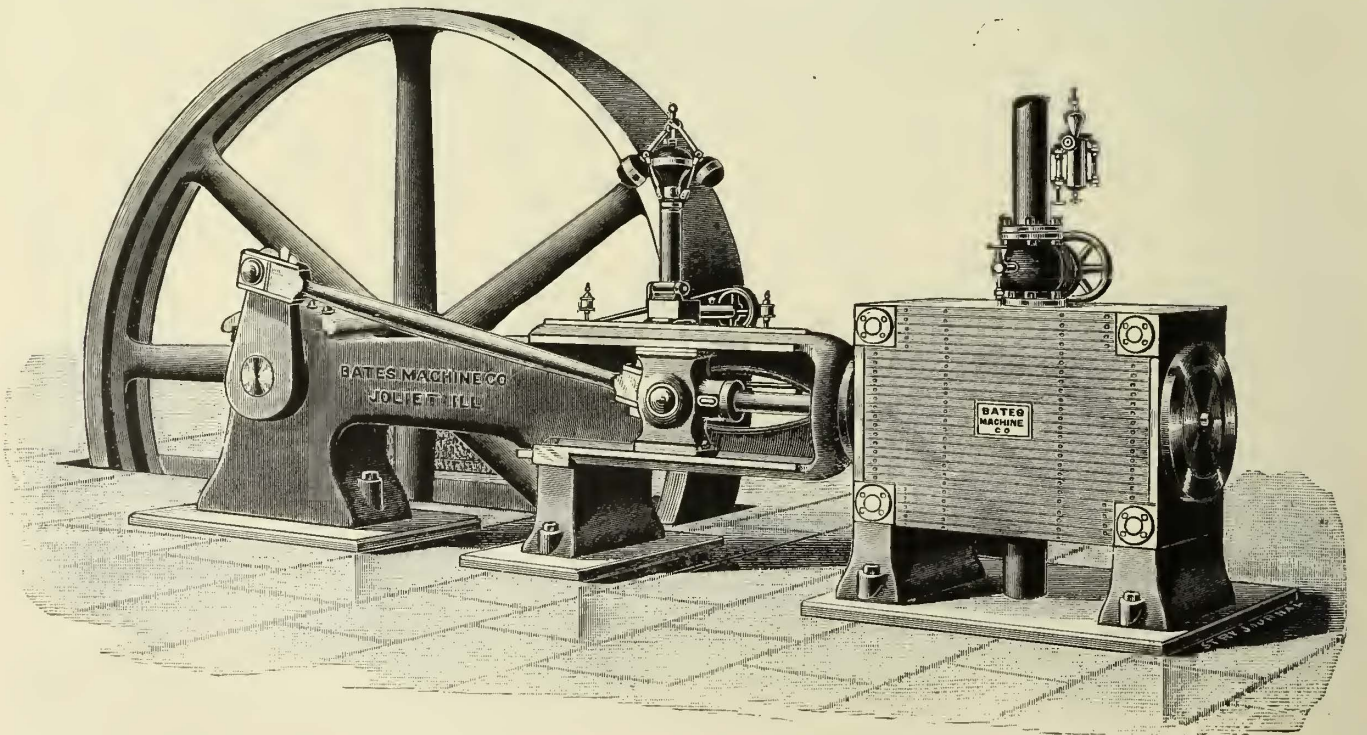


FIG. 2.—BATES-CORLISS ENGINE—REAR VIEW.

parallel to and in line with the seats, obviating any tendency to rock or twist and consequent uneven wear, thus insuring a longer life than the rotary valves.

Tripping is done at the wrist plate, by means of which the mechanism of the valve gear is much simplified, the springs and small parts, in fact, all mechanism at valve

especially essential on engines that are required to operate under widely fluctuating loads.

The frame is of the box girder form graceful in outline and contains an unusual amount of metal. The frame, main pillow block guides and centre leg which supports the guides are all cast in one piece, thus securing

great rigidity and stiffness. The main pillow block is provided with quarter boxes with large wearing surfaces, which are adjusted with wedges so that they may be removed without taking out the shaft. The out board pillow block is provided with a large cast iron adjustable sole plate.

The crosshead is of solid box form fitted with forged steel pin nearly one-half the diameter of the shaft. The shoes are adjustable with wedges and are provided with large wearing surfaces and filled with best babbit and scraped to fit guides.

The main shaft is of hammered wrought iron, one-half the diameter of cylinder, except in heavy duty engines where this proportion is increased.

The crank pin is of forged steel, one-half the diameter of the shaft. All bearings and journals are of ample proportion to insure the greatest strength and longest wear with the least possible friction.

Owing to the great demand for this type of engine, the capacity of the works has been doubled, which are now operated night and day, and with the present equipment are turning out on an average one engine a week. In addition to the manufacture of engines, the above firm make heavy flywheels, having facilities for casting and turning wheels thirty feet in diameter and any width of face. They give special attention to the equipping of electric light and railway stations with complete power appliances.

Cook's Patent Level.

We present in this issue illustrations of Cook's patent level which, as will be seen, differs from the ordinary level



FIG. 3.—COOK PLUMB AND LEVEL.

in many important particulars. Figs 1 and 2 show railway track levels and Fig. 3 a plumb and level.

The bulb tube carrying the bulb is set in a frame, which is faced on either side with glass, and can be seen from any position and from either side. The bulb tubes

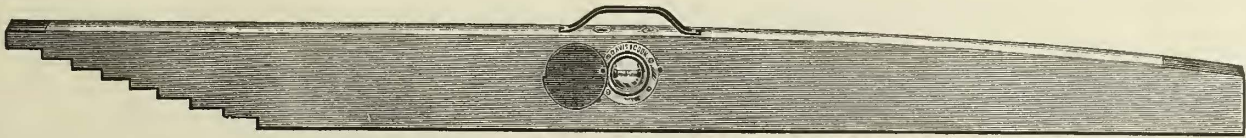


FIG. 1.—COOK RAILWAY LEVEL.

are also so arranged as to show their entire length, by which means the bulb can be seen from a distance, and overhead, which is not possible in the ordinary level.

The inside rings are made so as to revolve on their



FIG. 2.—COOK RAILWAY LEVEL.

own centre for adjustment, and cannot get out of adjustment unless the set screws are moved. Nearly all styles are made in various sizes. The manufacturers are Davis & Cook, Watertown, N. Y.

"Round Top" Insulator and "Salem" Bell.

The object in the construction of the "round top" insulator shown in Fig. 1 was to produce a moulded mica

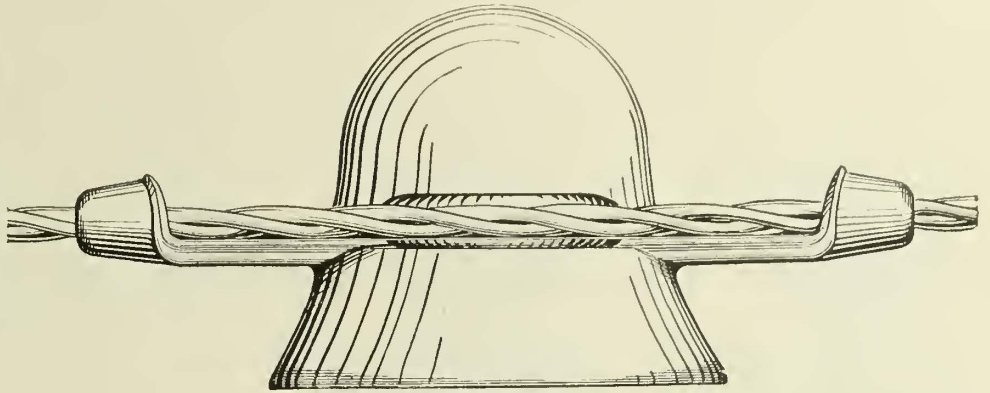


FIG. 1.—ROUND TOP INSULATOR.

insulator which should be entirely protected by a metal shell. The nub carrying the stem is entirely surrounded by the insulation which is formed into the shell at about sixty pounds pressure, the shell being turned over upon the edge, thus protecting the insulation against fracture

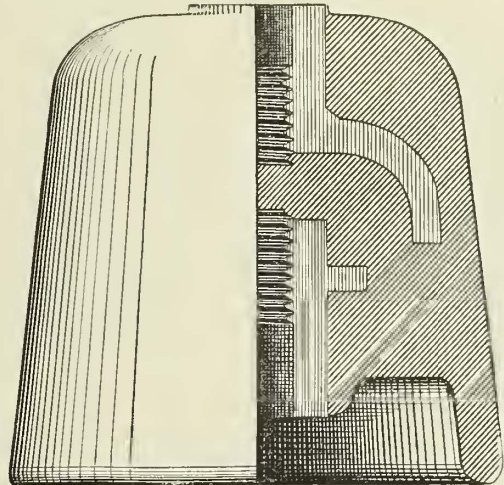


FIG. 2.—SALEM BELL.

from blows of the trolley wheel. The insulation is additionally anchored within the shell and by the peculiar method of manufacture attached to it, so as to be practically integral with the metal, giving, as will be seen, an insulator which is both strong and durable.

The "Salem" bell shown in Fig. 2, needs little explanation. It is made of moulded mica with the brass nubs of extra weight and firmly anchored. The top nub is three inches counter-bore; the bottom nub five-eighths

of an inch, and they carry one-half inch fittings. The weight of the bell is eighteen ounces.

The manufacturers of these insulators are the Johns-Pratt Co., of Hartford, Conn., and the mica insulation

used is the same as that which has been so long and favorably known in the different insulators manufactured by the Gould & Watson Co., of Boston. H. W. Johns Manufacturing Co., of New York, are the selling agents.

The Bryant Rail Saw.

A metal sawing machine especially adapted to cut rails is always a most convenient article in the work of

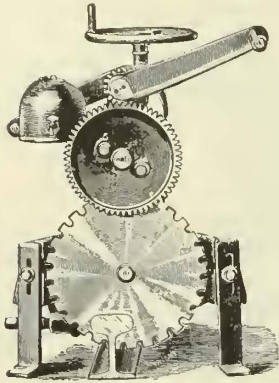


FIG. 1.

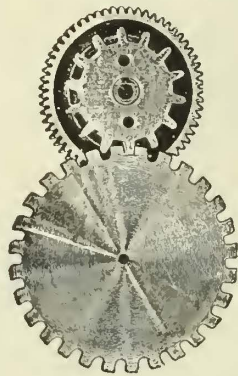


FIG. 2.

street railway track construction, and its use often saves a great deal of time and labor. Such an appliance is manufactured by the O. & C. Co., Phoenix Building, Chicago, and is illustrated herewith.

Fig. 1 shows a portable Bryant rail saw manufactured by this company. This saw is adapted to be operated by two men, and will cut any rail in use on a street or steam railway in less than ten minutes. Records show

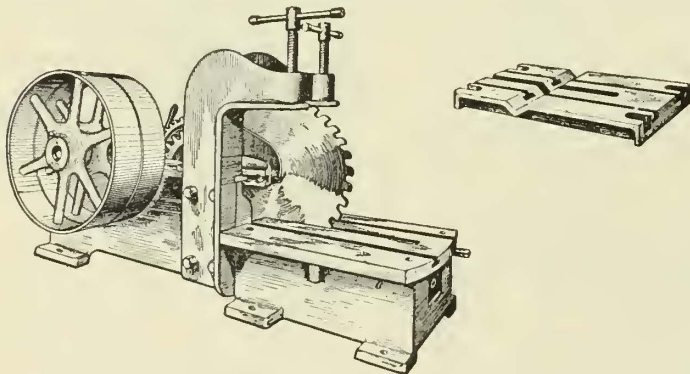


FIG. 3.

that by it a sixty pound rail, has been cut in three minutes, a ninety five pound in three minutes and twenty-five seconds, and a seventy-three pound rail, thirty-five degrees angle, in seven minutes. The machine requires a space of about 2 x 6 ft.

Fig. 2 shows the principle of transmitting power to the periphery of the saw blade, and, as will be seen, the arrangement is both simple and economical of power. The

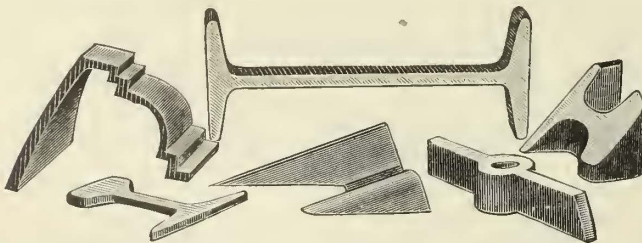


FIG. 4.

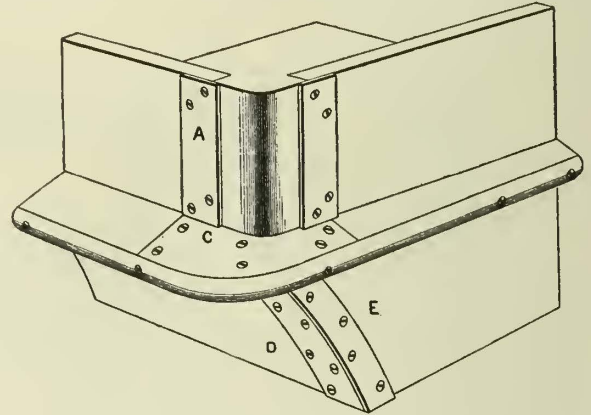
construction of the saw is such that each tooth acts as a planer cutter, leaving the work perfectly smooth and true and not disturbing the temper of the metal. As the machinery can be adapted for a mitre cut, mitred rails can be used very easily if desired.

Fig. 3 shows a larger type of machine for shop work, requiring, however, only about one H. P. for its operation; in fact it has been operated by a one-half H. P. electric motor. The saw is adapted for a large variety of work, and is provided with a movable table for clamping in

position the rail or other metal to be cut. A view of some of the cuttings made with these machines is shown in Fig. 4.

Corner Stay for Cars.

The accompanying engraving shows a new and improved corner stay for street cars, the object of which is to simplify and improve the means of securing side and



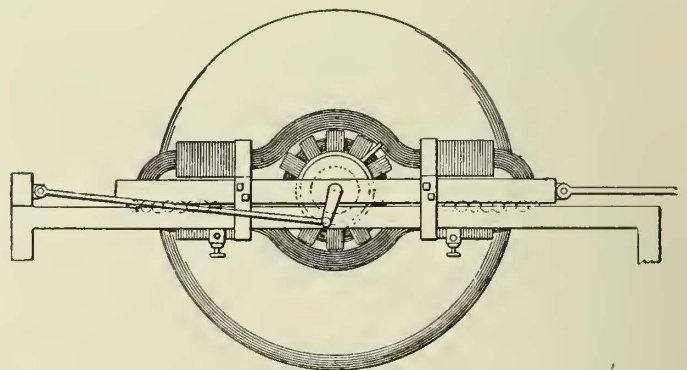
CORNER STAY FOR CARS.

end guard rails and panels to a corner post. The device is the invention of Henry Cochran, of Chester, Pa. As will be seen, the corner post is recessed to receive the two centre, side and end panels and the joints are covered by vertical plates, shown at A, secured to the panels by screws. The guard rails are also connected by a flat plate, C, arranged on their upper sides and secured in place by screws. This, together with a metal strap, which is placed on the edge of the guard rails, greatly increases their strength and durability.

The concave side panel and lower end panels D and E, are secured to the corner post below the guard rails and also have their ends covered by similar corner plates. This arrangement of plates makes a practically water tight corner, and is being used by the Lamokin Car Works, of Philadelphia, in the manufacture of their street cars.

Reciprocating Electric Motor.

A type of electric motor capable of giving a reciprocating motion has been recently patented by J. T. Wilson, of Tyrone, Pa., and is shown in section in the accompanying engraving. The field magnets of the motor are mounted on a longitudinal frame which is supported on balls resting in a groove of a second frame so that the

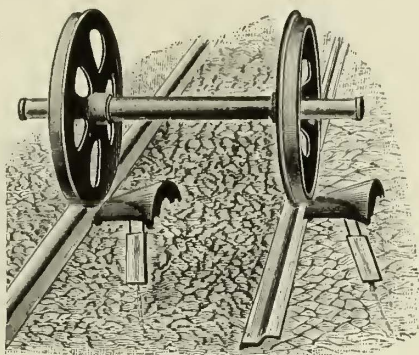


RECIPROCATING ELECTRIC MOTOR.

motor can reciprocate easily in a longitudinal direction. Mounted on the armature shaft, opposite that shown in the view, is a flywheel and a second crank secured by a rod to a fixed pivot, like the one shown. In street railway work the flywheel would be replaced by a small balance wheel. Rotation of the motor will then produce a horizontal motion equal in extent to the diameter of the circle described by the crank pin. The inventor claims the special adaptability of the device to operating street cars.

Tilden Street Car Replacers.

A replacing frog is coming to be regarded as an essential part of a street railway equipment. By the use of such a device as that shown in the illustration, a derailed motor or car will be replaced on girder rails by gravitation as soon as the wheels reach the altitude of the top of the rails. The frogs being double enders it is immaterial whether the cars be pulled ahead or backed. The dimensions have been developed by the most severe tests, and are now claimed to be practically perfect.



TILDEN STREET CAR REPLACERS.

They are self holding, and it is asserted that by their use rolling stock may be rerailed in one-quarter the time required when other devices of the kind are employed.

The replacers can be used as hose bridges in case of fire when the hose is stretched across the track, by locating the frogs over the hose. As an electric switch is a part of each replacer and the circuit being connected by the location of the device on the ground, a motor car may be rerailed at any time under ordinary circumstances. Replacers of this style, but much larger, are now used with great success on the principal steam railroads of the country. They are manufactured by B. E. Tilden & Co. of the Monadnock Building, Chicago.

South Side Elevated Road, Chicago.

The way is now open for the Chicago & South Side Rapid Transit Co. to reach the World's Fair grounds at Jackson Park. The City Council, at a recent meeting, passed the ordinance giving the company a franchise on Sixty-third Street, and they now possess rights from Congress Street on the north to the entrance of Jackson Park. The franchise has been granted in time to insure the completion of the road before the opening of the fair, unless some extraordinary accident occurs.

It was expected that the road would be operated from Fortieth Street to Congress Street during May, but the company furnishing the structural iron failed to come to time, and it will be June before trains are in operation. The cars and locomotives are practically ready for use. The former are substantially the same as those used on the elevated roads in New York. They were built by the



PROPOSED ELEVATED RAILWAY STRUCTURE—MICHIGAN AVENUE, CHICAGO.

Jackson & Sharp Co. of Wilmington, Del. The engines are rather novel in that they are compound, and their performance will be watched with a great deal of interest. They were manufactured by the Baldwin Locomotive Works.

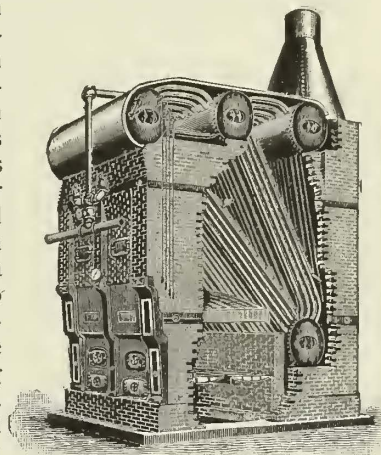
Speaking of the schedule, Chief Engineer Sloan recently said: "The number of trains we shall run will de-

pend altogether on the amount of travel the public furnishes. The public seems to be taking kindly to the road, but the permanent revenue must come from the building up of the property along the line. When the New York L. road started there were unoccupied miles of the street through which it passed, but in ten years solid business blocks lined the route. We expect the same thing here in Chicago. We can make the run from Congress to Fortieth Street in about fifteen minutes."

Where the road crosses Michigan Boulevard at Fortieth Street the Park Commissioners desired a more ornamental structure than the standard construction of the company, which, however, is extremely neat and substantial. The engineers of the company planned for this purpose the handsome structure which is shown in the illustration. There are three spans of this structure, the longitudinal trusses being six feet at the ends and arched to two feet at the centre. The columns are of wrought iron made up of angles and plates, and taper toward the base. Above the regular flooring is a solid iron floor made of buckle plates. On the latter is laid three inches of concrete upon which the ties are placed. The ornamental railing is of cast iron, and is bolted to the structure.

The Stirling Water Tube Boiler.

The general arrangement of the water tubes and drums of the Stirling water tube boiler was shown in our March issue, but in the accompanying illustration a better idea can be obtained of its external appearance when ready for operation. As our readers know, this boiler consists of two or more upper wrought steel drums connected with each other and with a lower or mud drum, also of steel, by tubes expanded directly into the drums. The engraving shows three upper drums. Not an ounce of cast steel or cast iron is used in the construction of the boiler. As will be seen, this arrangement allows of an excellent circulation, since each water tube has a separate outlet equal to its own area.



STIRLING WATER TUBE BOILER.

By opening one manhole in each drum access is gained to every part of the interior of the steel plates and both ends of every tube. The exterior of plates and tubes is accessible at all points, so that the boiler is an easy one to clean, but it has been found that the tubes are practically clean on the outside as well as the inside, because they are set at such an angle that the solid matter inside and soot on the outside fall to the bottom of the furnace or into the mud drum, where it is blown off. The manufacturers of this boiler are the Stirling Co., of Pullman, Ill., and the New England agent is J. Bradford Sargent, 620 Atlantic Avenue, Boston, Mass.

THE treasurer's report of the Third Avenue (N. Y.) Employes' Relief Association for the year ending February 26, 1892, shows total receipts, including cash on hand, March, 1891, \$9,086.80; disbursements, \$5,888.85, the latter including sick benefits of \$2,713, and death benefits, \$1,500. The work which this Association is carrying on is of great value to employes of the company.

Papers at the Chicago Electric Club.

A number of interesting papers have recently been read before the Chicago Electric Club on matters pertaining to electric railways, and the electrical engineers of that city have had an excellent opportunity to judge of the present status of electric railway science and the advisability of the adoption of electric power on the streets of that city. We give below the papers of Prof. S. H. Short and Mr. Geo. K. Wheeler.

THE GEARLESS MOTOR; BY PROF. S. H. SHORT.

At first thought it does not seem necessary to place on the market a motor of new design which involves the abandonment of gear wheels for transmitting the power of the armature to the axle, but when we consider it carefully and examine all the advantages to be gained by so doing, we feel justified. If you recall the history of the steam locomotive you will remember that in the first machines the power was transmitted from engines through gear wheels to the axles. This was soon abandoned because of the wear on the gears, the noise, the breakage and the many things which rendered it impracticable, especially where high speeds were required. If you will look back over the history of the electric street car motor, you will remember that among the first experiments which were made, the high speed armature was geared down through a long train of gears to the axle. Finally, within the last two years, the practical operation of electric motor cars with two sets of gears, of a double reduction, has become quite general. It has now been found, however, that those gears are a great source of expense in the operation of electric street cars, and it has been the object of the manufacturer to reduce the number of gears in street car practice as far as possible, until we now have all of the well known electrical manufacturers offering a motor for street car service with but a single reduction, and we have already found in practice that this is immensely superior to the old double reduction type of two years ago. While this single reduction type of motor is undoubtedly eminently successful, I believe we can go a step further with great advantage, that we can connect the armature directly to the axle of the car without the intervention of armature, intermediate or other kind of gears. The abandonment of gears, or a gearless motor is undoubtedly absolutely necessary where high speed is required for driving trains of cars upon suburban or interurban lines—a thing which we shall undoubtedly be called upon to do within the near future. It will be well for us to inquire into the disadvantages of the spur gear, which is the form which has finally been adopted as the only successful method of reducing the armature to the axle speed. These gear wheels vary in efficiency of transmission of power, with the load and with the speed. They wear rapidly, especially when placed under a street car in the dirt, grit and mud. This wear of the gears has been a very serious thing for the electric railways during the last three or four years. The repairs upon street car motors have been mostly because of the use of gears, and the cost of maintaining an electric motor car has been due largely to this one thing. With the single reduction motor, of course, much more than half of the difficulty has been removed, but we believe that with the gearless motor, which does not contain any of those wearing parts, and without the armature and intermediate bearings and shafts, bolts and nuts, etc. we can get rid of all this source of cost in operating electric street cars. Those of you who have operated electric street car lines can appreciate what a serious thing it is for a tooth to break out of a gear in a car motor while it is in service. The car is loaded with passengers who have paid their fares. If one tooth breaks, the probability is that more will follow; finally the teeth of the gear do not mesh with the pinion and it either bends the armature shaft, or breaks the motor frame. Probably the wheels become locked and the car is unable to proceed on its journey. The passengers must be removed, and the car must be taken from the track, or dragged to the car house by another motor. This is calculated to make the patrons of the road dissatisfied with the electrical system, and it creates a feeling of distrust in the public mind about the certainty and regularity of the operation of the cars. Nothing could be more serious for a street railway management than a feeling of distrust among the patrons of the road. While this is not now as common an occurrence as it was a year ago, because of the fewer gears in the single reduction motor and the fact that we are making our gears of steel which lasts longer and breaks less frequently, still the trouble is serious.

Again, it is a great source of loss to a street railway company when it is necessary to take a car out of service to replace worn out gear wheels. A car earns on an average in a good street car city, about \$20.00 per day. If a car is taken off of the road for half a day, or a day, we not only lose the cost of repairs, but we lose the profit on the day's run.

The causes which disable cars should be reduced to the minimum, and it is to this end that we are advocating the use of no gears in a street car motor. It is very seldom now that we have trouble with armature bobbins and field magnet spools burning out. While we had some difficulty of this kind in the early days, we have learned how to insulate and protect the motors for street car service, so that electrically they are quite equal to the work they are required to do. We have therefore to look more carefully to the mechanical construction of a street car motor and perfect that part of the machine. We believe that we should make a street car motor with as few parts as possible, and especially should we endeavor to do away with the wearing parts.

If we can abandon the gears you can easily understand that we not only do away with them, but also with those wearing parts which accompany a train of gears, fast running shafts and their bearings, box caps, nuts and bolts, all of which need looking after.

We will now take up the matter of the power lost in spur gearing, and see what we can gain in that direction by abandoning gears. When

we first took up the subject of a gearless motor, we set about to see how much could be gained in the efficiency of transmission of power by doing away with the gears. I made a very careful and thorough investigation of the losses between the armature pinion and the intermediate gear, and between the intermediate pinion and the axle gear of a double reduction motor. I first put a double reduction motor in good order, eliminating the armature bearing losses, as much as possible, by running the motor for a long time, to wear the bearings down to a good surface. I put my power brake for determining the horse power directly on the armature shaft and run my motor, delivering different horse powers all the way from no horse power to its full output—twenty H. P. At the same time we measured the electrical horse power

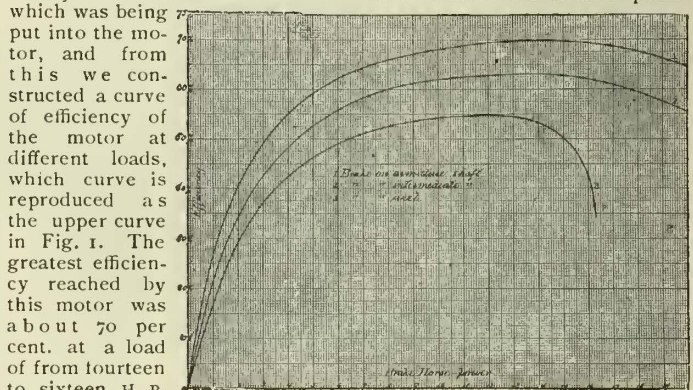


FIG. 1.

which was being put into the motor, and from this we constructed a curve of efficiency of the motor at different loads, which curve is reproduced as the upper curve in Fig. 1. The greatest efficiency reached by this motor was about 70 per cent. at a load of from fourteen to sixteen H. P. The efficiency at small loads, say, at two H. P. was something like 50 per cent; at four or five H. P. an efficiency of 65 to 70 per cent. We then took the brake from the armature shaft and replaced it with a well made armature pinion, allowing it to mesh with a well made intermediate gear, these gears being cut as nicely and as carefully as possible so that there would be the least possible loss between the two in making this test. Putting the brake on the other end of the intermediate shaft we again secured the number of readings of the horse power delivered, after being passed through this one pair of gears, the electrical horse power being indicated carefully at the same time. From the efficiency at different horse powers thus obtained we produced a second curve, which is shown in Fig. 1 as the middle curve on the diagram, and we find that the efficiency of this arrangement has fallen considerably. We once more removed the brake and placed the intermediate pinion on the intermediate shaft, allowing it to mesh with the axle gear. The brake was now placed on the axle itself and another set of measurements—the same as those before made—were secured and a curve of efficiency again plotted, which showed a large loss in these gears, the efficiency at the axle being less than that at the armature by an amount indicated by the two outer curves. The axle results showed that at fourteen H. P. delivered by the motor, we obtained an efficiency of 70 per cent. as a maximum when the brake was placed on the intermediate shaft delivering fourteen H. P. the efficiency dropped to

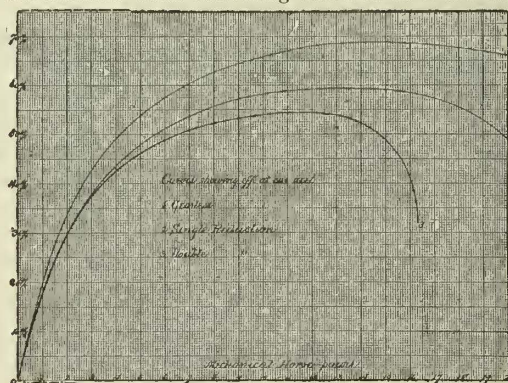


FIG. 2.

about 62 per cent. When placed on the axle, the efficiency dropped to a little less than 55 per cent., showing a loss in the gears of some fifteen per cent., when delivering fourteen H. P. You will find in going over these curves that the loads vary considerably with the speed. Making an efficiency curve of the gears alone at different speeds, you will find the efficiency is very low at heavy loads and slow speeds and rises to its highest at medium speeds and medium loads. It again falls when running up to higher speeds. For this reason it is more economical to run a geared motor not too fast or too slow, but at a medium speed. This fact has been established long since in the use of gears in other classes of machinery and in designing machines where power must be transmitted through gears. The best possible speed at which gears are to be run, and the relation between pinion and gear are carefully considered. In the single reduction motor we regain, we might say, more than half of this loss in efficiency, because the gears are run at a moderate speed. I think that this one feature of gear loss makes it desirable to abandon their use in street car motors if possible. If we can save in practice 15, or more nearly, 20 per cent. of the power consumed in operating a street car motor by using the gearless instead of the double reduction type, it is well worth while, as this means the consumption of less coal and the reduction of first cost in the power plant and accessories.

Fig. 2 represents another set of curves developed in the same way as those shown in Fig. 1. Three motors were used in this test, the double reduction, single reduction and the gearless. In each case the power

brake was placed on the car axle. The double reduction motor showing the efficiency at different horse powers is practically the same as the lowest curve in Fig. 1. The power brake placed on the axle of the single reduction motor shows the loss in but one pair of gears, and its axle efficiency is greater than that of the double reduction. In the gearless motor, however, there is no loss between the armature and the axle; therefore the curve shows the actual efficiency of the motor itself. In the single reduction motor the relation between the diameter of the pinion and the gear is greater than it is in the double reduction; therefore the loss is somewhat greater. If we had a still slower running motor armature on the single reduction, so that the pinion could be larger and the gear smaller, this loss would not be so great, and the efficiency at the axle would be greater. From these curves it is seen that the efficiency of the gearless motor at the axle when delivering 14 H. P. reached very nearly 70 per cent., or very nearly the same efficiency as the double reduction motor at the armature shaft. The single reduction motor, when delivering the same power through one pair of gears showed an efficiency of 60 per cent, while the double reduction shows a little over 50 per cent. These practical tests show that with the gearless motor we actually save from 15 to 20 per cent. in the power necessary to put into the car in order to get the same result at the axle.

We will now give you a description of the construction of our gearless motor. Gearless motors have heretofore, as you well know, been constructed and operated. The armature has been placed directly on the axle, and fairly good results have been obtained. The City & South London Railway in London is operating its road with gearless motors to-day. These motors are high speed, making the problem somewhat easier. It is, however, difficult to construct a small motor, not too large to be placed under an ordinary street car, the speed of which shall not be above 105 to 150 revolutions per minute. Because of the light construction of the roadbed in street railways, it is also necessary to avoid the heavy hammer blow which occurs at the rail joints from a motor partly or entirely carried on the axle. When the wheel of the car passes from one rail to another it falls, striking a very heavy blow. If we have a very heavy weight, directly attached and carried on the axle, without any intervening cushion or spring, we will have a very severe sledge-hammer blow on the rail at every joint.

This will soon pound out and destroy the rails. You are all familiar with the difficulty which is experienced in keeping up the rail joints on an electric line. The reason for this is apparent, if we think

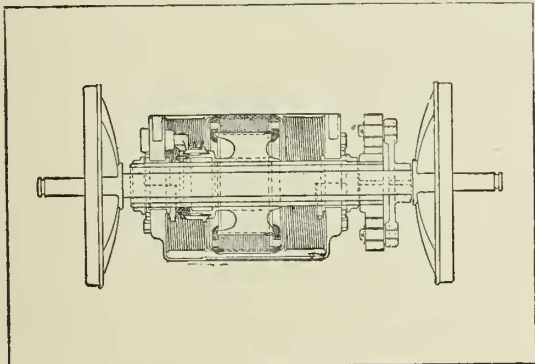


FIG. 3.

a moment, as it is a new element which has appeared since the introduction of the electric motor. All geared motors are supported at one end directly on the axle by means of axle bearings. At the other end these motors are supported on springs; thus, one-half the weight of a geared motor is carried directly to the car axle without the intervention of any flexible material. Imagine, if you please, that we could cushion both ends of a geared motor and put a spring between the motor and the car axle at the axle end. We will relieve the heavy blow of the wheels at the joints, and the wheels would not do as much harm or as much damage to the track. The actual weight carried by a set of wheels on the rails does not seem to affect the joints materially. Old horse cars, even when carrying heavy loads of passengers, did not affect materially the rail joints. Cable cars do not destroy their tracks, no matter how great their loads. Therefore it must be that this heavy weight of the motor carried solidly on the axle is the thing that is breaking down the rail joints on electric lines. This heavy jarring also crystallizes the axles, and we have complaints from all over the country that axles on motor cars are breaking. When we come to examine these breaks we find that the iron has crystallized, and the manufacturers are now endeavoring to overcome this by increasing the size of the axles. With the gearless motor, as we now construct it, none of the weight is directly carried on the axle. By referring to Fig. 3, which shows a section through the axle of the gearless motor, it will be seen that the armature is mounted on a hollow shaft which surrounds the axle, leaving an air space of about an inch entirely around the axle. This hollow shaft is really the armature shaft of the motor, and is carried in its own independent bearings in the motor frame. The motor frame consists of a box made in two halves. These two halves are fastened together and contain the field magnets, and enclose the whole, protecting it from mud and dust, the only opening in the box being on the upper side, next to the car floor. This box, which makes the complete motor when assembled, is provided with three projections at right angles to the armature shaft. These projections are made to receive steel spiral springs, similar to car springs. These springs are supported on the cross girders of an ordinary truck, such as is commonly used for motor cars, and support the entire weight of the motor. The axle is passed through this hollow armature shaft and can move freely in any direction within it. At one end of the hollow armature shaft is placed the flexible driving device which communicates the motion of the armature directly to the axle. This driving device can be seen in Figs. 3 and 5, and in Fig. 4 an end elevation of the motor is

shown, together with the spring mounting of the motor and a section of the axle in the centre of the hollow shaft. Fig. 5 shows a plan of the motor as you would look down through the trap doors in the floor of the car, the field magnets and armature, commutator and brushes, all being revealed, and the case with which you can get at the brushes and all the various parts of the motor is well shown. The axle also has a free end play of two inches through the motor and armature shaft. This is necessary in rounding curves and to ensure freedom for the

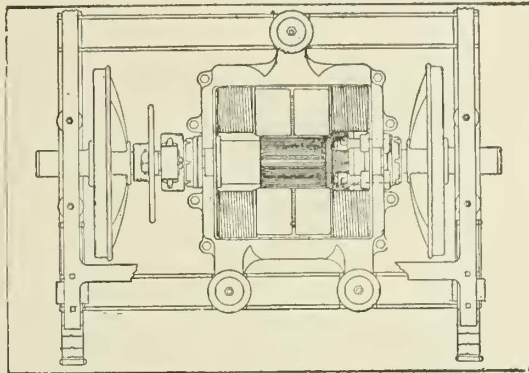


FIG. 4.

movements of the truck. When the wheels drop from one end of a rail to another the motor does not immediately follow, its inertia being so great. The wheels not being very heavy do not make a heavy blow, but by the time they have reached another portion of the rail the motor falls down against its springs, distributing, as it were, the blow over a considerable length of the rail, thereby preventing a serious damage to the rail joint.

The question is often asked, How do you obtain the necessary power or tendency to turn the wheels around without using an abnormal amount of current in so doing? It is contended that in a geared motor we have an enormous leverage through the gears. If we had a small armature, the same as is used in the geared motors on the axle, we would not, of course, be able to start the car, or to do the work necessary in moving a loaded car, but we have a large armature placed in a very strong magnetic field, and we have a great many more turns of the same current around the armature, thereby gaining in two ways a greater leverage because of a larger diameter of armature and a greater pull at the end of that lever, because of the increased number of turns of wire on the armature and the stronger magnetic field. It is something analogous to the steam engine. If we replace an electric motor with a steam engine, we can use a small engine under the car, with a small cylinder, and run it at high speed and gear down to the car axle, or, we can use a large engine connected directly to the axle, as is common now in locomotive practice, and run it slower and get the same power with, as has been demonstrated in steam motors, greater economy. You can make a similar comparison between the high speed engines of small size and the larger Corliss engines running at slow speed. We have the advantage in the slow running motor of practically doing away with the loss in Foucault currents set up in the armature ring. Air resistance we are liable to, the greater loss in the dead resistance of the motor, but by designing our motor with a very low resistance of the magnetic circuit, we are able to cut down the wire on the machine so that its resistance is quite low, being only about 2½ ohms. There is another advantage in this slow speed motor, which is not small—the wear on the commutator is very light and the heat produced by the friction of the brushes on the commutator is exceedingly small, making the motor run cool in all its parts. We are obliged, of course, to take advantage of everything that is possible in the construction of the gearless motor in order to make it small and light enough

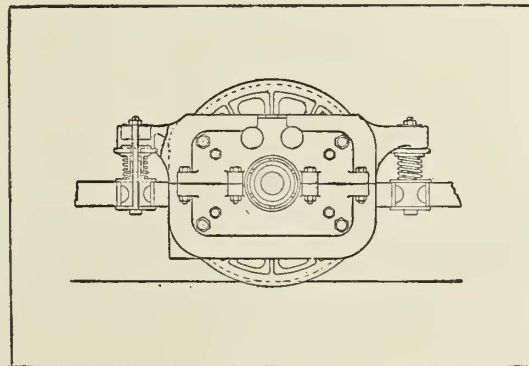


FIG. 5.

for street car service. We use the best wrought iron and steel in its construction, because of their superior magnetic qualities. We have to use the best copper of highest conductivity to reduce our resistance losses. This is, of course, in the end an advantage to the machine, because it makes it stronger and less liable to breakage.

It has been urged by some that the gearless motor is more difficult to repair than a reduction motor, and that it is a serious thing to repair an armature bobbin which has been burned out, because the armature will have to be taken out of the machine and the wheels pulled off in order to get at it. By referring to the drawings of the gearless motor it is easy to see that by dropping the lower half of the casing into the pit, it leaves the upper half of the motor carried on the truck frame and by simply raising the car body, the armature can be rolled out from under the car without taking it off the axle or removing the wheels. In practice we should have one of these axles and wheels with the armature all ready attached, to roll back into the place of the damaged armature. Replace the lower casing of the machine and the car can be put immediately into service, and the damaged armature bobbin re-wound in its place on the axle, there being no need of ever removing

the wheels from the axle, except when the wheels are worn out and have to be replaced with new ones. The gearless motor armature can be removed from the car by one man in as short a space of time as the geared motor armature can be removed, and without so much danger to the armature, as it is well protected from abrasion and injury in handling.

To answer the question as to how much current is taken by the gearless motor in operating a car, we have prepared a copy of readings taken from a car in actual service, drawing a trail car. The current readings, also the pressure readings, were taken every half a minute, and from Fig. 6 a very good idea of the amount of current required can be gained. These readings were taken in August on the East Cleveland Railroad, Cleveland, O. On this road the traffic is very heavy, although the grades are light; but by comparing these results with those obtained from single and double reduction you will find that there is practically little or no difference between the current readings. The average readings, however, in the test run with the gearless motor will be considerably lower than those with the geared motor, owing to the fact that we have gotten rid of the gear friction. The gearless motor will coast so easily that on a very slight down grade a car equipped with gearless motor will run up to speed, without any current being used, and in making stops the current is shut off from a gearless car long before it is in a geared motor car. These intervals of the use of little or no current, as compared with the intervals in which there is little or no current used in a geared motor, are very considerable, and represent the extra loss in the gears.

We have carefully tested double reduction, single reduction and gearless cars running on the same track on roads in Cleveland, Ohio, taking at the same time readings of current and pressure, and we have found that in some cases the single reduction would require the least amount of current—sometimes the double reduction and sometimes the gearless, depending upon the number of passengers hauled, stops made, and other things that might come in to consume more or less power; so it is difficult for us to say that there is any difference in actual power consumption between the three classes of machines. The gearless motor is capable of starting loads as quickly as the geared motor, and is capable of starting as heavy a load under similar conditions, and we have a curve shown in Fig. 7 which illustrates the actual horizontal pull of a 20 H. P. gearless motor mounted on 33 inch wheels. In examining this curve, it will be seen that the horizontal effort in pounds when the car is running 20 miles per hour is about 250. In ordinary street car practice we find that it requires about twenty pounds per ton to move a load on street car rails. This means that with a horizontal pull of 250 lbs. this single motor could move a car weighing twelve tons at the rate of twenty miles per hour, or, as the curve will show, that at fourteen miles per hour the motor has a horizontal pull of 700 lbs., or it will move a load of thirty-five tons at the rate of fourteen miles per hour on a level track. This curve is not falling off rapidly—certainly not as rapidly as it would with a geared motor, because the loss in the gears begins to increase very rapidly with the heavy loads.

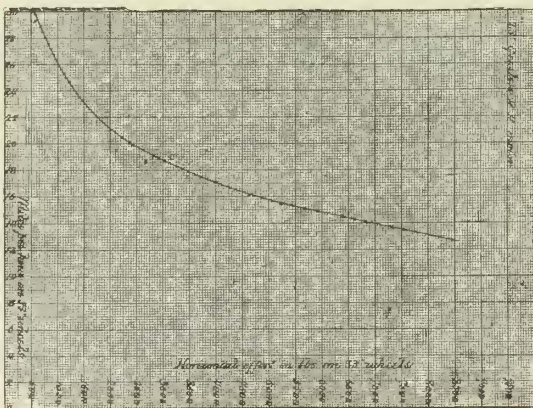


FIG. 7.

FIG. 6.
 Gearless motor trial—Aug 17, 91—3x regular service pulling trail-car—Temp=76° F

Time	Cur	Volts	Current	Volts	Remarks	Time	Cur	Volts	Remarks
2:20	53	448	2:26	16	440	3:13	30	412	
2:31	420		7:18	18	424	4:30	0	420	99amp
2:39	424		7:18	18	440	4:30	0	412	to start
2:40	428		7:27	27	428	3:15	0	416	
2:50	416		7:27	27	400	3:15	0	412	
2:51	424		7:27	27	410	6:21	0	416	
3:19	424		7:30	0	420	6:21	0	420	
4:17	436		7:30	57	400	6:21	0	420	
			7:30	20	380	7:16	19	420	
2:20	16	440	7:30	60	404	7:16	16	428	
6:0	0	440	7:30	33	396	8:14	14	426	
6:16	0	440	7:30	2	420	9:14	14	420	
7:21	0	440	7:30	60	404	9:14	14	420	
17	0	440	7:30	3	410	3:20	30	436	
18	0	440	7:30	4	0	4:0	0	416	
18	0	440	7:30	19	416	4:0	0	416	
20	0	440	7:30	39	380	4:0	0	416	
21	0	440	7:30	59	360	4:0	0	416	
17	0	440	7:30	4	0	3:0	30	460	
18	0	440	7:30	19	416	3:20	27	418	
18	0	440	7:30	39	380	3:20	27	418	
19	0	440	7:30	4	0	6:37	0	416	
20	0	440	7:30	19	416	6:37	0	416	
21	0	440	7:30	39	380	7:15	14	418	
22	0	440	7:30	59	360	7:15	14	418	
19	0	440	7:30	4	0	8:14	14	420	
19	0	440	7:30	19	416	8:14	14	420	
20	0	440	7:30	39	380	9:14	14	420	
21	0	440	7:30	59	360	9:14	14	420	
22	0	440	7:30	4	0	9:14	14	420	
23	0	440	7:30	19	416	9:14	14	420	
24	0	440	7:30	39	380	9:14	14	420	
25	0	440	7:30	59	360	9:14	14	420	
26	0	440	7:30	4	0	9:14	14	420	
27	0	440	7:30	19	416	9:14	14	420	
28	0	440	7:30	39	380	9:14	14	420	
29	0	440	7:30	59	360	9:14	14	420	
30	0	440	7:30	4	0	9:14	14	420	
31	0	440	7:30	19	416	9:14	14	420	
32	0	440	7:30	39	380	9:14	14	420	
33	0	440	7:30	59	360	9:14	14	420	
34	0	440	7:30	4	0	9:14	14	420	
35	0	440	7:30	19	416	9:14	14	420	
36	0	440	7:30	39	380	9:14	14	420	
37	0	440	7:30	59	360	9:14	14	420	
38	0	440	7:30	4	0	9:14	14	420	
39	0	440	7:30	19	416	9:14	14	420	
40	0	440	7:30	39	380	9:14	14	420	
41	0	440	7:30	59	360	9:14	14	420	
42	0	440	7:30	4	0	9:14	14	420	
43	0	440	7:30	19	416	9:14	14	420	
44	0	440	7:30	39	380	9:14	14	420	
45	0	440	7:30	59	360	9:14	14	420	
46	0	440	7:30	4	0	9:14	14	420	
47	0	440	7:30	19	416	9:14	14	420	
48	0	440	7:30	39	380	9:14	14	420	
49	0	440	7:30	59	360	9:14	14	420	
50	0	440	7:30	4	0	9:14	14	420	

You can easily figure from this curve what the motor will do under any conditions of load, grade and speed. The tendency in street car practice is to increase the speed of the cars, and the gearless motor lends itself especially to this end, as we have found that with very rapid speed geared motors wear out the running parts more rapidly and become very much more expensive to maintain, while the gearless motor can operate with as great economy at the slow pace required in crowded streets; it is also capable of running at a very much higher speed in suburban traffic without the slightest fear of damage to the machine. In this respect it makes a very much more flexible motor than the geared machines. You can easily understand that this motor now makes it possible for us to develop large electric locomotives to be used in elevated railway service, and for pulling suburban trains in and out of large cities. From calculations and designs which we have made, we find that the size and weight of the motors required for 200 and 400 H. P. locomotives is not more than is necessary to produce the required adhesion to the rails needed for the required tractive pull to move these heavy trains. The motors are not large comparatively, and their economy will be very great. We believe that this branch of electric railroading will develop rapidly, and that within a few years gearless electric railway motors will be used in places for purposes and in numbers unthought of at the present time.

THE SINGLE REDUCTION MOTOR: BY GEORGE K. WHEELER.

All practical electric street railway men appreciate the necessity of having a motor that shall have the greatest possible degree of self-protection from outside injury. This necessity was evident by the number and severity of the storms of the last few years, and it has been the aim of electric manufacturers to design a motor that would meet the requirements of ordinary street railway service, and so constructed as to be perfectly protected within itself, and to reduce the number of wearing parts, reduce the weight of the motor, and construct a frame of such strength that breakage would be impossible, and to provide a more perfect magnetic circuit than that found in the double reduction motors. The important problems to be solved in making a successful single reduction motor, are as follows:

- First, electrical and mechanical simplicity;
- second, slow speed and powerful torque;
- third, protection of field and armature from dust and water;
- fourth, accessibility of all parts of the motor so as to render it easy for repairs and adjustment;
- fifth, high commercial efficiency at all speeds and loads;
- sixth, reduction of weight per horse power, developed with a view of lightening the load that must be carried at all times;
- seventh, small expense of maintenance.

There have been various types of single reduction motors placed upon the market during the past fifteenth months, and I must say that some of them have not fulfilled the above requirements. It is my opinion that much better results are obtained by a two pole single reduction motor than by the four pole, for the reason that it is much lighter, simpler in construction, has a smaller commutator, half the number of bobbins on the armature, also half the number of brushes, and is much more economical to maintain. One of the leading electrical manufacturers has produced a motor that, I think, meets all the requirements for ordinary street railway service. This motor is fifteen H. P., weighs about 2,000 lbs. complete, including gear, pinion and gear case. The motor frame is constructed of two castings of steel, clamped together by bolts at the front and back, the axle brasses being held between the two parts. The armature bearings are cast in one piece with the lower half of the frame, and are provided with caps so that the linings may be inspected or renewed without disturbing the other parts of the machine. The frame is hinged together at the axle end so that the upper half may be raised if desired. The lower half of the frame is so constructed that it is perfectly waterproof up to the centre line of armature and axle bearing. All the metal in the frame forms a part of the magnetic circuit, and dead weight is thereby avoided. The armature is a combination of the Gramme and Paccinotti type, and so constructed that it is entirely iron-clad. The iron core is a ring with projecting teeth solidly fastened to the shaft. The coils are wound between the teeth and firmly held in place by wooden wedges. It is not necessary with this form of armature to use the mica, insulating paper, canvas and German silver bands. The winding is continuous, and all joints are made by electric weldings, no solder being used in any part of the armature. The winding is such that there is no crossing of wires, and as it is below the surface of the iron core it is protected from any mechanical injury. This form of armature permits of much less clearance between the armature and pole pieces, and the smaller airgap materially decreases the magnetic resistance of the circuit. This certainly means less weight and less heating of the field spool, and that a smaller motor will perform more work on account of greater efficiency. The field coil (there being but one) is placed at the top of the motor, and in this position exerts upon the armature a solenoidal pull, so proportioned that under normal load the armature is lifted from its bearings. I have had an opportunity of inspecting a set of armature bearings that had been in use upon a motor of this type for several months, and the tool marks in the bearings had not been scored, with the exception of a small spot on the bottom and top of bearing, thus demonstrating that the wear on brasses is reduced to a minimum. The armature pinion and axle gear are made of steel of ample width of face and are run in an oiltight case in order to insure free and continuous lubrication and to exclude dust and grit. As to the exact life of gear and pinion thus enclosed, I am unable to state accurately, but I know of single reduction motors that have been in operation since May 1, '91, so enclosed and running in a light weight of grease, which up to the present time do not show a wear of more than .005 of an inch. It would certainly seem by this that the expense of maintaining the gear and pinion for two motors per car could not exceed \$10 per year. The tendency of modern improvement in railway motors is to diminish the gearing, and I do not think that any

thing is to be gained over the double reduction motor by placing two sets of gears and pinions one on each side of a single reduction motor, as it not only increases the friction losses, but adds an additional weight to the motor, and if the motor frame and armature shaft are properly constructed there is no liability of straining or breaking either by reason of placing the gear and pinion on one side only. It is stated by a number of competent electrical engineers that the placing of one motor on a truck is ample for all ordinary street car service. By experience I have found that with a truck having but one motor attached to one axle, the wheels on the axle to which the motor is attached do not brake as quickly as the free wheel, and flats are thus formed on the free wheels on this account; also that it is a difficult matter to ascend grades over 3 per cent., and that it is next to an impossibility to operate a car so equipped, during the winter months. It is also advocated that the proper method is to gear a single motor to both axles; this, in my opinion, is open to serious objections. In gearing a single motor to two axles of a truck, it is almost impossible to keep wheels perfectly true; that is, one set of wheels will perhaps wear more than the other on account of the variation in the quality of the iron, and as soon as one set of wheels is in the slightest way different from the others a bad action takes place between the driving gear and wheel, for the reason that one wheel is trying to run faster than the others, which, of course, naturally will cause one set of wheels to be dragged along until that distance has been overcome, and when the wheels start anew, the gears are in a short time thrown out of mesh with each other. It will be understood that in order to make a successful gear driven by a single motor, it is necessary that both sets of wheels travel exactly with the same speed over the rails, and that the truck on which the motor is mounted must be perfectly rigid, so that the gears will at all times mesh with each other. In practice this has been found almost impossible, especially where heavy work is required and a large number of curves are to be found, and also where the track is in bad condition, excepting possibly when the wheels on the truck are perfectly new, and the track in good shape and the curves very liberal, but it will be found if one set of gearing is disconnected, that it will require from 15 to 20 per cent. less power to operate. It is for these reasons that I believe the best results are obtainable by connecting a single motor to each axle of a truck. It may be argued that there is twice the liability for trouble where two motors are used, but experience proves that this is not exactly so, for by this method you obtain the proper traction and benefit of all wheels, and in case of extra load you have ample power to operate the car under all conditions of service, and in case of injury to any part of one motor, it can be disconnected and the car operated until an opportunity offers to make the necessary repairs.

A single reduction motor should be so constructed as to give the greatest possible distance between the bottom of motor and top of rail. With the best form of motors which have, up to the present time, been constructed, the greatest distance obtainable between a 15 H. P. motor and top of rail is $2\frac{1}{2}$ ins. when placed on a wheel 30 ins. in diameter. I strongly recommend the use of larger wheels, either 33 or 36 ins. in diameter. With a motor mounted on 36 inch wheels, this will give a clearance of $7\frac{1}{2}$ ins., which is more than ample to clear ordinary track obstructions, and if the motor is thoroughly protected in its frame, it will not be necessary to use motor pans, which have been a necessary evil in connection with double reduction motors. It may be stated that a car equipped with 36-inch wheels requires an excessive amount of current to operate, but this is not a fact. On a test which I made more than a year ago on a car equipped with 36-inch wheels and a car equipped with 30-inch wheels, the same motor equipment and car of same length and weight, operated over same length of road on same day and by same man, total length of line being 16 miles, it was found that the car equipped with 36-inch wheels required about three-quarters of one H. P. more on an average than the car equipped with 30-inch wheels, although the 36-inch wheel car required more current in starting and climbing grades, but it would run longer on the level by momentum, and thus average up the current consumption.

With the present form of single reduction motors I think that the 33-inch wheel is of ample size.

On tests which have been made with the best types of single reduction motors, they have been found to be from 8 to 10 per cent. more efficient than the double reduction, and are capable of retaining a much higher speed under various conditions of service. On a recent test which I made on an over-country road, which was some $11\frac{1}{2}$ miles in length, the car being 34 ft. in length, and with 25 passengers, the total weight of the car being 23,700 lbs., the car equipped with double trucks having two 25 H. P. single reduction motors to each car, the maximum speed attained was 32 miles per hour, this car climbing grades of 4 and 5 per cent. at the rate of 17 miles per hour, and on a car 16 ft. in length, equipped with one 15 H. P. single reduction motor, the maximum speed attained was 25 miles per hour, on the level, and the car in climbing grades of 4 and 5 per cent. would not attain a speed of over 5 miles per hour.

By the use of single reduction motors the cost of maintenance and operation will be greatly reduced on any road so equipped for the reason that the number of parts has been greatly reduced from that of the double reduction, and its efficiency greatly increased. I am of the opinion that the single reduction has come to stay and will continue to force its way to the front, and eventually supersede the double reduction motors with which the earliest roads were equipped.

Following these papers on April 11 was a debate on the resolution "That the Trolley System should be used in Chicago."

The affirmative was supported by Alex. Dow and Frank L. Perry, and the negative by St. John V. Day and E. E. Keller. F. W. Parker acted as judge.

The arguments both *pro* and *con* were well given, and the points

made on each side were appreciated, though the sentiment of the audience was evidently with the affirmative. One of the advocates on this side showed by the stereopticon a view of Indiana Avenue at present, and as it would appear equipped with trolley poles, as evidence that the latter are no disfigurement to the street. Mr. Parker as judge, decided that both the affirmative and negative of the question were proved, and that the trolley system was the best adapted for some of the streets of Chicago, while on some streets another system was preferable.

At the same meeting resolutions were also passed expressing the appreciation by the club of the work done in electrical science by the late Charles J. Van Depoele, and their sympathy with his bereaved family.

Methods of Electrically Controlling Street Car Motors.*

BY H. F. PARSHALL.

While in many respects the controlling apparatus for street car motors and the general requirements of the same do not differ greatly from some other cases, there are some features that demand the closest attention if the car is to be handled either efficiently or comfortably so far as the passengers are concerned. While the number of methods proposed and tried in times past has been great, at the present time there seems to be sufficient agreement between the principal designers and sufficient data at hand to warrant the writing of a fairly comprehensive paper on the subject.

The problem of controlling the motors is probably the most difficult one in the whole range of street car work, and in no small degree determines the electrical design of the motors, or, to be more specific, to start a car under any given conditions of track a certain torque is required. Beyond a certain limit, fixed largely by the convenience of passengers, this torque cannot be exceeded. The smaller the current with which the motor is able to develop this torque, the smaller the rheostat or other starting devices may be and the more efficient the car equipment. Should the motor, therefore, be incapable of developing a comparatively powerful torque per ampere, the amount of energy dissipated either in the magnetic windings, armature windings, or rheostat becomes excessive, the results being the more or less rapid deterioration of these parts.

It may not be out of order here to discuss the design of the motor with reference to getting this torque most efficiently. The average horse power exerted by a street car motor at the car wheel probably does not exceed 20 per cent. of the maximum it is expected to do in starting the car under the various conditions encountered. Now, to get the highest efficiency from a motor run under these conditions, it is necessary to get the highest possible efficiency at that horse power at which the greatest amount of work is to be done, and inasmuch as the loss in the conductors for this horse power is necessarily low (otherwise the motors would burn out in doing the maximum work to which they are subjected), the question does not resolve itself into how to get the least possible motor resistance of armature and magnets, but rather, how to minimize the constant loss of hysteresis, eddy currents and friction. While all of these losses vary somewhat with the speed in series wound motors, the variation of these losses is not great, since for an increased speed there is in general a diminished intensity of magnetization and pressure. To render these losses a minimum, and at the same time to get the requisite torque to handle the car efficiently, there is but one solution; that is, to put the maximum number of turns on the armature compatible with good running as to heating and sparking.

The particular advantages of the commutated field method are, that with a limited number of pounds of copper, or, in the case of street car motors, with the limited space available for field magnet windings, it is possible to adjust the magnetizing force of the field coils so that the rate of doing work of the motors may be made to correspond with the rate this work is required by the car for the various speeds and conditions of track. This adjustment may be made for any size of motor with any required degree of precision by varying the number of magnetic coils. To increase the range or precision it is only necessary to increase the number of coils. In practice it has been found that this number could not be very great, otherwise the car wiring becomes too complicated and too expensive. This same holds true of the controlling switch. Three magnet coils, or sets of magnet coils, seem to be the practical limit, since there is a general agreement between street railway managers that the present number of magnet connections (six) should not be increased, and even with this number there is occasional trouble with broken wires or terminals. With a fifteen H. P. motor it is possible with three sets of coils to run under most conditions met with in practice without employing external resistance. It is occasionally necessary, however, when the car is to be run at two or three miles an hour, to make use of the resistance coil that is ordinarily used only when starting. With twenty-five H. P. motors it is necessary, with three sets of magnet windings, to make use of this resistance coil very considerably in ordinary practice, since without this it is not possible to get a speed of less than one-third of the maximum speed of the car, which is generally taken to be about eighteen miles an hour.

A method that is receiving a great deal of attention now is that known as the "Series Parallel Method." While it has not yet been introduced very largely in practice, numerous experiments have indicated the desirability of doing this as soon as some of the troublesome features of the switch have been overcome. The method of operating is as follows:

*Abstract of a paper read at the sixty-sixth meeting of the American Institute of Electrical Engineers, New York, April 19th, 1892.

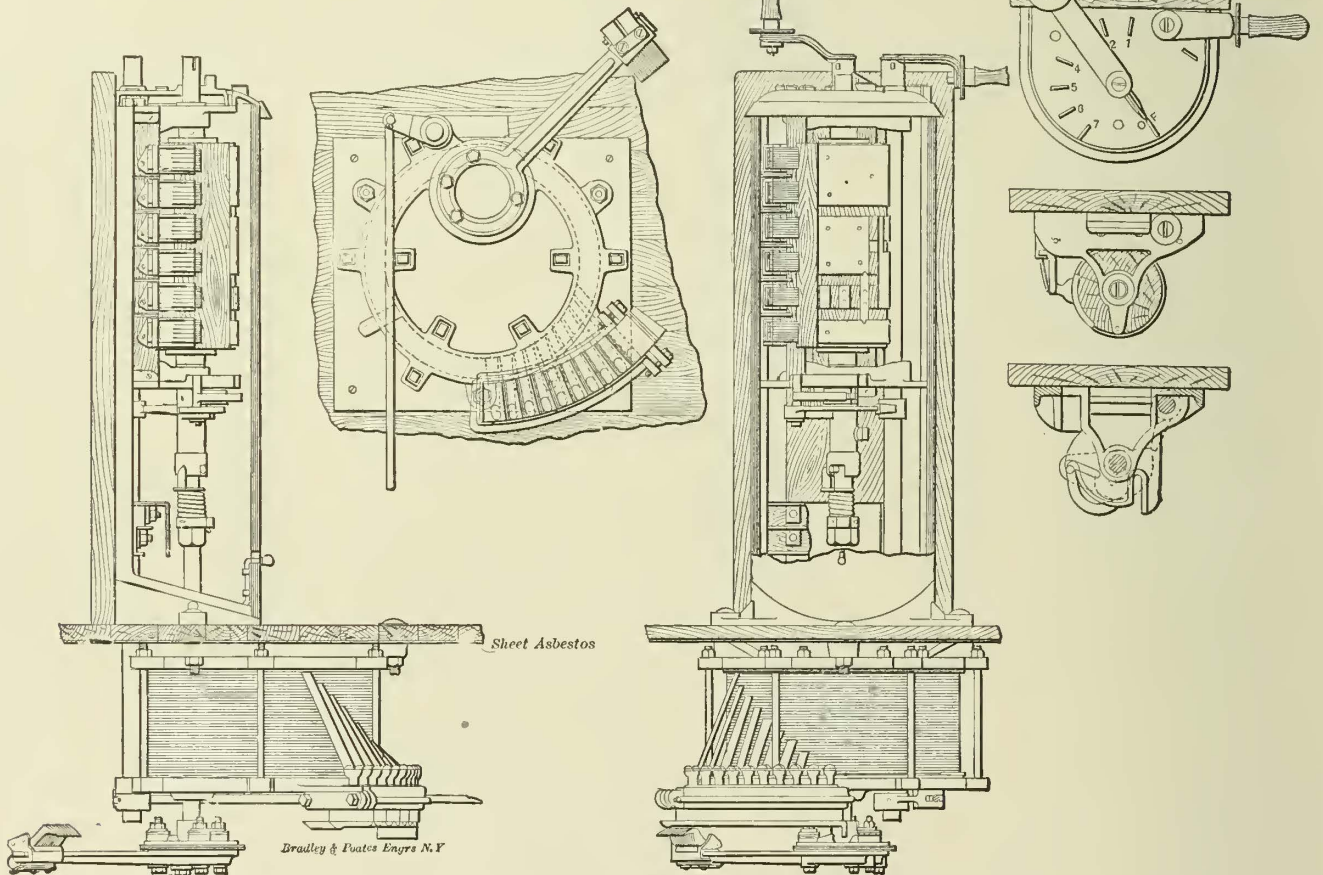
In starting, a rheostat of from eight to twenty ohms is used, according to circumstances, in series with the motors, which are in series with each other. After this resistance is thrown out of circuit the magnet coils of one of the motors are short circuited, a section at a time. To make the start smooth, three or four coils at least are required. The magnet coils being short circuited, the armature is then short-circuited, and the magnet coils thrown in circuit simultaneously with the armatures being thrown in parallel. It is just at this point where the difficulty with the switch has been encountered, since either the switch has to be operated with great rapidity or the contacts act in perfect unison, otherwise unpleasant results as to short-circuiting occur.

The advantages of the method are that a very wide range of speeds is obtainable at a comparatively high efficiency, and that the energy required to be dissipated by the rheostat is small for the low speeds frequently required in city practice. This lessening the duty of the rheostat is a very important point, since as yet it has been found exceedingly difficult to construct a cheap rheostat that could be placed under the car in the small space available and dissipate so large an amount of energy as is required when the car is to be run for a considerable time at a speed as low as two or three miles an hour. Any method

the rheostat and commutated fields the switch mechanism becomes too complicated and the switch too large to have the reversing performed by a reverse movement of the controlling switch handle.

It is to be noted that the general design of this rheostat is such that those parts having mechanical functions and energy dissipating functions have been separated as much as possible. Of course the mechanical functions of a rheostat are more or less limited; it is evident, however, this effort is in the right direction. It is with respect to this particular point that the rheostat has a decided advantage over any form of mechanical clutch in starting a car. The clutch, of course, has its advantage in starting quickly bodies that have a great amount of inertia. In ordinary practice, however, the amount of energy dissipated in a clutch is approximately equal to that necessary to dissipate in a rheostat, but the clutch has, in addition to its energy dissipating function, a very exact mechanical function, and these two functions are interdependent on the same wearing parts. For this reason, if no other, clutches have not yet been made to compete favorably with rheostats.

An important point that has been attended to in this switch is the breaking of the circuit on a separate switch instead of on the cylinder. A snap switch, of the knife blade pattern, is employed to break the



of control that has lessened the energy to be dissipated in the rheostat has in general been considered with favor, since there has been a corresponding diminution of trouble in each case that the energy to be dissipated has been lessened.

Having now given a general discussion of the problem a brief description of some of the apparatus recently devised may prove of interest.

The cut shows the general design and arrangement of an improved form of platform switch, which combines both the "field commutation" and the "series resistance" methods of starting cars. To start the car, the switch handle is turned from the position marked "off" with a counter clockwise movement; this movement carries the arm of the rheostat, which is placed under the switch, around and over the contact segments, so that the resistance is gradually cut out of circuit. After the contact arm has been carried around to 135 degs. and all the resistance has been cut out, it is released from the cylinder shaft and left locked in this position. A further movement of the switch handle then affects only the cylinder, and commutates the sectional windings of the field magnets of the motor from series to parallel in the usual way. In stopping the car the field coils are turned from parallel to series, the resistance coil is then again put into circuit and the circuit broken when the contact lever leaves the last segment of the resistance coil, and not, as hitherto, upon the cylinder contacts. The only caution to be observed in stopping is to see that the switch handle shall be turned to the position marked "off," for the motors are reversed by means of a separate reversing switch placed under the car and operated by a lever connecting with a separate shaft in the controlling switch case. The shaft of the platform switch interlocks with this reversing shaft in such a manner that it is impossible to reverse the motors until the cylinder is in the "off" position. The use of this separate controlling switch has been objected to, but to combine both the advantages of

circuit at four points. It operates in connection with the cylinder shaft to which it is connected with a special locking and releasing gear of similar design to that shown in the cut. The first movement of the cylinder shaft closes the snap switch and completes the circuit through the coil. Further movement then disengages the snap switch from the shaft (leaving it closed) and the different commutations are affected. When breaking the circuit the snap switch is again brought into action.

When this form of car controlling switch is used, the platform lever is fitted at its lower end with a bevel gear wheel meshing into another gear wheel placed on the cylinder shaft. When necessary, an extension shaft fitted with one or more universal joints, makes connection between the platform lever and the cylinder shaft. When this switch is placed in the middle of the car, the amount of car wiring is materially lessened and the car inspection made more easy.

THE Short Electric Railway Co., of Cleveland, have made a change in the location of their New York office. Having found their somewhat limited quarters in the *World Building* too small for their purposes they have opened an office in the *Mills Building*, 15 Wall Street. At this office will be found, hereafter, the same genial and gentlemanly representatives of this enterprising electric railway company, Messrs. E. J. Wessels, manager of the office, and Mr. C. C. Curtiss, confidential agent of the company, who have represented them before and who are rapidly making themselves a power in the street railway fraternity of New York and New England.

Short Electric Railway Notes.

THE New York special agent of the Short Electric Railway Co., Mr. E. J. Wessels, has recently returned from a business trip throughout New England, and reports much interest in apparatus manufactured by the Short Electric Railway Co. in that section. As a practical result of his trip he returned to New York with orders representing no less than fifty-two motors, the first, we believe, of the kind which will be installed in New England. The New Haven & West Haven Street Railway Co., of New Haven, Conn., head the list with an order for nineteen single equipments of twenty-five H. P. single reduction motors and seven double equipments of the same type. This railway company have long been anxious to install electric motors, but have only just received the requisite permission from the municipal authorities. Work has been begun and the road will be equipped as rapidly as possible. The order for the engines and generators has been placed with Westinghouse, Church, Kerr & Co., who will supply three of their large size direct connected engine and generator units. The power station will be at about the middle of the line on West River.

Next on the list appears the name of the Norwich Street Railway Co., who have ordered fifteen twenty-five H. P. single reduction motors, and this road will be changed from a horse to an electric line as rapidly as possible. The power station will be located at Taftsville. The third name on the list which Mr. Wessels brought back with him is that of the Natick (Mass.) Street Railway Co., who have requested the Short Electric Railway Co. to supply them with four twenty-five H. P. single reduction motors. Mr. Wessels says that the outlook in the street railway line in New England is very bright, and expects to do a large business in this territory.

For these three orders, aggregating fifty-two motors, the Short company promise prompt delivery, and it is expected that all three roads will be using their summer apparatus early in June.

The Short Electric Railway Co. also announce recent sales to the Braddock Electric Railway Co., Braddock, Pa.; the Union Passenger Railway Co., Chester, Pa.; the Ft. Wayne Electric Railway Co., Ft. Wayne, Ind., and the Schuylkil Electric Railway Co., Pottsville, Pa.

THE Short Electric Railway Co. are now shipping to Siam the entire installation of the first electric tramway in that country. The name of the company who are the purchasers is the Bangkok Tramways Co., and the road, which is six miles in length, is practically level and most interesting throughout its entire length, crossing fourteen of the many canal bridges in Bangkok. Teakwood poles will be used in construction throughout—in fact, all wood used in construction with the installation will be teakwood. Included in the equipment are generators, two steam plants complete, six car equipments and extra parts. The order is the outcome of the visit to this country of Mr. Aage Westenholz, who made a thorough examination of electric railway apparatus, both in Europe and in this country, visiting all the large manufacturing companies and the most successful of their plants.

THE Fort Wayne Electric Railway Co., of Fort Wayne, Ind., is one of the most recent corporations to adopt Short motors, and their decision to install electric power is all the more interesting because the principal owners are also largely interested in the cable railway at Cleveland. The order for apparatus includes twelve car equipments complete, comprising fourteen twenty H. P. single reduction Short motors, and ten miles of overhead construction. Shipment of apparatus is already begun, and from the vigorous manner in which the Robisons are pushing the construction work, it is expected that the road will be completed and in operation by June 1.

ONE of the most successful railways ever installed is that operating between East Liverpool and Wellsville, O. It will be remembered that this road, which consists of eight miles of overhead construction and operates eight cars, was completed in exactly three months from the day when the ground was broken. Mr. Al. Johnson, an in-

domitable worker, personally superintended the installation, and the road, as might be expected, is furnished throughout by the Johnson Rail Co. A full description of this road was given in our January issue just after trial trips had been made.

The success of the road from the start was assured, and the company, consisting of Mr. Al. Johnson, Mr. S. H. Short and Mr. C. E. Grover, all of Cleveland, have been obliged to double the equipment in order to accommodate the summer travel. The J. G. Brill Co. are just completing eight fine open cars, somewhat unusual in the fact that they are eight instead of seven bench cars, and for these cars the Short Electric Railway Co. of Cleveland, O., will furnish sixteen 20 H. P. single reduction motors and two additional 133 H. P. generators.

E. H. Jones & Co. of Cleveland, who put in the first steam plant, are also doubling their part of the equipment.

It is a curious fact, to be explained only by the character of the manufactories in Wellsville and East Liverpool, that these towns, the total population of which is 16,000 people, can support a street railway system larger than that to be found in some cities of 40,000 and 50,000 inhabitants.

Refunding Street Car Fares.

A suit of more than usual interest to street railway companies, although the amount involved was extremely small, was brought against the North Side Railroad Co., Chicago, in a justice's court. There were seven complainants. They had boarded a Clark Street car bound south. At Chicago Avenue the cable broke, and the passengers were offered transfers good on the Wells Street cable line two blocks distant. The seven men who figured in the suit refused the transfers, and demanded the return of the fares which they had paid the conductor. Naturally, the latter refused to refund the money, but offered the transfers. Suits were then brought, and each complainant wanted, in addition to five cents, the sum of \$2.00 to pay for wear and tear of shoe leather and the injury wrought to his feelings. Attorney Johnson who represented the company asserted that when the company accepted a nickel from a passenger that fact did not oblige the company to carry the passenger on that particular car only. That in the event of a breakdown, transfers on other lines were given. Neither was there any contract, according to Mr. Johnson, to land a passenger at any particular point by any particular car unless the latter insisted upon such an agreement when he entered the car.

Justice Wallace decided that the company must refund the nickels and pay \$3.75 into the court as costs in one case. In the other cases the complainants failed to appear, or the complaints were thrown out on technicalities. An appeal was taken.

THE University of Wisconsin, at Madison, Wis., has just issued a circular of its engineering school, containing an outline of the courses open to students there. We are pleased to notice that in the electrical engineering department, which is in charge of Prof. D. C. Jackson, considerable attention is devoted to the study of the special conditions arising in electric railway engineering and that this institution recognizes the call for trained experts in this branch of electrical work.

THE electric railway company of Lexington, Ky., seem to be prolific of novel ideas. In a recent issue mention was made of the company's plan of interesting the public in taking care of fare receipts. Since that time it has been decided to carry weather signals on the cars.

THE Thomson-Houston Electric Co. have received an order for fifty car equipments from the New Orleans & Carrollton Railway Co. The construction will be done by J. G. White, of New York.

Obituary.

STEPHEN T. POPE.

The death of Stephen T. Pope, superintendent of the Chicago City Railway Co., is announced. Mr. Pope was born in Dorchester, Mass., and was graduated by the Massachusetts Institute of Technology in Boston. For many years he was superintendent of the Chicago Division of the Chicago, Burlington & Quincy road. Mr. Pope was appointed to the superintendency of the Chicago City Railway Co. about a year ago, but for a short time only performed the duties of the position. Failure of health necessitated a trip to California, and his death occurred in that state.

COL. CALVIN GODDARD.

Col. Calvin Goddard, president and manager of the Chicago & South Side Rapid Transit Co., died April 4, at San Francisco. About a month previous to that time he had left Chicago for a rest, as he was entirely broken down by overwork. Col. Goddard was fifty-five years of age at the time of his death. He was born at Norwich, Conn. He entered on his business career in Chicago, and was assistant cashier of a bank in that city when the war broke out. He immediately volunteered his services and went on the staff of the governor of Ohio as adjutant. While in West Virginia he met Gen. Rosecranz and joined his staff, soon becoming adjutant-general of the Army of the Cumberland, being the youngest man to hold that position in the national forces. He was with Rosecranz both at Vicksburg and Chattanooga. After the war he accepted the position of treasurer for the Wells, Fargo & Co. express, and later held a similar office with the New York & New England railroad company. He was connected with the first Edison company. He was the president from the time of the organization of the Chicago & South End Rapid Transit Co. Until two years ago he had resided, since the war, in New York, but then he moved to Chicago.

A Valueless Franchise.

The Union Railway Co., of Providence, R. I., which controls all the street railway business of the city, being desirous of equipping its lines for electric traction, recently tried to negotiate \$3,000,000 of bonds upon its property and franchise, but found that no financial institution in the country would have anything to do with them, owing to a clause in the charter, which reserves to the City Council the right, on giving ninety days notice of its intention so to do, to annul, amend or alter the terms and conditions upon which the company is authorized to operate its lines of road, and to order the rails or any part to be taken up and the streets restored to their original condition.

In order to secure an amendment to the charter and give it value, the company has petitioned the legislature for an extension of time to twenty years, and while the objectionable clause is allowed to remain, it is supplemented with the provision that an equivalent location be provided in another street.

The history of the case is fully set forth in the following communication recently presented to the City Council of Providence by the Union Railroad Co. The communication is not only interesting in the features relating to the franchise, but also for the endorsement given to the value of electric traction:

"Your honorable body is familiar with the urgent needs of this community in the matter of improved facilities for the rapid transit of passengers. It is universally conceded that the future growth and prosperity of the city depend in a very great measure upon the early and successful solution of this question.

"This company, after a careful study of the situation, in the summer of 1890, applied to your honorable body for permission to use electricity as a motive power under the trolley system on all its lines. After prolonged discussion permission was granted it to inaugurate that system on the Broad Street route, where it has now been in successful operation for a number of months. The opposition to it entertained by many good citizens prior to its introduction has now substantially disappeared in the light of practical every day experience of it in our midst. One has only to take a trip over Broad Street to see the marvelous improvements already called into being by that line. Similar

results will undoubtedly be produced by other lines in other parts of the city. The great mass of our citizens are awake to this fact, and this company is now in almost daily receipt of applications and requests to extend the electric service in other directions.

"We are desirous now, as in the past, of giving to the public a street car service as good as the best in the land.

"One thing we have learned by experience, however, is that to replace horses with electricity means, in effect to throw out our entire present plant and replace it with a new one; the roadbed must be rebuilt and relaid with heavier rails; larger, heavier cars of different construction must be provided and new car houses built to meet their requirements. Besides this there is the matter of electric construction and power.

"A conservative estimate shows that it will cost this company not less than \$2,000,000 to equip its system for operating by electricity. It is obvious that the only way to raise this large sum of money is on bond and mortgage. Such bonds would have to be sold in the great financial centres of the country.

"Negotiations have been had with bankers and institutions, both here and elsewhere, with a view to placing the first mortgage bonds of this company, with the uniform result that the gentlemen applied to have declined to entertain the matter."

Their reasons for this are set forth in a number of letters, two of which are quoted as a fair sample of all:

NEW YORK, April 12, 1892.

"JESSE METCALF, Esq., President Union Railroad Company, Providence, R. I.

"DEAR SIR:—We are in receipt of your favor of the 11th inst., with enclosures as stated. While the bonds of such companies as yours would undoubtedly otherwise be considered a good investment, it is proper for us to state that the clause of the charter empowering the City Council in giving ninety days notice of its intention so to do, to annul, amend or alter the terms and conditions upon which your company is authorized to operate its lines of road and to order the rails or any part to be taken up and the streets restored to their original condition, etc., would naturally make any conservative person hesitate to purchase them. Under existing conditions we beg to say, frankly, that we shall not ourselves care to undertake their negotiation.

"Regretting that we are not able to make you a more satisfactory answer, we remain, yours truly,

MORTON, BLISS & Co.,

NEW YORK, April 12, 1892.

"JESSE METCALF, Esq., President Union Railroad Company, Providence, R. I.

"DEAR SIR: We are in receipt of your letter of the 11th inst., enclosing balance sheet and synopsis of charter of your company and the city ordinances controlling it.

"We can understand how, with local ownership of capital stock, your company can have grown up under the extraordinary conditions of city control which appear in the rules and regulations of which you give an abstract, but we say without hesitation that it would be entirely impracticable to place in this market the proposed new mortgage or any considerable part of it, excepting under such concession from the city as will give assurance of permanent occupation of the existing and proposed lines, without the reserved right to the charging City Council to practically destroy the value of the property at any moment it pleases.

"Capitalists always regard with timidity securities, the existence of which depends largely upon the judgment or caprice of politicians, and it is certain that the ordinances which you quote place in the hands of the city authorities a measure of power which practically prohibits the creation of a mortgage good enough to recommend to investors.

"We regret to have to send you this adverse opinion, but we feel sure that an essential modification of the franchise will be necessary to enable you to make a good bond. Yours truly,

"H. C. FAHNESTOCK, Vice-President."

First National Bank.

"In order to obtain the money necessary to carry out the improvements which are demanded in the immediate future by the citizens, this company finds itself, therefore, under the necessity of applying to the General Assembly for such legislation as shall be required to do away with the features objected to. It is believed that the objectionable clauses are of theoretical rather than real value to the city. To order up the rails of the street car lines out of the streets would create a revolution in the entire life of the people. The citizens would not tolerate it. The right to order up the rails can be of value to the citizens only in exceptional cases where owing to changing conditions, the rails are no longer desirable in some particular locality. This must have been the intention in framing the law as it now stands. A reservation of a right to order up the rails in a street, provided an equivalent location be given elsewhere; would not be objectionable to bondholders, and would answer all the requirements of the city."

"We beg herewith to give notice to the city of our intention to make this application to the Legislature at once, and to request your Honorable Body to co-operate with us in obtaining the needed legislation, which will so manifestly inure to the benefit of the city as well as of this company.

"In order to prevent any possible misunderstanding, we will add that it is not our purpose to ask for any legislation that will in any way interfere with the entire control by the city over the speed and running of the cars and other police regulations in the streets as at present; nor with the right and power of taxation by the city; nor with the right and power of the city to grant franchises and impose payment therefor under the provisions of the "Franchise act," so called. Respectfully submitted,

Union Railroad Co.,

JESSE METCALF, President."

Annual Report of the Thomson-Houston Electric Co.

The annual meeting of this company was held at Middletown, Conn. during the past month. The old board of directors was re-elected and the report of the company's finances and business for the year ending February 1, 1892, was presented by Vice-President Coffin.

The following board of directors was elected: H. A. Pevear, C. A. Coffin, J. I. Smith, B. S. Spinney, C. H. Newhall, S. A. Barton, E. Griffin, S. E. Peabody and T. J. Coolidge, all of Boston.

The report contains many interesting figures regarding the business of the past year. Owing to the extremely depressed and precarious condition of the commercial interests of the country at the opening of the year an essential decrease in the business of the company was experienced during the first few months of the year, particularly in that portion derived from the local lighting organizations operating from central stations.

The number of street railway companies operating and under contract, reported January 1, 1891, was 145; added during the year, 59; total, January 1, 1892, 204, employing altogether nearly 3,000 cars, with an aggregate mileage of about 2,500 miles.

The annual report shows the income for the year ending January 30, 1892, after deducting dividends paid, to be \$1,524,414.25 and the total surplus account \$7,546,947.96.

Street Railway News.

General.

Brooklyn, N. Y.—Last month a fire broke out in the Atlantic Avenue Railroad Co.'s stables and did damage estimated at \$7,000.

Chester, Pa.—The Union Railway Co. have awarded the contract for building ten new cars for the trolley system to the J. G. Brill Co., of Philadelphia. The contract for building the two engines and boilers for the operation of the plant has been awarded to Robert Wetherill & Co., of Chester. The company will probably give the rail contract to the Johnson Co., of Johnstown. The electrical equipment is to be put in by the Short Electric Railway Co., of Cleveland, O.

Chicago, Ill.—The cable cars of the North Side system were delayed recently by an unusual accident. A horse in some way caught his shoe in the slot, and so tightly was it wedged that it was found necessary to pry off the slot rail in order to release the animal.

THE Lake Street Elevated Railroad Co., of Chicago, have filed a certificate stating that the capital stock has been increased from \$3,000,000 to \$5,000,000. The money is to be used in extending the system. It is assumed that the increase in capital stock means that the negotiations by New York capitalists for the purchase of the road are now abandoned. The representative of the New York syndicate objected to the road for several reasons, the chief of which consisted in the fact that the terminus of the road was on the West Side and not within several blocks of the heart of the city.

Detroit, Mich.—The Supreme Court has recently handed down a decision which is of interest to street car companies. A suit was brought by Clara L. Roshier against the East Detroit & Grosse Pointe Railway Co. While the plaintiff was driving in a buggy on the tracks of the defendant the vehicle was struck by a car. She was injured, and claimed damages to which the Appellate Court finds she is entitled. The court holds that she was not negligent in driving upon the track, nor was a trespasser. The question whether, being on the track, the plaintiff used reasonable diligence and ordinary care to prevent a collision, was one for the jury to determine. Street cars have precedence necessarily in the portion of the way designated for their use. This superior right must be exercised, however, with proper caution and due regard for the rights of others, and the fact that it has a prescribed route does not alter the duty of the company to the public who have a right to travel upon its track until met or overtaken by its cars.

THE Board of Public Works, in a communication to the Detroit Citizens' Street Railway Co., refuse to sanction the overhead electrical system. The company, however, will make the attempt to equip their Jefferson Avenue line so that if rapid transit is not adopted it will not be their fault.

Elmira, N. Y.—A syndicate composed of the mayor and a number of bankers and capitalists of this city, have just obtained control of the Elmira Water Works, the Elmira Electric Light Works, the Electric Street Railway system of thirty-three miles and the Interstate Fair Association, which will be put under one management as the Elmira Municipal Improvement Co.

Hamilton, Ont.—The street railway injunction has been dissolved and the street railway company have awarded their contracts for electrical equipment. The Eastern Electrical Supply Co. will furnish the poles, etc., the Edison General Electric Co. the feed wire, John A. Roebing's Sons Co. the bare copper wire, J. Cooper & Co. the iron wire, the Westinghouse Electric & Manufacturing Co. the motors and generators, and Ahearn & Soper the labor and work of construction.

Lynn, Mass.—The Lynn & Boston Railroad Co. are erecting a handsome brick power station on lower Washington Street. By June 1 it is hoped to have it equipped with three 350 H. P. Watts-Campbell engines and Babcock & Wilcox boilers, also three 350 H. P. multipolar generators of the Thomson-Houston type. As soon as this plant is in operation several additional lines in Lynn, now running with horses, but equipped for electricity, will be furnished with electric cars.

New Bedford, Mass.—James Irvine of the New York Equipment Co., has purchased a controlling interest in the Union Street Railway Co.

New York, N. Y.—A big street railway deal has been brought about by the Widener-Elkins-Lamont syndicate, by which seven New York City railroads are consolidated under one management, the title being the Metropolitan Traction Co. and the president John D. Crimmins, the contractor. The combination at present consists of the Broadway Cable Road, Broadway & Seventh Avenue Line, Chambers and Twenty-third Street Crosstown lines, Ninth Avenue, Sixth Avenue and the Avenue C lines, but it is the intention of the new company to obtain control of the entire surface car system of this city, overtures with that end in view having been made. President Crimmins will have as his associate officers Henry Thompson, vice-president; Daniel S. Lamont, secretary; Thomas F. Ryan and Daniel B. Hasbrouck, treasurers.

Pittsburgh, Pa.—The Duquesne Traction Co. are making a car wheel which, they think, competes favorably with anything in the market. If successful, the wheel will probably be adopted for all their cars. Mr. George Rice has now no connection with this company.

San Diego, Cal.—The San Diego Electric Railway Co. have commenced work on the electric equipment of their road. This company take the place of the old San Diego Street Car Co., which went into the hands of a receiver some time ago, and whose property was sold to A. B. Spreckels of San Francisco last October. Joseph A. Flint, who has acted as receiver for the old company, is secretary and treasurer of the new company.

San Francisco, Cal.—A very quick piece of cable construction was performed recently on the Sacramento Street branch of the Ferries & Cliff House Railway. The length of line was 2,800 ft. of single track with concrete roadbed, and the entire work was completed in seventy days from the time of commencement. The work was under the charge of Mr. Howard C. Holmes.

Toronto, Ont.—A deputation of aldermen have been inspecting the various electric systems in the United States in order to determine on the one most suitable for Toronto. The City Engineer has reported in favor of the trolley, but the Council wanted more information in regard to the storage battery. Detroit, Cleveland, Pittsburgh, Washington and other cities were visited.

THE company will have thirty new open cars ready to go out by May 1, and have twenty box cars now in course of construction and it is proposed to give a better summer service than ever before. Though the snowfall has been considerable during the past winter, no difficulty has been experienced in operation and the receipts have shown good gains over the previous year, the increase for the month of March being \$8,638.97. The average earnings per car mile for the same month was 14.5 cents, the total car miles being 413,434. The company has over 1,400 horses at present, but they will soon have to give place to the electric motor.

Extensions and Improvements.

Atlanta, Ga.—THE Consolidated Street Railway Co. have asked permission to operate a double track electric line on Peachtree Street.

Brockton, Mass.—The East Side Street Railway Co. have petitioned for authority to extend their tracks from Centre Street at Quincy Street, to the Abington line.

THE Industrial Improvement Co., of Boston, expect to extend their street railway here to Holbrook, and will then build a line from Holbrook to Braintree to the Boston & Quincy line, which practically connects with the West End Street Railway of Boston.

Buffalo, N. Y.—Franchises lately put up for sale were all bought by the Buffalo Railway Co., the only bidder. The bid put in by Manager H. H. Littell was on the percentage plan, approved by the citizens' special committee and adopted for the whole system: 2 per cent. of annual gross earnings upon less than \$1,500,000; 2½ per cent. when under \$2,000,000 and over \$1,500,000, and 3 per cent. when over \$2,000,000. The company promise to conform to the various conditions of the general agreement.

Cambridge, Mass.—The West End Street Railway Co. have applied for the right to operate their electric system on Harvard Bridge and its approaches.

Charlottesville, Va.—Since the opening of the street railway in June, 1887, this city has doubled its population and area. The building on the line and at either end has been remarkable, and the undertaking of the street railway (which was considered by many a foolish thing) has proven to be one of the best investments, and increasing in value each year. The cars only run six days in the week, and yet the company have been offered four times its cost for the road. George Perkins has recently been elected secretary. The company expect to extend their line in May, and will want two cheap second hand, open, one horse cars.

Chester, Pa.—Media and Chester will be connected by a trolley railroad this summer. Samuel A. Dyer, president of the Union Railway Co., appeared before the Borough Council last month and asked for concessions, which were promptly granted, and he has signed a contract for the construction of the road.

Chicago, Ill.—The Calumet Electric Street Railroad Co. will extend their line from the terminus of the Cottage Grove cable line at Seventy-second Street to Burnside, at Ninety-third Street. This will be a distance of about three miles.

THE Calumet Electric Street Railroad have begun the extension of their lines from the terminus of the South Side cable system at College Grove Avenue and 72d Street. The road will build extensions

aggregating eighteen miles during the present year. The three miles of line on which the company are now at work will, when completed, give communication up South Chicago Avenue to Jackson Park, between Chicago and South Chicago, Pullman, Grand Crossing, Burnside and Dauphin Park.

The West & South Towns Street Railway Co. have asked for a permit to lay tracks on Twenty-second and May Streets and on Lawndale Avenue, making six miles of road. The application states that the company have decided upon using the overhead system of electricity, and will use, if permitted, an eighty pound girder rail.

Covington, Ky.—The new management of the Cleveland syndicate, who have purchased the street railway system, will at once begin the work of repairing the road. The iron rails are to be changed and the lines extended to Latonia, Ludlow, Milldale and to all the flourishing suburbs of Newport and Covington.

Denver, Colo.—The Tramway Co. expect to convert the Broadway and Colfax Avenue lines into electric lines.

Fort Wayne, Ind.—More double tracks are wanted by the Fort Wayne Street Railway Co., for their new electric system. An ordinance has been presented to the Council, to permit the company to extend their system.

Grand Rapids, Mich.—The Township Board has granted the Consolidated Street Railway Co. a new franchise to Reed's Lake from the city limits.

Jersey City, N. J.—The Jersey City & Bergen Railroad will extend the Newark Avenue horse car line from the Five Corners to the Hackensack River.

Kansas City, Mo.—The Northeast street railway have made a contract with the American Car Co. of St. Louis to build six eight-seat open cars for summer travel. They will be put on the road early in June. The tracks on Independence Avenue from Grand Avenue to Highland Avenue, will all be rebuilt. Steel curves and switches will be put on all parts of the road, and some of the tracks in Pendleton Heights will be relaid.

La Crosse, Wis.—An ordinance now being considered by the Council grants to the La Crosse City Railway Co. the exclusive right to construct and operate electric railways upon all their lines now operated with animal power, and in all streets which the Common Council may designate. This right to continue until June 1, 1927, a period of thirty-five years.

Lansing, Mich.—The Lansing City Railway Co. are about to build a new power house, and have asked for bids.

Marlboro, Mass.—A bill has been reported by the Legislative Committee authorizing the Marlboro Street Railway Co. to extend their tracks to Hudson and Westboro, or either of them. It requires the company to use the overhead electric system.

Memphis, Tenn.—The Citizens' Street Railway Co. will this summer extend their lines to the grounds of the Memphis Fair and Exposition.

The City & Suburban Railway Co. are having four elegant open motor cars made, and they will be received and put on the lines by May 15. They will seat about forty people each. Work is being pushed on the Raleigh electric road and it will be completed some time in June. The East End dummy line are contemplating some great improvements this summer. It is understood that work will shortly commence on equipping the line with electricity.

Milwaukee, Wis.—The Villard syndicate will extend the National Avenue line this summer. This is the line that it is expected will be extended to the State Fair grounds.

Montreal, Que.—A syndicate, which includes H. E. Everett, who controls the Toronto street railways, has acquired a controlling interest in the Montreal street railway, and purposes to introduce an electric system.

New Bedford, Mass.—The Union Street Railway Co. are making an extension of about three-fourths of a mile to their line and are laying a fifty-six pound T rail.

New Orleans, La.—Lately Comptroller Thoman sold a franchise at public auction to Mr. Judah Hart for the right of way for a street car service, for twenty-five years, over a number of streets. The work of construction is to begin within two weeks from the signing of the contract, and to be completed within a year from the same date. A bond of \$50,000 is exacted.

Newark, N. J.—The New Jersey Traction Co. have asked for the privilege of laying double tracks on Bank Street and Central and Fifteenth Avenues. This company intend to connect Elizabeth and Newark by electric cars before the summer is over.

Newton, Mass.—Two petitions were received recently by the aldermen from residents in Newton Centre and Newton Highlands asking that a franchise be granted to the Newton & Boston street railway to extend their route from the Centre to the Highlands.

North Woburn, Mass.—The North Woburn Street Railroad Co. will equip their line with electric power. The company have about seven miles of track, with termini at North Woburn and Medford.

Oakland, Cal.—An ordinance has been introduced in the Council supplementing the permission heretofore granted to the Consolidated Piedmont Cable Co. to construct, maintain and operate a street railroad on Washington Street and to provide for and require the running of a continuous line of street cars thereon from First to Fourteenth Streets.

The Oakland Consolidated Street Railway Co. have asked for a franchise to run cars to Mountain View Cemetery.

Peoria, Ill.—The Fort Clark and the Peoria Rapid Transit railroad companies will, it is said, shortly equip with electricity.

Pittsburgh, Pa.—A number of improvements in the way of increased facilities for carrying passengers will be made during the coming months by the Pittsburgh and Duquesne traction companies. Two new lines will be opened this spring. One will be an extension of the Lincoln Avenue branch out Deary Street and Larimer Avenue and across the Larimer Avenue bridge. The other branch will start at the junction of Fifth and Penn Avenues, go out Fifth Avenue under the Pennsylvania Railroad out Hamilton Avenue. Thirty new summer cars will be placed on the Duquesne line. They will be four feet longer than the present cars, with closed front and back, and with the seats back to back. On the Fifth Avenue line a double deck car will be tried.

H. SELLERS MCKEE has awarded the contracts for the Homestead extension of the Birmingham road. It will be a five mile double track road.

A SYNDICATE of property owners, among whom are J. B. Dewhurst, Sullivan Johnston, E. T. Earle, Fred. Schwitter and James Breen, have organized for the extension of the Perrysville electric line from the city line at Jacob Born's tavern to Perrysville, a distance of two and a half miles. The intention is to have the Federal Street & Pleasant Valley Co. operate the new road, or to effect some traffic arrangement by which the cars of the new line will have the use of the Pleasant Valley tracks.

Reading, Pa.—The Reading & Southwestern Railway Co. want the privilege to extend their tracks from Third and Penn Streets over a number of streets to North Reading.

St. Louis, Mo.—Bills for the extension of the Citizens' and Northern Central roads and change of motive power to electricity for the latter road and the Cass Avenue and Union lines have been signed by Mayor Noonan. The reconstruction of the three last named roads will begin at once and will be operated by a 2,000 H. P. plant to be erected on the site of the Northern Central Railroad stables.

San Francisco, Cal.—The Ferries & Cliff House Railway Co. have purchased the franchise known as the Eisner & Reinstein franchise, which was granted about two years ago with the privilege that cable or electric motors might be used on D Street. Work on the proposed branch will be commenced immediately. In due time it will be extended to the beach.

Sandusky, O.—The People's Electric Railway Co., the opening of whose line is fixed for May 1, contemplate extending it twelve miles to Milan.

Steinway, N. Y.—At a meeting lately of the directors of the Steinway & Hunter's Point Street Railroad it was decided to change the name of the road to the Steinway Street Railroad. George A. Steinway was elected president, Henry Ziegler vice president and Harry De Low secretary and treasurer. It was resolved to extend the railroad from Long Island City to Flushing, and that the trolley system of electric cars should be substituted for the present horse car system. The building of the electric road from the car stable in Steinway to Ninety-second Street ferry will be commenced immediately. The company have been capitalized in the sum of \$2,500,000.

Stoneham, Mass.—The East Middlesex Street Railway Co. have petitioned for a right to operate the electric system in the town.

Washington, D. C.—The Washington & Georgetown Railroad Co. have been authorized and required to extend their tracks from High Street, in the city of Georgetown, and west along M Street to Aqueduct Bridge. The changes are to be made and cars operated on the extension of the line by December 1, 1892.

SENATOR MANDERSON has introduced a bill to change the name of the Capitol, North O Street & South Washington Railway Co. to that of the "Belt Railway Co.," and to authorize the extension of the company's tracks over various streets to the company's present line on Seventh Street. To construct this extension the company are authorized to increase their capital stock in a sum not greater than \$100,000.

Waterbury, Conn.—The Waterbury Horse Railroad Co. are making preparations for more rapid car service on the South Main Street line in anticipation of the summer travel.

Worcester, Mass.—The City Council lately gave a hearing on the petition of the Worcester Consolidated Street Railway Co. for location of electric railway tracks in Summer Street. This brought out the fact that four other companies want the location.

New Roads.

Atlanta, Ga.—The North Atlanta Electric Car Co. have received permission to build a line from the Kimball House along Pryor Street to Church, on Church to Williams, on Williams to Spring and thence to the city limits.

Austin, Tex.—The Austin & Suburban Railroad Co. have been chartered. The directors are Seyes Hanlenback, of Chicago, R. Vanslyke, of Dallas, Geo. P. Warner and Chas. P. Schriviner, of Austin and J. W. Hoyt, of New York. The capital stock is \$70,000.

Baltimore, Md.—The bill incorporating the Baltimore & Washington Turnpike & Tramway Co. has been introduced in the legislature. Its design is to develop property between Baltimore and Washington. The capital stock is fixed at \$150,000, with authority to increase to \$300,000 and to mortgage at a rate not exceeding \$500,000 per mile. The plan is to make a turnpike road between the two cities, and authority is given to build a tramway for cars to be propelled by electricity or other motive power.

THE ordinance authorizing the construction of tracks on certain streets in the city by the Baltimore, Canton & Point Breze Railway Co. was passed by both branches of the City Council without discussion.

The Baltimore, East Baltimore & North Point Railway, with Frank Morrison and others as incorporators, have been incorporated, with a capital stock of \$50,000, with the privilege of increasing it to \$500,000. The company are authorized to construct a double or single track road, with horse traction or electricity, for the carrying of passengers or freight.

Bridgeton, N. J.—The Bridgeton Street Railway Co. have been organized here with Dr. H. K. Trask, president; William S. Scull, vice-president; Alexander R. Fithian, secretary and G. G. Browning, treasurer. Over \$20,000 is subscribed. It is intended to cover five miles of streets in Bridgeton and the company in the near future will continue the road to Carmel and Millville.

Brookwood, Pa.—A. B. Hamilton, N. Hamilton, C. W. Lynch, J. E. Fox and others have applied for a charter for the incorporation of an electric line, to be called the Brookwood Traction Co., to operate, lease and maintain railways in Dauphin, Lebanon and Cumberland counties. It seems that the intended corporation desire to connect the small towns in the lower end of this county by an electric railway.

Buffalo, N. Y.—Another suburban street railroad out of Buffalo will be built by the Buffalo & Hamburg Railway Co. which filed a certificate of incorporation lately. The new road will run from the city to Hamburg, and will be operated by electricity or cable. The capital stock of the company is \$150,000, and the directors named are: Cyrus J. Wheeler, J. H. Meech, Benjamin B. Hamilton, Joseph A. Oaks, Daniel O'Grady of Buffalo, and others. The principal office of the company will be in Hamburg.

THE certificate of the Buffalo, North Main Street & Tonawanda Electric Railroad Co. has been filed. The line of the new road will be from the end of Main Street along the town line road to Eggertsville and to Tonawanda. The capital stock is \$60,000. L. F. W. Arend is president; A. W. Fancher, vice-president; Edward Rutherford Secretary; C. C. Mead treasurer. Work will be commenced about May 1 and finished July 1 five cars will be installed at first.

Chattanooga, Tenn.—A meeting has been held at Sherman Heights to consider the question of an electric railroad. The Electric Railway Co. are willing to extend the North Dobbs Avenue line, but the Heights' residents object to the roundabout route and want a direct route by way of Harrison Avenue.

Chicago, Ill.—The Grand Crossing & Windsor Park Railway Co. are a new company, with a capital of \$40,000; incorporators, Belton Halley, Andrew J. Toolan and Frank H. Clark.

ARTICLES of incorporation for the Chicago Union Elevated Railway Co. were filed last month. The capital stock is \$17,000,000. The incorporators and first board of directors are John Tyler, Thos. F. O'Malley, Wm. Bell, G. E. Scott and Geo. M. Rekels.

THE Calumet Belt Railroad Co. has been formed. The railroad which it is proposed to construct will extend from a point on the South Chicago Railroad intersection of Erie Avenue and South Chicago Avenue, running in a southerly or southeasterly direction to a point on the Illinois-Indiana State line, with a branch extending westerly to a point on the Illinois Central road between Kensington and Harvey.

A FIFTY year franchise was granted to the Metropolitan West Side Elevated Railroad Co. at the Council meeting recently. The ordinance requires that at least eight miles of two tracks shall be laid down and operated within two years, and the remainder within three years from the time of the acceptance of the ordinance; that \$100,000 in cash or Chicago City bonds shall be deposited in the city treasury to secure the completion of five miles of track in two years and become the property of the city if they are not completed, and that a further bond of \$100,000, to secure the city from damages, be filed.

THE Western Dummy Railroad Co., have been organized to operate a dummy railroad on the World's Fair grounds; capital stock, \$500,000; incorporators, Eugene H. Dupee, Lockwood Honore and Arthur A. Bliss.

A PROJECT for building an electric road along the North Shore, connecting with the proposed Chicago & Evanston electric road has been talked of. The new line would extend as far north from Evanston as might be considered desirable.

THE Grand Crossing & Windsor Park Railway Co. of Chicago, have been incorporated to operate a street railway; capital stock, \$40,000; incorporators, Belton Halley, Andrew J. Toolan and Frank H. Clark.

Coraopolis, Pa.—The people of Neville Island and Coraopolis are about to build an electric line, as follows: Beginning at Thorne Street in Coraopolis and running along Fourth Avenue to Ferry Street to Montour Junction, thence to Neville Island, and from there to McKees Rocks and connect with the Pittsburgh & West End line. The capital stock is \$50,000. J. W. Arras is president, J. I. Shanks, treasurer and M. D. Rowland, secretary of the company.

Dallastown, Pa.—There was an enthusiastic meeting held here in the interest of the proposed motor line railway to York. Mr. V. Shatto, of the firm of M. V. Shatto & Son, presided. The probable cost of the eight miles of line, which it is proposed to build, was stated upon estimates of Mr. S. Page, of Steelton, to be about \$80,000.

Dedham, Mass.—A movement is on foot in Dedham looking to the introduction of a street railway into the town. Articles of association have already been drawn for the formation of a company which

is entitled the Suburban Street Railway Co. The proposed railway is to commence at or near the court house, thence through the town of Hyde Park and the city of Boston, to a point at or near the Forest Hill depot, its terminus, a length of six and half miles. The capital stock of said company is \$65,000. Amongst the directors are Thomas T. Robinson, of Dedham, James D. McAvoy and John T. Robinson, of Hyde Park, and W. B. Ferguson, of Malden.

Denver, Colo.—An ordinance has been introduced in the board of supervisors granting the right of way to the Circuit Railway over certain streets. The road is to be operated by electricity, gas or compressed air.

Des Moines, Ia.—A bill has been passed which provides for authorizing electric street railway companies to operate on public highways in the country. The bill is designed to allow the building of the proposed electric road between Des Moines and Indianola.

Detroit, Mich.—It is stated that a number of prominent Detroit men have filed articles of association with the secretary of state for the incorporation of the Detroit Transit Railway Co. The purpose of the company is a gigantic one, contemplating the construction of an elevated double track line of railway completely encircling the city of Detroit, accessible to all the present lines of railway and all that may be constructed in the future, for freight traffic as well as affording a system of rapid transit for passengers. Charles H. Ellis is the projector of the enterprise.

Fishkill, N. Y.—On April 12, the board of directors of the new electric street railway held a special session and a new company was formed, who purchased the stock of the old company. Among the new members are John T. Smith, Willard H. Mase and Samuel Phillips; \$30,000 was raised and paid in, a contract drawn up but not given out, which called for the completion of the road by July 1.

Freeland, Pa.—Negotiations are now on foot for the incorporation of an electric light and railway company. The capital stock is to be \$100,000.

Fresno, Cal.—An ordinance has been asked for granting the Fresno Electric Railway Co. the right to construct and maintain an electric street railway system for the period of fifty years. The company are required to expend at least \$25,000 on the work within the period of one year from the passage of the ordinance, the work to be commenced within three months from the granting of the franchise.

Fultonville, N. Y.—The Fulton & Montgomery County Electric Railroad Co. was incorporated recently, with a capital of \$75,000, to build and operate an electric railroad from here through the village of Fonda and the village of Johnstown to the city of Gloversville. The road will be about seven miles long. The company's office will be in Johnstown. The following are the directors: Robert Wemple, Fultonville; M. B. Northrup, Johnstown; Jere S. Sitterly, Fonda; Ezra Nare, Gloversville and J. W. Schroeder, New Brunswick.

Gettysburg, Pa.—E. M. Hoffer, of Hummelstown, will build an electric line which will start from the square in the town and take in all of the important and historical points of the entire second and third days' fight. The length of the road will cover eight miles and the cost will be about \$170,000. Stations will be erected at most of the important points. Mr. Hoffer expects to have the road completed and in running order by June 1.

Grand Island, N. Y.—A new company, the Grand Island Electric Belt-line Bridge & Ferry Co. are to be organized. The company's plan is to build a belt line around the island with bridges at each end connecting with the mainland. A ferry is also proposed. Among those interested are Messrs. John H. Meech, of Buffalo; Ossian Bedell, of Grand Island, E. N. Stone, of Batavia and George H. Ahrens, of Jamestown.

Hammond, Ind.—A franchise for the Hammond Electrical Railway Co. has been granted. By December 15 the company are to complete and operate a line from Ridge Road to Gostlin Street on Hohman; on Gostlin from Hohman to Ft. Wayne depot; on Indiana Street from Howard Avenue to Hohman Street.

Huntingdon, Pa.—A new company called the Huntingdon Street Railway Co. has been formed here, with a capital of \$18,000. The road will be three miles long. It will extend from Huntingdon to Alexandria. Three of the directors are Samuel E. Henry, George A. Port and Alex. Denny.

Independence, Ia.—A franchise has been granted C. W. Williams to build three miles of electric street railway, extending from the Illinois Central depot south to Main Street, thence west past the Burlington, past Rush Park and South to the Iowa Hospital for insane. The cost of the project will be \$40,000, and will be completed by July 4.

Jeffersonville, Ind.—The Jeffersonville City Railway Co. have filed articles of incorporation. Among the incorporators are Dennis Long of Louisville, John Zuluaf and John Read, Jr. of Jeffersonville. The company have purchased of Samuel Miller the plant and franchise of the defunct Ohio Falls Street Railway Co. bought by him at the foreclosure sale on March 19, for \$16,000 and have put the road in operation. The officers are Ed. J. Howard, president; Geo. J. Long vice-president; John C. Zulanf, secretary and treasurer.

Kennebunk, Me.—A meeting of the Kennebunk Board of Trade was lately held for the purpose of considering the advisability of constructing an electric railway between Kennebunk and Sanford. R. W. Lord, S. T. Fuller, Ivory Littlefield, Jos. A. Titcomb and Wm. F. Moody are actively interested in the matter.

Kingston, N. Y.—The Kingston City Electric Railway Co. was incorporated recently to operate an electric street railroad for a distance of three miles. The directors are: Edward T. Stelle and others of Kingston, and Jansen Hasbrouck of Rondout.

La Crosse, Wis.—Common report has it that Messrs. Powell, Mosher, Neumeister and Zeisler, are about to form a company to operate a line of electric railway.

Lancaster, Pa.—An electric railway from Lancaster to Columbia is projected. The Lancaster City Railway Co. are said to be pushing the scheme.

Lansdale, Pa.—Citizens here are taking steps to build an electric railway from Lansdale to Skippackville, by way of Kulpsville and Harleysville. The length of the road will be about ten miles, and its estimated cost is about \$100,000.

Leadville, Colo.—Dr. John Law and Colonel Goodell, of this city, in conjunction with Eastern capitalists, are to build and operate in this city an electric street car line, and operations will probably commence about May 1. The company will invest \$400,000 and build about eight miles of track. The main line will start near the Denver & Rio Grande depot and from the city limits will reach to Evergreen Lakes along the Malta road. The road will be operated with the trolley system, and a gigantic reservoir will be built in Lake Park to supply power.

Lewiston, Me.—There is a plan on foot to build an electric railroad from Lewiston to Augusta. Gen. C. W. Tilden and others are interested in the scheme.

Lewistown, Pa.—The Lewistown & Reedsville Electric Co. have been incorporated, with a capital stock of \$25,000.

Marshallton, Pa.—The committee of citizens of the Marshallton, who have in charge the matter of an electric railway from Unionville to West Chester via Glen Hall and Marshallton have reported considerable encouragement. Thomas Pennypacker, George March, Harry Hall and Emmor B. Cope are active in the movement.

A LARGE meeting of citizens has been held here to further the project of building an electric line between West Chester and Oxford by way of Marshallton. A committee consisting of George March, Harry Hall, Wilson Loller, Thomas Pennypacker and Emmor B. Cope were appointed to look after the matter.

Martins Ferry, O.—The Wheeling & Belmont Railway Co. have been organized to operate a street railway. The capital stock is \$500,000. John S. Cochran is interested in the project.

Massillon, O.—Articles have been drawn up for the incorporation of the Massillon Street Railway Co., capital stock \$50,000. The incorporators are W. A. Lynch, J. W. McClymonds, C. A. Gates, C. M. Russell and W. E. Russell.

A CHARTER has been applied for for the Canton-Massillon Electric Railway Co. with headquarters in the two cities named. Eventually the Canton-Massillon Electric Railway Co. will purchase the Massillon and the Canton street railways. Construction has begun on the Canton-Massillon line. In the city, lines will be built this spring from the West Side railroad stations to the city limits; and from the base ball park to Main Street, on Erie. Extensions will be then pushed as rapidly as convenient, over all the other streets named in the ordinance. For the Massillon city lines five cars have been ordered. For the cross country line the car order includes one extra long car, two cars thirty feet long and two street cars. In addition to these there will be trailers and also a baggage and mail car. It is designed to have hourly mails between the two cities. The Westinghouse system will be used throughout.

New Haven, Conn.—A new company, the New Haven & Morris Cove Railroad Co. have received permission to construct an electric line from here to Morris Cove, a seaside resort. James N. Townsend is president, and George H. Townsend is treasurer. The capital stock is \$100,000. Construction will begin soon.

New London, Conn.—The Connecticut Tramway Co. have been organized here, with a capital of \$20,000, all paid in. The business of the company is to build and construct railroads. The incorporators are Dwight Townsend, of New York; Tracy Waller and Charles A. Gallup, of New London.

It seems probable that the attempt to start an electric street railroad has been abandoned, it being the opinion of competent judges that the town is too small to make such a road profitable. The chances, however, for a horse railroad to be built this summer are considered good, and should one be built, doubtless, heavy rails will be laid in view of the possible change to electricity as a motive power later on.

New Orleans, La.—An ordinance has been introduced in the City Council granting to Adolph Schreiber, his associates and assigns, the right to construct and operate a belt railroad in the city of New Orleans.

Oakland, Cal.—The Oakland, San Leandro & Haywards Electric Railway Co. have filed a petition with the City Council asking for a franchise to construct and operate an electric street railroad on certain streets. They ask that the franchise may be granted for a term of fifty years.

A FRANCHISE has been granted to San Jose parties for a continuation of the road from Haywards to San Jose, but they have been unable to obtain a franchise permitting the laying of tracks into that city, and operations upon that portion of the line are not likely to be commenced yet.

Parkersburgh, W. Va.—Captain Shaw has asked for franchises to build a street car line over certain streets. His idea is to make it an electric line if possible.

Pekin Ill.—W. P. Craig, president of the Palatka & Heights Street Railway, proposes to spend \$10,000 in extending and improving his line along the Heights, making a belt line, and use motor power as a means of transit.

Petaluma, Cal.—The project of connecting this place with Santa Rosa by an electric railway is being talked of. It is said that Wilfrid Page, a large property owner, has offered the right of way through his land.

Philadelphia, Pa.—A charter has been granted to the Boulevard Passenger Railway Co. of Philadelphia, a corporation organized with Edward J. Moore of 5,017 Wayne Avenue, Germantown, as president. The new company propose to construct and operate a street car line over the proposed boulevard from the City Hall to Fairmount Park, providing the city grants the right of way.

Phoenix, Ariz.—A franchise has been granted for an electric street railway, to Henry L. Wharton for a period of fifty years.

Pinckneyville, Ill.—The Pinckneyville Street Railway Co. have been incorporated, with a capital of \$5,000. The incorporators are George W. Clark, John B. Davis and Charles D. Kane.

Pittsburgh, Pa.—The ordinance granting the Millvale, Etna & Sharpsburg Traction Co. the right of way through Millvale was presented at the meeting of the Borough Council last month. George B. Hill and other representatives of the company were present and assured the Councils that the road would be built as soon as the ordinance was passed.

Plainfield, N. J.—The Council has granted to the Plainfield Street Railway Co. a franchise to construct and operate a street railway on the overhead trolley through West Sixth Street, Plainfield Avenue, West Seventh Street, Monroe Avenue, West Fourth Street, Grant Avenue, East Front Street and Somerset Street. The road is to be completed within six months.

Providence, R. I.—A petition for the incorporation of the Point Judith Electric Railroad Co. has been presented to the Legislature. The incorporators are Jeremiah P. Robinson, Isaac R. Robinson, William G. Roelker, Frank D. Sturgess and Mark W. Maclay, all of New York. The intention is to construct a railroad, commencing at some point near the Providence & Stonington railroad, or the Narragansett Pier railroad, and thence to the Atlantic Ocean at the extremity of Point Judith.

Red Bank, N. J.—The Red Bank & Sea Bright Street Railway Co. have been organized, with a capital of \$150,000, to build a six mile street railway. The officers of the company are W. B. Price, Newark, president; James A. Turnbull, Newark, treasurer; Thomas Davis, Jr., Red Bank, secretary. The road will be commenced about May 1, and the officers hope to have it in operation early in July.

Salem, Ore.—A charter has been issued to the Salem Motor Railway Co. The incorporators are: E. F. Parkhurst, F. A. Turner, F. N. Derby, William England and H. W. Cottle; capital stock \$100,000. They wish to use steam, electric or other power.

San Francisco, Cal.—A petition for a street railway franchise has been presented by W. B. Wilshire, *et al*, along and upon certain streets. The petitioners are willing to expend \$40,000 in the construction of the road within a year after the granting of the franchise, and to pay 2 per cent. of the gross income of the company every year into the city treasury. They desire the privilege of using cables, horses or electric motors, and agree to purchase all the material for the construction of the road, as far as possible, in this state. The petition was referred to the Street Committee.

THE City Front Railway Co. have been incorporated to maintain a street railway along the water front and to operate cars for passenger traffic upon the rails of the Belt Railroad. The capital stock is \$100,000. The directors are C. A. Spreckels, R. J. Huffacker, P. L. Wooster, H. C. McPike, and Rudolph Spreckels. For the use of the Belt Railroad the company are to pay for the first six months \$100 a month, for the second six months \$150 a month, and thereafter \$200 a month. The term of the franchise is six years.

ANOTHER street railway franchise has been asked for by Robert Sherwood, H. Epstein, Charles Goodall, James L. Byrnes and W. S. Keyes. The route proposed is from Market and East Street to Broadway, thence to Devisadero, to Fell and to Stanyan.

GUSTAV SUTRO has also applied for a street railway franchise on many streets of the city.

Seattle, Wash.—The Duwamish Construction Co. were recently incorporated by Angus Mackintosh and others, to build suburban electric railway lines on which trains will be capable of making forty miles an hour.

Sing Sing, N. Y.—The Ossining Electric Railroad Co. is a new company to operate an electric railroad in Sing Sing. The executive officers are as follows: President, Col. Edwin A. McAlpin; vice-president, John V. Cockcroft; treasurer, A. S. Underhill; secretary, F. D. Arthur. The capital stock is placed at \$50,000. The proposed route is from the railroad station to the camp meeting grounds. A branch will strike off south from Main Street down Spring Street to the south line of the village.

St. Paul, Minn.—The St. Paul & White Bear Railroad Co. have contracted, it is said, with the Northwest Thomson-Houston Electric Co. to build an electric line from North St. Paul to Mahotmedi, on White Bear Lake. The electric plant for the line will be located at North St. Paul, and will consist of two 100 H. P. dynamos, with two steel boilers made by Babcock & Wilcox and two compound, condensing engines.

Tiffin, O.—This city will have an electric street railway during the present season. Meshech Frost, Judge J. F. Bunn and Frank Bloom, all of this city, and F. W. Brightman of Fall River, Mass., having organized a company for that purpose. They will begin work as soon as the right of way and franchise can be secured.

Vacaville, Cal.—The preliminary survey for an electric railway running through the centre of Vaca Valley has just been completed. As laid out it will be a little over ten miles in length. The cost is estimated at \$100,000.

Warren, O.—The ordinance granting the Trumbull Electric Railroad Co. the right to construct and operate an electric street railway in certain streets in the city, passed June 3, 1891, has been amended in certain particulars and the time limit in which the road is to be completed extended to December 3, 1893.

Washington, D. C.—A new electric railroad known as the Washington, Alexandria & Mount Vernon Railway is to be built here. The cars will be run by the overhead system. The company have rented the building at No. 140 South Fairfax Street as headquarters.

West Chester, Pa.—The Board of Trade are deeply interested in the proposed construction of an electric railway through Chester County between West Chester and Oxford. Charles W. Roberts, Frank P. Darlington, A. D. Sharpless and others are actively interested.

Westport, Wash.—The owners of Westport are preparing to build a motor line from the wharf in the harbor, through the town of Westport and the bathing resort of Cobassett, a distance of three miles. It is said also that they will extend the road to North Cove, on the Willapa harbor if they meet with encouragement.

Williamsport, Pa.—Two new companies have been incorporated here, entitled, respectively, the South Side Passenger Railway Co., capital, \$15,000; and the Vallamont Passenger Railway Co., capital \$10,000. The directors include Henry C. McCormick, J. Henry Cochran, Eugene R. Payne, James B. Kranse, Fletcher Coleman and E. B. Westfall.

Worcester, Mass.—The Worcester & Millbury Electric Street Railway Co. are a new company, with \$150,000 capital. The road is to be running by midsummer.

A Tax Decision in Pennsylvania.

An important decision was recently given by Judge Reeder, of the Pennsylvania State Supreme Court in the case of Northampton County vs. the Easton, South Easton & West End Passenger Railway Co. The action arose on a case stated and raised the question whether the railway company was liable for local tax assessed upon its horses and stables. The case stated described the property as being "necessary, appurtenant and indispensable" to the exercise of the franchise, and the Supreme Court decides that they are therefore exempt.

As every passenger railway company can clearly establish, by competent testimony, that their horses and stables are necessary and indispensable to the enjoyment of their corporate rights, the practical effect and meaning of the decision is that all such property is exempt from local taxation.

The decision is of great importance to the passenger railway companies of the state, and will save them, for all time, the yearly payment of large sums to the local tax gatherer.

Personal.

Mr. A. P. Smith of the American Supply Co., of Kansas City, and **Mr. C. E. Cook**, of New Bedford, Mass., called at our office last month.

Mr. Charles T. Yerkes president of the North Chicago and West Chicago railroad companies, has been elected a director of the World's Columbia Exposition.

Mr. R. Walters, who for several years has been connected with the firm of A. L. Ide & Co. of Springfield, Ill., has been appointed superintendent of the mechanical department of the National Electric Manufacturing Co. of Eau Claire, Wis.

Mr. G. M. Angier, who has been connected with the Knapp Electric Works of Chicago, has accepted a position with the Mather Electric Co. of Manchester Conn.

Mr. J. A. McLure, the street railway contractor who went to Colima, Mexico, last fall to build a surface road, has completed it, and sails from there for home on April 21. He will be kindly greeted by his friends in New York City on his arrival.

Mr. M. K. Bowen, for some time assistant superintendent of the Chicago City Railway Co., was on the first of April promoted to be full superintendent in place of Mr. S. T. Pope, recently deceased. Mr. Bowen comes well qualified to his new position, as he was formerly superintendent of the Kansas City Cable Railway, a position which he held for four years. We congratulate Mr. Bowen on his promotion, and congratulate the company that have been able to secure the services of so competent a man.

Mr. Frank H. Monks, who for the past three years has been general manager of the West End Street Railway Co. of Boston, resigned that position on April 19, and will engage in private business. The Board of Directors on accepting his resignation passed complimentary resolutions respecting his faithful services during his connection with the company. Mr. Monks has contemplated this action for more than a year, and it was not, therefore, a surprise to his intimate friends. Be-

fore engaging with the West End company Mr. Monks had been connected with other street railway enterprises, and he has the pleasure of a large acquaintance with street railway men throughout the country. The duties of general manager will for the present be divided by President H. M. Whitney and C. S. Sargeant, second vice-president.

Mr. Thos. H. McLean, late general manager of the Twenty-third Street Railway Co., has recently been appointed general manager of the seven New York lines now controlled by the Metropolitan Traction Co., of which company John D. Crimmins is president, Henry Thomson, vice-president, Daniel T. Lamont, secretary, and Thomas H. Ryan and Daniel Hasbrouck, treasurers. Mr. McLean has been connected with the Twenty-third Street company in various capacities since 1877, and previous to this was interested in the operation of the Albany day line of steamers, so that he is well qualified for the duties of this new position. The JOURNAL has many good wishes for all of the above named officers, and trusts that abundant success will crown their labors in the broader field to which they are called.

New Publications.

Vulcabeston and Moulded Mica is the title of a pamphlet which the H. W. Johns Manufacturing Co., Maiden Lane, New York, have recently published. It contains illustrations and descriptions of the various insulators, sockets and other insulation appliances sold by this company as well as of their well known asbestos and Vulcan packing, indurated vulcabeston for steam, weather and waterproof work, etc.

Illustrated Catalogue, No. 7, published by the Interior Conduit & Insulation Co., of New York. Another handsome catalogue, No. 7 of the series published by the Interior Conduit & Insulation Co., and similar in appearance to those already issued, has been received by us. The catalogue is mainly devoted to the electrical fittings and tube system of this company, of which it gives illustrations and prices, but also shows the other apparatus manufactured by the company, of which the Johnson switches of various sizes and the deadbeat ampere meters are examples.

Comparative Boiler Tests at the Rochester Railway Co., published by the Heine Safety Boiler Co., of St. Louis, Mo. Under this title the Heine Safety Boiler Co. have published in pamphlet form a statement in regard to the recent test of boilers at the power house of the Rochester Electric Railway which was described in our last issue. The statement is interesting and consists in large part of the letter from Mr. Charles F. Foster, which was published in our last issue.

Electrical Progress and Development. A New England electrical journal, R. F. Ross, editor and proprietor, 146 Franklin Street, Boston, Mass. We are in receipt of a publication bearing the above name, which, in the editor's salutatory, is announced as the successor to *Modern Light and Heat*. Mr. Ross is well known among the electrical fraternity, has a wide experience in electric journalism, and is well fitted for the task of publishing a journal devoted to electrical interests. *Electrical Progress and Development* will be published at the end of each month, and in the main will be devoted to New England electrical and kindred interests, although at the same time chronicling important electrical events elsewhere. The first number is well printed, contains, exclusive of cover, twenty-eight pages, and affords much interesting reading matter.

Record of Scientific Progress for the year 1891, by Robert Grimshaw, M.E., Ph. D., published by Cassell Publishing Co., New York. The plan of this work, as its name indicates, is to give in brief compass a statement of the most important discoveries and improvements made during the past year in all branches of scientific work. These improvements have been mentioned at probably greater length and with more detail in different periodicals throughout the world, but as these more extended records are so scattered as to be all practically inaccessible to most readers, the value of such a compilation is readily seen. Mr. Grimshaw is well fitted as an author of such a work, and has arranged the facts in a systematic manner under various headings, so that a record made in each branch of science is by itself. The book contains 372 pages, and is carefully indexed.

A Swindler Caught.

We are told that a man calling himself C. H. Lawrence and representing himself as an agent of the United States Railway Equipment & Construction Co., of Chicago and New York, has been obtaining money under false pretenses from a number of street railway companies and individuals interested in street railways. His method of operation has been to offer to build electric railways provided a few thousand dollars in cash was advanced, agreeing to accept his pay in bonds for the construction work. After obtaining the cash he would suddenly leave without carrying out his part of the contract. Latest reports state that he has been apprehended in Memphis at the instance of several Lockport, N. Y., parties.

Equipment Notes.

Alfred F. Moore, of Philadelphia, reports that prospects for general trade in wires, cables, etc., are exceedingly promising.

The **Stearns Manufacturing Co.**, of Erie, Pa., will establish a branch office in Chicago, on May 1. The office, which will be in charge of Mr. A. S. Griswold, will be located at 1120 The Rookery.

The Beacon Vacuum Pump & Electric Co. of Boston, Mass., have sent us two blotters upon which are printed the advantages claimed for the incandescent lamp manufactured by them. One blotter is cut in the form of a lamp.

The Crossley Friction Car Brake Co., of Cleveland, O., are equipping the cars of the Brooklyn Street Railway line of Cleveland, O., with their car brakes which have already been illustrated and described in these columns.

The United States Steam & Street Railway Advertising Co., Carleton & Kissam, proprietors, have recently closed a lease for the advertising privileges in all the cars of the Elizabeth Street Railway Co., Elizabeth, N. J., and the Paterson Railway Co., Paterson, N. J.

The Tripp Manufacturing Co., of Boston, have just closed contracts to furnish trucks to the following street railroads: The Olympia & Tumwater Railway Co., Olympia, Wash.; San Diego Electric Railway, San Diego, Cal.; Central Electric Railway Co., Sacramento, Cal., San Jose & Santa Clara Railway Co., San Jose, Cal.

The Falls Rivet & Machinery Co. of Cuyahoga Falls, O., are doing a heavy business at the present time. E. L. Babcock, president of the company, who was in Chicago recently, stated that the works were crowded with orders, and that a large number came from electrical companies requiring heavy transmission machinery.

The Germania Electric Co., of Boston, have removed their manufacturing department from Cambridgeport to their new factory at Marlboro, Mass., and ask us to give notice that any shipments to their account should be made to them at Marlboro, Mass., while all correspondence should be addressed to their office as heretofore, Room 505 Exchange Building, Boston.

Mark & Sterling, of Cleveland, O., report this month some very good orders, and prospects for many more. The joint problem seems to bother the street railway people as much as anything that they have to deal with and this problem, Mark & Sterling say, they can solve effectually by their patent joint bridge. This firm also do a large business in rails, crossings, ties, spikes, etc.

Albert & J. M. Anderson, have recently had some tests made of their electric railway insulators with the view of learning their actual resistance. The voltage used during the tests was 1,100, and one minute electrification of the insulator was allowed in each case, with results which show a resistance of 156,000 megohms. The tests were made by the Massachusetts Electrical Engineer Co., of Boston.

The R. D. Nuttall Co., of Pittsburgh, Pa., manufacture a wide range of electric supplies many of which were mentioned in our last issue. Their factory is pushed to its fullest capacity to supply the many orders which this company are receiving, and their apparatus is giving good satisfaction, if the large amount of business which they enjoy and testimonials from patrons are any evidence.

The Wenstrom Consolidated Dynamo & Motor Co., of Baltimore have sent us word that the receivers of the company, by virtue of a decree of the Circuit Court, of Baltimore City, have ordered all the real estate, building, tools, patent rights, plants, stock on hand, etc., belonging to the company, to be sold at auction on May 2, 1892. Full information in regard to the terms of the sale can be had of the receivers.

The Engineering Equipment Co., of New York, are sending out a general circular stating that the business of equipping electric roads is their specialty, and requesting the privilege of estimating upon the equipment of any railway with electric power. This company have had wide experience in the equipment of electric railways, and have on hand poles, wire trolleys and all other construction materials needed.

The Hill Clutch Works, of Cleveland, O., through their New York agent, Mr. J. E. Irwin, have closed a contract with the Hartford Light & Power Co., Hartford, Conn., for 130 ft. of seven inch shafting and clutch pulleys for thirteen dynamos and two engines, aggregating about 1,000 H. P. They have also received an order from the Richmond Railway & Electric Co. for forty-five feet of shafting and clutches for six eighty-light Wood dynamos.

The National Pipe Bending Co., of New Haven, are meeting with a large demand for their feed water heaters for steam plants. Among their recent orders from street railway companies they mention two heaters of 400 H. P. each for the Coney Island & Brooklyn Railway and an order to supply all the heaters required for the power station of the New Haven & West Haven Street Railway Co. whose cars are to be equipped with Short electric motors.

The Rochester Car Wheel Works are making remarkable progress in the introduction of street car wheels made in the Barr contracting chill, with which our readers are familiar. The additional orders given by roads after a thorough trial is the best possible recommendation of the good qualities of this method of wheel manufacture. Mr. F. D. Russell, who is in charge of the street railway department, is to be congratulated on the success of his efforts.

The Goubert Manufacturing Co., of New York, are having a large business in the sale of their feed water heaters, and tell us that among street railway companies especially their heaters seem to be meeting with great favor. As mentioned in another portion of this issue, they have recently received the order for three heaters of 1,000 H. P. each for the Broadway (New York) cable railway. They will also supply six feed water heaters to the Third Avenue Railway Co. for use in their new cable power station.

The Peckham Motor Truck & Wheel Co., have closed a contract with the Atlantic Avenue Street Railroad Co., of Brooklyn, N. Y., for fifty of their radial geared non-oscillating trucks. These trucks

will be equipped with Westinghouse motors, the car bodies being furnished by the St. Louis Car Co., of St. Louis, Mo. The Peckham company have also contracted with the Harlem Bridge, Morrisania & Fordham Street Railway for sixty standard trucks, and with the Coney Island & Brooklyn Street Railway for twenty trucks.

The Ball Engine Co., of Erie, Pa., have sent us the copy of a letter recently received by them from the Warrenton Electric Co., Warrenton, Mo., in which they say: "We started the engine purchased from you for our electric plant, last night, and the way it moved off was beautiful to behold. It is certainly a very fine and powerful piece of machinery. No vibration, no noise, in fact and in short, it is perfect in every part and way. The satisfaction it gives is a pleasure to us, and it must be gratifying to you." The letter is signed by C. E. Peers, president of the company.

The John Stephenson Co., Limited, of New York, are busy on the completion of many orders at their factory, and their works present to the visitor an appearance of great activity. Especially prominent among the cars which they have just finished are twenty motor cars destined for the Rochester Electric Railway of Rochester, N. Y. These all have a sixteen foot body with no vestibules. The company are also building cars for Paterson, N. J., Baltimore, Md., Asheville, N. C., Pittsburgh, Pa., and have recently shipped cars to Washington, D. C., Salt Lake City, Utah, and Bridgeport, Conn.

George H. Hollingsworth of Beaver Brook, Waltham, Mass., has secured the contract for the entire car equipment of the Newton & Boston Street Railway Co., which will build at once about five miles of track, connecting Newton Centre, Newton Highlands and Newton Upper Falls with Newtonville. This equipment will consist of five open and five closed cars which will be models of elegance and luxury, and will be fitted with all the latest improvements. Mr. Hollingsworth is also the builder of a new combination car, which has a number of novel points and has attracted considerable attention.

The Fulton Foundry Co., of Cleveland, O., are kept busy filling the many orders for their electric trucks which seem to be regarded with much favor. They say that they have received a large number of letters from different patrons, all speaking in the highest terms of these trucks, and coming as they do, unsolicited, they are very gratifying. They also inform us that the other departments of their works, such as the axle and wheel fitting and wheel making departments, are worked to their utmost capacity. Their departments for turning out switches, turnouts and special track work are also very busy.

The Reliable Manufacturing Co. of Boston, continue to ship their Reliable sand box and Collett ratchet brake handle to many street railway companies and car builders. Some large orders have been filled during the past month by them for the Newburyport Car Manufacturing Co., Ellis Car Co., Briggs Carriage Co., Lamokin Car Works, J. G. Brill Co. and other car builders; for the Brooklyn City Street Railway Co., Worcester, Leicester & Spencer Street Railway Co., Newburyport & Amesbury Street Railway Co., New York & Harlem Railroad Co., Merrimack Valley Horse Railroad Co., and many other successful street railway companies.

F. P. Little & Co., of Buffalo, have recently closed a contract with the Connecting Terminal Railroad Co., of Buffalo, for the installation of a plant consisting of one 500-light Thomson-Houston dynamo, one thirty-eight H. P. engine of the John T. Noye Manufacturing Co.'s make, and twenty-four 200 C. P. (Mosher) arc lamps and twenty-five sixteen C. P. incandescent lamps. They have also closed a contract for wiring the Columbia Bank Building, of Buffalo, and are at work wiring a number of other buildings in that city, including the city elevator and the American Bell Telephone Co.'s building. They announce business as very brisk.

The Lamokin Car Works of Philadelphia have closed a large number of contracts for street railways during the last month. Among others they mention one for the City Passenger Railway Co., of Altoona, Pa., for three open, eight seat, trail cars, the second order from this company, and one from the Harrisburgh Street Railway Co. of Harrisburgh, Pa., for sixteen thirty-three foot car bodies. These bodies will be mounted on Robinson radial trucks. Four will be for early delivery and twelve for August and September delivery. A new corner stay for cars, Cochran's patent, is being used by this company, and is illustrated in this issue.

The Fourth Avenue Railway Co. of New York, have decided to lay on iderably more of the Duplex track after having given it a trial since December. The Duplex company have made contracts for their rail with the Atlantic Avenue Railway Co. of Brooklyn, N. Y.; the Rochester Railway Co., Rochester, N. Y.; the Camden Horse Railway Co., Camden, N. J. They have also made a contract for the track to be used on the new electric railway at Kansas City, Mo.; the Lakeside Electric Railway at Fort Wayne, Ind.; and the Steinway & Hunters Point Railway at Long Island City, N. Y.; also the New Orleans & Carrollton Street Railway at New Orleans, La.

The Wightman Electric Manufacturing Co., of Scranton, Pa., have met with the most flattering success in the introduction of their electric railway system during the year and a half that it has been in operation, and it is now in practical service on the following roads: The People's Street Railway, Scranton, Pa.; the Pennsylvania Motor Co.'s road at Easton, Pa.; the Citizens' Passenger Railway, Altoona, Pa.; DuBois Traction Passenger Railway, DuBois, Pa.; Auburn City Railway, Auburn, N. Y.; Wheeling Railway, Wheeling, W. Va.; the People's Street Railway, St. Joseph, Mo.; the East Cleveland Railroad, Cleveland, O.; Brooklyn City Railroad, Cleveland, O.

The Underwood Manufacturing Co., of Tolland, Conn., have just furnished the Chicago City Railway Co. two endless belts, 62

ins. wide, and 400 ft. long. This belting was ordered something over a year ago, and is being placed in the cable power house at Twentieth and State Streets, Chicago. These belts when in operation will transmit about 2,500 H. P. They weigh 3,940 lbs. and contain about 2,050 sq. ft. The company have had two belts, 48 ins. wide, 350 feet long, in operation at the station at Fifty-fifth and State Streets for about five years, running night and day 5,200 ft. per minute, and driving about 700 H. P. each. These belts drive the fast lines of cable from Thirtieth to Sixty-third Street.

The Fitchburgh Steam Engine Co. of Fitchburg, Mass., announce their removal into their new quarters. For several years there has been an increasing demand for their engines until they were unable to keep up with their contracts, although running nights for some time. Their new factory is fitted throughout with all the best modern tools and facilities for handling large work, such as traveling cranes, etc., and is more than twice the size of their old plant. Their facilities for shipping are the best, as they can load directly from their erecting room on to the cars. They are now in shape to fill all orders promptly, for either large or small, vertical or horizontal, high speed, slow speed or compound condensing engines.

Chas. A. Schieren & Co. of New York, manufacturers of tanned oak leather belting and lace leather, number many street railway companies among their customers, and tell us that this branch of their extensive business is constantly increasing. As evidence of the popularity of their belts for electric work the following list of orders received by them during ten days in April will be interesting: Six twenty-four inch double belts for Trenton, N. J.; two thirty-six inch double belts and five fifteen inch double, perforated, electric belts for Salem, Mass.; two twenty-four inch double, perforated, electric belts for Asbury Park, N. J.; one twenty-eight inch double belt for Perth Amboy, N. J., besides many other smaller belts for generator works.

Pepper & Register, of Philadelphia, have secured the order to build and equip the Delaware Bay & Cape May Electric Railway, a six and a half mile road, with ten car equipments, generator to be 150 H. P., and cars to be equipped with thirty H. P. single reduction motors, both of the Westinghouse Electric & Manufacturing Co.'s manufacture. The Ball engine, Coatesville boiler and stack and Schieren's belts will be employed in the station, and on the outside work the company will employ Morris, Tasker & Co.'s brackets for pole construction and Washburn & Moen's trolley wire. The road is to be in operation complete by June 1. They have also secured an order to build complete the municipal electric lighting plant for Doylestown, Pa., and several isolated plants, work on which will begin at once.

Mr. Granville T. Woods, of New York, inventor of the multiple distributing electric railway system in operation on the Coney Island & Brooklyn Street Railway, has severed his connection with the American Engineering Co., and says that he is ready to give estimates for the equipment of street railways with this system. He tells us that he has the support of a syndicate of financiers, and is ready to guarantee the legality of his claims to exclusive use of the system. Mr. Woods has recently been engaged in litigation with the American Engineering Co. as to the right of the latter company to use certain details of the multiple distributing system and says that in a recent case before Justice Connolly in Brooklyn, in which the exclusive ownership in certain patents relating to the system was brought in question, a decision was promptly given in his favor.

The Berlin Iron Bridge Co. of East Berlin, Conn., have received a recent order from the Henry R. Worthington Hydraulic Works of South Brooklyn, N. Y., for a new machine shop to be built of iron. The building will be 200 ft. long by fifty feet wide, will be equipped with a twenty ton Sellers traveling crane, and will be made from the designs of the Berlin company who furnish it complete, including the foundations and brick work. This company have also taken the contract to build a producer building for the Solvay Process Co., of Syracuse, N. Y. The building will be 30 ft. wide \times 100 ft. long and three stories high, built entirely of iron, even the floors being made of plate iron in order that there may be no wood work about the building to take fire. J. H. Horne & Sons Co., have also decided to build a new machine shop 64 ft. wide \times 107 ft. long and have placed the contract for it with the Berlin Iron Bridge Co., of East Berlin, Conn.

The Westinghouse Electric & Manufacturing Co., of Pittsburgh, Pa., have met with large demand for their motors in all parts of the country. Their New England agent, Mr. R. S. Brown, of Boston, tells us that he has closed a large number of orders in that section. Among the companies who have recently placed orders with him for apparatus are the Waterville, (Me.) & Fairville Street Railway Co., who will use six gearless motors, and one 150 H. P. generator; the Fitchburg, (Mass.) Street Railway Co., who wish eight single reduction motors and one 115 H. P. generator; the Worcester, (Mass.) Consolidated Street Railways Co., six twenty-five H. P. single reduction equipments and one 250 H. P. generator; Springfield, (Mass.) Street Railway Co., two twenty H. P. single reduction motors for their palace car; Amesbury, (Mass.) Street Railway Co., ten single reduction equipments; Gloucester, (Mass.) one twenty H. P. single reduction equipment.

The Stearns Manufacturing Co. of Erie, Pa., have now acquired, by purchase, the remaining franchises of Woodbury, Booth & Pryor and the Woodbury Engine Co. of Rochester, N. Y., including all patterns, patents, special tools, trade marks, good will, etc. This puts into the hands of the Stearns company not only the sole ownership of the Woodbury high speed, automatic engine, which they previously purchased, but also the world renowned Woodbury medium speed automatic engines, and the means of producing both. The name "Woodbury" has been for forty years synonymous with good

steam engines, and with something over 3,000 of the two classes here named, all bearing the "Woodbury" earmarks to point and refer to, the Stearns company ought to be satisfied they have made no mistake in adding the medium speed, automatic Woodbury to the Woodbury high speed they have already pushed to the front rank of its class.

John Wood, Jr., of the Schuylkill Foundry & Machine Works, Conshohocken, Pa., reports an active business in his patent water tube boiler at the main works and also at branch works at East Saginaw, Mich., and Zanesville, O. Recent shipments are as follows: 1,000 H. P. to Dancannon Iron Co., Pa.; 600 H. P. Windsor Locks Steel Co., Conn.; 200 H. P. New Haven Rolling Mill Co., Conn.; 1,000 H. P. to J. Wood & Bros. Co., Conshohocken, Pa.; 400 H. P. Hughes & Paterson, Philadelphia; 600 H. P. Chester Pipe & Tube Co., Thurlow, Pa.; 500 H. P. John & James Dobson, Philadelphia; 500 H. P. Alex. Kerr Bro. & Co., Salt Works, New York; 100 H. P. Pottstown Iron and 150 H. P. Pottsville Iron & Steel Co., Pottstown, Pa. The greater number of orders now in hand are for electric light and railway purposes for which these boilers are specially adapted. The increasing demand for these boilers will necessitate the establishment of other works in connection with those now in operation.

The Pennsylvania Iron Works Co. of Philadelphia, have recently purchased the compression ice machine business formerly belonging to David Boyle, of Chicago, and owing to this and to their increased business in the manufacture of cable railroad, winding and driving machinery, etc., it has become necessary for the company to enlarge their plant. They have, therefore, lately contracted for the erection of a new machine shop, about 300 ft. long \times 75 ft. wide, which will be equipped with the most improved tools, capable of turning out the heaviest class of machinery manufactured in this country; it will also contain a thirty ton electrical crane, and one ninety foot pit lathe capable of turning wheels forty feet in diameter, ten feet face, and weighing from 100 to 125 tons each, as well as the latest adopted machinery for the purpose of speedily turning out compression ice machines, which they are manufacturing. When this shop is completed, the plant will be one of the largest of its kind in the United States. They have also just moved into their new office building, at the corner of Fiftieth Street and Lancaster Avenue, which is 100 ft. long \times 50 ft. wide, vacating the space in the main building, which is now occupied by the engineering department.

E. H. Wilson & Co., of Philadelphia, proprietors of the Lamokin Car Works, write us that they number among their orders, in April, for electric cars, eight sixteen-foot, closed car bodies to be mounted upon Robinson motor trucks, made in Altoona, Pa., and two eight seat, open car bodies to be mounted on the same trucks, for the Richmond & Manchester Railway Co., Manchester, Va.; for the Zanesville (O.) Electric Railway Co., they are building four nine seat, closed end, open car bodies, May delivery, this being the second order from this company. These car bodies will have the roofs sunk in the centre to allow the trolley base to pass under low bridges; for the Cape May (N. J.) & Sewells Point Electric Railway Co., eight eight-seat, open cars complete with the Robinson motor truck, palace finish, May delivery; for the Milwaukee (Wis.) Street Railway Co., one eighteen foot, closed car complete, with Robinson motor truck, also one open car with same truck; for the Derby (Conn.) Street Railway Co., one open car body and for the Richmond (Va.) & Manchester Railway Co., eight sixteen-foot closed car bodies with Robinson motor trucks, of Altoona, also two eight seat, reversible, open car bodies with same truck; for the Rock Creek Railway Co., Washington, D. C., they are building the following order: Six eight-seat, reversible, open cars, Cochran's patent malleable seat panels, palace finished; six sixteen foot, closed, palace finished car bodies mounted upon Peckham motor trucks, and six twenty-six-foot, closed car bodies, length over all, thirty-three feet; these will be finished in quartered oak, with hand carved panels, and brackets with pendent acorns, will have ceilings of oak decorated, three combination centre lamps; the seats and backs will be spring, upholstered and covered with best Wilton carpet; the cars will have nine windows on each side of twenty-six ounce English glass. Solid bronze trimmings and deck glass of handsome crushed ruby will complete the equipment. These cars are built under Cochran's patent, and tied at corners by steel guard rail stays. The car bodies are to be mounted upon the Robinson radial trucks, and are in every way model cars.

The Morton Safety Heating Co. of Baltimore Md., have quite a large business in the street railway field, in addition to the extensive business in heating steam railway cars with their safety heater. This company have received many testimonials from officials of both steam and street railways on which their heaters have been adopted, all speaking in the highest terms of their desirability for heating purposes, and have sent us copies of a number of such letters recently received by them, which furnish very interesting reading. One of these is from W. R. Crumpton, general manager of the Baltimore & Lehigh Railway Co., and from it we make the following extract, showing the effectiveness of the Morton heater: "The heater, with which you this winter equipped our train running between Baltimore, Md., and York, Pa., has given us perfect satisfaction. On February 6, 1892, the coldest day of the season, the thermometer at 2 A. M. was at zero and at 7:30 A. M. seven degrees above zero. The train was heated in thirty minutes to seventy-two degrees above zero. The train was in service eleven hours, during which time only twenty-two minutes of additional steam was applied, making fifty-two minutes during the entire day. In actual practice we have found it necessary to apply steam only while the train is standing at station, or while the engine is taking water, thus consuming steam which would otherwise probably be lost through the safety valve. This, of course, reduces to a minimum the cost of heating. I think it an absolute storage system; it is also simple in construction, easy to manage, safe and cleanly." Among other

letters received by the Morton company are some which must be of an extremely gratifying nature to the recipients, testifying as they do to the safety in cases of accident, as well as to the efficiency of the heater. One of these is from David Evans of Philadelphia, who was injured in an accident on the Baltimore & Lehigh railroad occurring March 3, 1892. Mr. Evans writes that the car in which he was at the time was heated by the Morton safety heater, and was precipitated down a steep bluff from a height of fifty feet, and he attributes his escape from death by fire to the fact of the use of the Morton heater. Another car of the train which was heated by a stove caught fire from being overturned. The Morton Co. have received a similar letter from the legal agent of the Baltimore & Ohio Railroad Co., in Baltimore, Mr. McCahan, who also attributes the fact that he escaped with his life to the use of the Morton heater on the train. Among other recommendations recently received by this company, are one from D. F. Henry, president of the Federal Street & Pleasant Valley Railway Co., Pittsburgh, Pa., and one from H. W. Burgett of the Consolidated Light & Power Co., Dover, N. H. Mr. Henry writes that the Morton heaters have been in use upon his cars during the entire winter with excellent results, and Mr. Burgett reports the use of the heaters during two winters in which time they have met all the requirements of that road satisfactorily.

WESTERN NOTES.

The American Car Co., of St. Louis, now have over 250 cars in the various stages of construction in their extensive works. The management claim that this beats the record.

The Standard Railway Supply Co., Garson Myers, manager, are now located at 1,117 Monadnock Building, Chicago, Ill. The company manufacture and handle street railway specialties.

Kohler Bros., of Chicago, representatives of the Eddy Electric Manufacturing Co., report a most active demand for generators and motors. They state that they can sell machines a great deal faster than the company can manufacture them. The office is to be removed from the Rookery to the Monadnock Building.

The Metropolitan Electrical Corporation is the title of a new company organized to do general electrical engineering business, with headquarters at the Whitney Building, Kansas City, Mo. They will furnish plans, specifications and supervisions for complete steam and electrical installations, and request the privilege of estimating upon the installation of electric railway equipments.

B. E. Tilden & Co., dealers in railway supplies and motor replacers, have decided to discontinue their Cleveland office, and have established their general office in the Monadnock Building corner of Jackson and Dearborn Streets, Chicago. The change has been made to accommodate the growing business of the firm, and they have now better facilities for shipping the goods which they manufacture.

The Central Electric Co., of Chicago, are sending out a handsome circular descriptive of tested fuse wire and terminal fuses. The circular containing an article on fuse wire was read before the Chicago Electric Club December 7, 1891, by Elmer A. Sperry, and which gives valuable information on this subject. The company are also preparing a house goods catalogue, which, it is expected, will be ready in April.

The Chicago Rawhide Co., of 75 Ohio Street, Chicago, are doing a large business at the present time. Electric railway companies are ordering a great many rawhide gears which this company have been making for fourteen years. No dissatisfaction has ever been expressed by a railway company who have used the gears made by the Chicago company. They are growing in popularity, as no pains are omitted to adapt them to the requirements of this exacting service.

The Electric Appliance Co., of Chicago, have closed arrangements for the exclusive Western agency for canvas jacket, weatherproof wires and interior conduit, and will carry a large stock of both wire and canvas jacket flexible conduit. This material is all well known to the electrical trade. In anticipation of a heavy spring trade the company are stocking up very heavily on standard lines of supplies, such as sockets, switches, cut-outs, wires, etc., and will be prepared to meet any demand that can be made upon them.

The Lunkenheimer Brass Manufacturing Co., of Cincinnati, O., are preparing for the World's Fair a most elaborate display of their popular specialties in valves, sight feed lubricators, oil and grease cups, etc. They will also exhibit a complete line of brass and iron goods, besides some novelties in steam whistles and sight feed lubricators. They report business exceedingly brisk, being crowded with orders for their numerous specialties and receiving large contracts for special work for United States cruisers.

The International Register Co. of Chicago have removed their office from 435 Rookery to 302 Dearborn Street, where their factory is located. Larger shop space has been secured and new machinery has been added to accommodate their increasing business. Street railway companies are showing a great deal of interest in the registers manufactured by this company, numerous inquiries and orders being received daily. The company are now perfecting their stationary register, and will announce its completion in a short time. This device, it is stated, is both novel and very simple.

The Detroit Electrical Works, have received an order for sixteen car equipments from the Dubuque, Ia., Street Railway Co. and not for six as stated in our last issue. This is the road which has recently abandoned storage batteries for the overhead electric system. The Detroit Electric Works have moved their Chicago office from the Rookery Building to Rooms 917-918 Monadnock Building. This is one of the largest office buildings in Chicago, and, owing to its central location and the fact that it will be occupied largely by representatives of railway and electrical interests, the managers of the Detroit Electrical Works think that their customers and friends will find this new

location of their Chicago office much more convenient than the former. Mr. L. E. Myers will have charge of the Chicago office. This gentleman writes us that he has recently closed a contract for electrical equipment for Sioux City, Ia., which calls for \$40,000 worth of their apparatus. This will include fifteen forty h. p. equipments as well as all the overhead construction, in fact a complete road with the exception of track work and poles. This company have recently secured orders for equipments from a large number of railways, and have motors in operation upon the following roads, in addition to those previously mentioned: Aurora, Ill., Street Railway, fifteen cars; Riverside Street Railway of Fort Worth, Tex., six cars; Consolidated Street Railway, Grand Rapids, Mich., ten cars; Merrimack Valley Street Railway, Lawrence, Mass., fifteen cars, and the Essex Electric Street Railway Co., Salem, Mass., six cars.

The Pullman Palace Car Co., of Chicago, received the following orders recently for street cars: Two closed and six open motor cars for the Colorado Springs Rapid Transit Railway Co.; three open motor cars for the Kankakee Electric Railway Co.; eight long open and four centre vestibuled, double deck, cars for the Union Electric Railway Co. of Saratoga; twenty open motor cars for the Toledo Consolidated Street Railway Co.; two closed motor cars for the Patton Motor Manufacturing Co.; two closed motor cars for the Illinois Judson Power Co.; three closed motor cars for the Northwest Thomson-Houston Electric Co. for service at Olympia, Wash.; two closed motor cars for the Northwest Thomson-Houston Electric Co., for service at Tacoma, Wash.; one long open car for the Bay Railway Co., of Astoria, Ore.; ten open horse cars for the Capitol, North O Street & South Washington Railway Co., of Washington, D. C. Freight and passenger cars: One private car for Mr. J. J. Hagerman, president of the Pecos Valley Railway Co.; one private car for the Minneapolis, St. Paul & Sault Ste. Marie Railway Co.; one private car for Mr. G. W. Breckinridge of San Antonio, Tex.; two dining, five passenger and five combination passenger and baggage cars for the New York, Lake Erie & Western Railway Co.; two combination passenger and baggage cars for the Chicago, St. Paul, Minneapolis & Omaha Railway Co.; one parlor car for the Windsor & Annapolis Railway Co. of Canada; twenty-two passenger cars for the Southern Pacific Co.; twenty-five passenger, ten express, ten baggage and five postal cars for the Norfolk & Western Railroad Co.; one car for the transportation of horses for Mr. W. A. Caswell of Chicago; three first class passenger and one combination passenger and baggage car for the Cleveland & Marietta Railway Co.; one first class passenger and one combination passenger, baggage and mail car for the Wabash, Chester & Western Railway Co.; two dining cars for the Chicago, Rock Island & Peoria Railway Co.; six parlor cars for the Chicago & Northwestern Railroad Co.; twenty-five passenger cars for the Central Railroad of New Jersey; 1,000 box and 400 coal cars for the Norfolk & Western Railroad Co.

A Storage Battery Decision.

Judge Coxe in the United States Circuit Court delivered an opinion, April 9, in the case of the Accumulator Co. vs. New York & Harlem Railroad Co., involving the infringement of Patent No. 11,047, issued to complainant as assignee of J. W. Swan. The decision was in favor of the Accumulator Co. The invention consists in forming the electrodes of a secondary battery with perforations extending through the plates and having the active material packed in these perforations only. Swan's date, *de jure*, is January 18, 1882. Prior to this, Eaton had filled perforations and covered both sides of the plate with active material, and Brush had pressed the absorbent material into grooves. No one had packed it into holes extending through the plate, and confined it entirely to the holes, and Judge Coxe held that the arrangement was patentable.

A Progressive Firm.

The success which the firm of Barbour, Stockwell & Co., of Cambridgeport, Mass., have attained may be fairly said to be well deserved. Both Messrs. Barbour and Stockwell, as well as H. R. Luther and J. P. Winlock, who with them constitute the firm, have had wide experience in the manufacture of machinery and machine fittings; and the work turned out by them has always maintained a record for good quality of material and first class workmanship.

The firm began with purchasing the business of W. O. Taylor, of Boston, in 1886, and in 1889 added to their works the plant of Alfred Morrell & Co. These properties, together with the foundry owned by Mr. Barbour before the formation of the firm, comprised all the works of the firm, until last June, when the increased demands made for their products led to the increase of manufacturing facilities. This consisted in the erection of the extensive plant now located at Broadway, Hampshire, Market, Clarke and Davis Streets. The estate purchased for the site comprised 90,000 sq. ft. The buildings erected consisted of a foundry 175 x 75 ft., a three story pattern storage house 156 x 50 ft., and a machine shop three stories high, 150 x 50 ft. To these buildings has been recently added a one story blacksmith shop, 50 x 80 ft. To run the machinery of this plant a 90 h. p. engine and a 100 h. p. boiler are required. 250 men find employment beneath the roofs of these several buildings.

A large proportion of the company's business is for railways, and one of the largest contracts undertaken by them was the furnishing of the curves, frogs and switches for an electric railroad in Austin, Tex. The work was put together in the firm's large yard and then taken apart again and shipped to its destination. It required a space 160 ft. sq. to lay out this work. They have also done considerable for the West End Street Railway, of Boston and for other prominent lines,

Railway Equipment Co. of Chicago.

The Railway Equipment Co. has just been organized in Chicago, with W. R. Mason as president and general manager. Mr. Mason has resigned his positions as general manager and president of the Electric Merchandise Co. in order to devote himself to this new enterprise. With Mr. Mason is associated Mr. W. L. Adams, formerly secretary of the latter company. In the electric railway field, with which Mr. Mason is now thoroughly identified, no supply man is, perhaps, better known. He has achieved success by a broad policy which, with a liberal treatment of customers, has attracted and retained the trade of street railway companies. The plans of the new company are not yet definitely settled. It is not unlikely that ultimately the company will handle some supplies for steam railroads as well as for street railways. Just at present the offices are located at 616, 618 and 619 Pullman Building, but within a very short time a store will be secured and a complete line of supplies will be carried. On this point Mr. Mason says in a prospectus addressed to the trade :

RAILWAY EQUIPMENT CO.

We beg to call your attention to the above company which has been organized for the purpose of manufacturing and dealing in electric railway supplies for use on all systems. Having had a long and practical experience in all branches of the business, we feel confident of our ability to successfully meet the wants of this branch of the trade. We shall carry in stock large quantities of everything needed for the complete equipment and maintenance of electric roads. We have lately perfected several new line devices which we believe have enough merit to claim the attention of parties about to build or make extensions.

We shall be pleased to advise parties as to the best manner of building and operating such roads. We have no affiliations whatever with any company or individual which will interfere with the exact and impartial conduct of our business.

At the earliest possible moment we shall issue a very complete catalogue, fully illustrating and describing material of our manufacture, also containing data of great interest to builders, owners and managers of electric roads.

In the meantime, we beg to assure the trade that any orders which may be sent to us will be filled promptly and at the lowest market prices. The general manager desires to express to the trade generally his thanks and appreciation of favors granted to him during his connection with a former company, and begs to state that sincere regard will be paid to their wants and suggestions.

Trusting that the conduct of our business may be such as to merit a share of your patronage, we are, very truly,

W. R. MASON,
General Manager,

Since the new enterprise was started Mr. Mason has been overwhelmed by letters expressing best wishes for his success, and promises of business. Orders, in fact, began to reach the office before the company was fairly able to handle them. The company is strongly backed, and among the stockholders are several gentlemen influential in the street railway and electrical fields. The success of the new enterprise is assured if hard work, "hustle," capital and experience are able to achieve that result.

Fall River Line.

The well known Fall River Line between New York and Fall River, Mass., connecting at the latter place with trains to Boston, resumed Sunday trips on April 3. Trains connecting with steamers leave Boston from Park Square station at 6 P. M. week days and 7 P. M. Sundays, and going East steamers leave New York at 5 P. M. Sundays and week days.

New Transit Facilities to Boston.

The Providence & Stonington Steamship Co. have placed in commission on the Stonington Line their magnificent new steamer "Maine," which is a notable addition to the Sound fleet, and is making a fine record as a fast vessel. This steamer is now making regular trips between New York and Stonington (125 miles) en route to and from Boston and the East, averaging about seven hours. The "New Hampshire" will be finished and put in commission about May 1.

Improvements on the Western New York & Pennsylvania Railroad Co.

On and after April 25, trains on the Western New York & Pennsylvania Railroad will arrive at and depart from the Exchange Street depot of the New York Central & Hudson River Railroad, in the city of Buffalo. These arrangements give to this road equal accommodations with other lines in Buffalo, and the benefit of Union Depot connections with the New York Central & Hudson River Railroad, Michigan Central Railroad, Lake Shore & Michigan Southern Railroad, West Shore Railroad and Grand Trunk Railway.

The Western New York & Pennsylvania Railroad is the direct line from Buffalo to Olean, Mayville, Chautauqua Lake, Jamestown, Corry, Titusville and Oil City; and in connection with the Allegheny Valley Railway, forms the only through route by which solid trains are run between Buffalo and Pittsburgh, Pullman buffet parlor cars on day trains, and Pullman palace sleeping cars on night trains. Trains arrive at and depart from the Pennsylvania Union Depot at Pittsburgh, giving this line the best depot facilities in both cities.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, MARCH 29, 1892, TO
APRIL 19, 1892, INCLUSIVE.

MARCH 29.

Car Brake, William B. Filbin, San Francisco, Cal.....	471,635
Car Truck, John Taylor, Troy, N. Y.....	471,912
Car Truck, Sidney D. King, Pittston, Pa.....	471,644
Device for Transmitting Motion, George S. Strong, New York.....	471,655
Device for Transmitting Motion, George S. Strong, New York.....	471,656
Electric Railway, William C. Goss, Lynn, Mass.....	471,543
Passenger Car, Charles L. Pullman, Chicago, Ill.....	471,761
Pole for Supporting Electric Wires, John H. Huntress, Janesville, Wis.....	471,759
Power Transmission, John F. Devold and Gustav Monrath, Chicago, Ill.....	471,812
Railway Rail Chair, George H. Graham, Ridgeland, Ill.....	471,971
Running Gear for Street Cars, Soren Robertson, Cleveland, O.....	472,001
Safety Attachment for Cable or Electric Cars, Albert Raynal, New York.....	471,750
Switching Attachment for Street Cars, Orson W. Brenzler, Duluth, Minn.....	471,714
Track Cleaning Apparatus, Peter A. Dowd and Thomas Long, Boston, Mass.....	471,814

APRIL 5.

Automatic Railway Switch, George S. Maxwell and James Clark, Jr., Louisville, Ky.....	472,063
Cable Roundabout, Joseph F. Fraefinger, Atlantic City, N. J.....	472,211
Car Truck, John Taylor, Troy, N. Y.....	472,236
Car Wheel, Wilfred Ward, Buda, Ill.....	472,415
Fare Register, William L. Silvey, Lima, O.....	472,232
Fare Register, Calvin B. Cushman and Horace G. Canfield, Akron, O.....	472,035
Fastening and Seating of Guard Rails, etc., for Street Railways, John A. Duggan, Quincy, Mass.....	472,165
Hanger for Electric Wires, Henry H. Luscomb, Boston, Mass.....	472,220
Inclosed Supply System for Electric Railways, John C. Fyfe, Denver, Colo.....	472,447
Rail Holding Splice, Frank G. Johnson, New York.....	472,168
Rail Joint, Cyrus Roberts, Three Rivers, Mich.....	472,228
Safety Attachment for Street Cars, Phillip S. Townsend, Rochester, N. Y.....	472,184
Street Railway Track, John A. Duggan, Quincy, Mass.....	472,164
Truck for Railway Cars, Louis Pfingst, Boston, and Sumner A. Bemis, Springfield, Mass.....	472,271

APRIL 12.

Anti-Friction Car Wheel, John D. Farquher, Des Moines, Ia.....	472,944
Box Brace Chair for Girder Rails, Arthur J. Moxham, Johnstown, Pa.....	472,767
Brake for Street Cars, Fred. W. Wood and John Fowler, Los Angeles, Cal.....	472,597
Car Brake, Albert P. Massey, Watertown, N. Y.....	472,929
Car Brake Shoe, George Sands, Beaver Falls, Pa.....	472,955
Car Truck, James Henderson, Three Rivers, Mich.....	472,923
Electric Railway Wire Suspension, Alexander Philipsborn and Walter Reichel, Berlin, Germany.....	472,810
Elevated Railway, St. John V. Day, Chicago, Ill.....	472,862
Motor for Propelling Cars, Walter L. Davis, Chicago, Ill.....	472,524
Safety Attachment for Overhead Electric Wires, Charles D. Brown, Minneapolis, Minn.....	472,784
Street Car Door, Frank Mansfield, New York.....	472,737
Street Car Heater, James Allingham, Minneapolis, Minn.....	472,778
Trolley Wire Clamp, Montraville M. Wood, Chicago, Ill.....	472,596
Trolley Wire Support, Frank C. Prickett, Kansas City, Kan.....	472,953

APRIL 19.

Armature for Dynamo Electric Machines, Sidney H. Short, Cleveland, O.....	473,363
Armature for Dynamo-Electric Machines, Sidney H. Short, Cleveland, O.....	473,364
Armature for Electric Generators or Motors, Sidney H. Short, Cleveland, O.....	473,366
Cable Grip, Elias R. Guerra, Hoboken, N. J.....	473,221
Cable System, James B. Mahaffey, Baltimore, Md.....	473,233
Car Brake, Edward A. Kinley, Bressport, N. Y.....	473,319
Conduit and Trolley for Electric Railway Systems, Charles W. Carl and James W. Phillips, Trenton, N. J.....	472,982
Converter System for Electric Railways, Mark W. Dewey, Syracuse, N.Y.....	473,253
Dynamo Electric Machine, Sidney H. Short, Cleveland, O.....	473,367
Gearless Motor for Electric Railway Cars, Sidney H. Short, Cleveland, O.....	473,365
Gearless Propelling Mechanism for Electric Railway Cars, Sidney H. Short, Cleveland, O.....	473,368
Grip Pulley, James M. Dodge, Philadelphia, Pa.....	473,254
Holding Strap for Cars, Henry A. Hartman, Philadelphia, Pa.....	473,255
Multiple Arc Railway System, Sidney H. Short, Cleveland, O.....	473,361
Rail Joint, John Nelson, West Bay City, Mich.....	473,162
Railroad Tie and Chair, Commodore P. Howell, Chattanooga, Tenn.....	473,071
Sand Box for Cars, Herbert H. Hennegin, St. Louis, Mo.....	473,070
Sanding Mechanism for Cars, Nicholas Seibert, Boston, Mass.....	473,090
Trolley Switch, Sidney H. Short, Cleveland, O.....	473,362

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. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

A CHICAGO dispatch states the North Chicago Street Railway Co., of which Mr. Charles T. Yerkes is president, has acquired control of the experimental line in Chicago equipped with the Love electric conduit, and that the Love system will, in all probability, be adopted upon a large portion of the roads under Mr. Yerkes' control, if further tests prove equally satisfactory.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & CO., 215 Montague Street, Brooklyn, April 18. Stock quotations are per cent. values.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid., Ask'd. Includes sections for STOCKS and BONDS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & CO., Bankers and Brokers, corner State and James Streets, Albany, N. Y., April 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid., Ask'd. Includes sections for STOCKS and BONDS.

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, April 18. Stock quotations are per cent. values.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid., Ask'd. Includes sections for STOCKS and BONDS.

BOSTON STOCKS.—Corrected by R. L. DAY & CO., 7 Exchange Place, Members of Boston Stock Exchange. April 18. Stock quotations are prices per share.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid., Ask'd.

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, April 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid., Ask'd.

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & CO., Bankers, Holyoke, Mass. April 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid., Ask'd.

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., April 18. Stock quotations are prices per share.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid., Ask'd. Includes sections for STOCKS and BONDS.

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., April 18. Stock quotations are prices per share.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid., Ask'd. Includes sections for STOCKS and BONDS.

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & CO., Bankers and Brokers, New Haven, Conn. April 18. Stock quotations are prices per share.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid., Ask'd. Includes sections for STOCKS and BONDS.

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, April 18. 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	\$900,000	M. & N.	4	May, '91.	219	220
BONDS.							
Montreal St. Ry.	1885	£60,000		5	1905		

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., April 18.

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	77	77½
Louisville St. Ry. Co., com...	100	5,000,000			Jan. 1891	21½	22
BONDS.							
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	93½	94
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	113	
Central Passenger Ry. Co.	1888	400,000	M. & N.	6	1908	113	
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	\$7,000,000	Q.—J.	3		334½	335
Chicago Passenger	100	1,000,000	A. & O.	2½		91	92
North Chicago City	100	500,000	Q.—J.	7½		500	
North Chicago Street	100	5,000,000	J. & J.	4		178	178½
West Division City	100	1,250,000	Q.—J.	8½		635	
West Chicago Street	100	10,000,000	Q.—F.	1½		132	132½
BONDS.							
Chicago City	1880	4,619,500	J. & J.	4½		98½	98½
Chicago Passenger	1883	400,000	F. & A.	6	1903	108	109
North Chicago City, 1st mort.		500,000	M. & N.	6	1900		112
North Chicago Street 1st mort		1,640,000	M. & N.	4½	1927	95½	96
West Division Railway		2,350,000	J. & J.	5	1906	100	100½
West Chicago Street, Ext.		3,790,000	J. & J.	5		101	101½
West Chicago Street, Tunnel.		250,000	J. & D.	6		101	101½
West Chicago Street, Tunnel.		4,100,000	M. & N.	5		101½	101½
West Chicago Street, Tunnel.		1,500,000	F. & A.	5			98

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa. Members of New York, Philadelphia and Pittsburgh Stock Exchanges, April 18. 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				28½	
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3		62½	63
Pitts. & Birmingham R. R. Co	50	3,000,000				25½	26¼
Pittsburgh Traction R. R. Co.	25	2,500,000	J. & J.				
Federal St. & Pleasant Valley	50	1,300,000	J. & J.	3		25	35½
Pittsburgh, Allegheny & Man	50	3,000,000				39½	39½
West End R. R. Co.	50	200,000	J. & J.				50
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					
Pittsburgh Incline Co.	100	150,000					
Duquesne Traction Co.	50	3,000,000				26	
BONDS.							
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	1927	108	
Pitts. & Birmingham Traction Co.	1889	1,500,000	M. & N.	5	1929	103	
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937		
Pleasant Valley Ry.	1891	300,000	J. & J.	5	1919		
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		
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909		
Central Traction Co.	1889	375,000	J. & J.	5	1919		
Pleasant Valley R. R. Co.	1873	75,000	J. & J.	6	1903		
Union R. R. Co.	1881	100,000	A. & O.	5	1901		
West End R. R. Co.	1887	75,000	J. & J.	5	1907		
Fort Pitt Incline Plane Co.	1881	30,000		6	1901		
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901		
Penn Incline Plane Co. 1st Mort.	1883	125,000		6	1903	102½	
Monongahela Incline Plane Co.	1887	50,000	A. & O.	5	1892		
Monongahela Incline Plane Co.	1887	50,000	A. & O.	5	1897		
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919		

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co.	100	800,000					100
California St. Cable Co.	100	1,000,000	Monthly	5		115½	116½
Central R. R. Co.	100	1,000,000					12
Geary St., Park & Ocean R. R. Co	100	1,000,000		1		94	105
North Beach & Mission Ry. Co	100	1,000,000				50	75
Ferries & Cliff House R. R. Co.	100	2,500,000				36½	40
Omnibus Cable Co.	100	2,000,000	Monthly	4		57½	60
Presidio & Ferris R. R. Co.	100	1,000,000				20	30
BONDS.							
Ferries & Cliff House.		650,000	M. & S.	6	1914	100½	110
Market Street R. R.		3,000,000	J. & J.	6	913	123	
Omnibus R. R.		2,000,000	A. & O.	6	1918	112½	
Powell Street R. R.		700,000	M. & S.	6	1912	112½	
Park & Ocean R. R.		250,000	J. & J.	6	1914	113½	
Park & Cliff House R. R.		350,000	J. & J.	6			95
Cal. St. Cable R. R.						104	

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine	100	\$324,000	Q.—J.	3	1864	102	103
Cass Ave. & Fair Grounds	50	300,000			1876	44½	45½
Citizens'	100	1,500,000	A. & O.	1½	1887	100	105
Jefferson Avenue	100	112,000			1885	102	105
Lindell	100	2,500,000	Q.—J.		1890	56	60
Missouri	100	2,000,000	Q.—J.	2	1891	225	250
Mound City	100	1,000,000			1890	190	200
Northern Central	100	200,000			1884	100	105
People's	50	1,000,000	M. & S.	6	18—9	40	45
St. Louis	100	1,000,000	J. & J.	6	1890	250	275
4th Street & Arsenal	50	150,000	Jan.	.50	1872	15	25
Union	50	600,000			1870	20	25
Union Depot	100	1,200,000			1890	200	250
St. Louis & Suburban	100	2,500,000			1891	48	50
BONDS.							
Benton-Bellefontaine	1880	\$500,000	F. & A.	6	1900	102	102½
Cass Avenue	1886	200,000	F. & A.	6	1906	100	101
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	107	108
Lindell	1890	1,500,000	J. & J.	5	1895-1910	99	100
Mound City	1890	525,000	A. & O.	6	1900-1910	105	106
Missouri Cable	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort	1882	125,000	J. & D.	6	1902	102	105
2d mort	1886	75,000	M. & N.	7	1902	104	105
People's Cable	1889	800,000	J. & J.	6	1889-1914	97½	100
Northern Central	1884	200,000	J. & J.	6	1904	100	101
St. Louis Cable	1890	1,500,000	M. & N.	5	1900-1910	97½	98
Union	1885	150,000	M. & N.	6	1895-1915	102	103
Union Depot	1890	1,000,000	A. & O.	6	1900-1910	105	105

PHILADELPHIA STOCKS AND BONDS.—Corrected by ROBERT GLENN-DINNING & Co., 143 South Fourth st. (Builit Building), Philadelphia, April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'	50	\$500,000	Q.—J.	4	1858	260	270
Continental	50	1,000,000	J.—J.	6	1873	120	122
Frankford & Southwark	50	1,250,000	Q.—J.	6	1854	210	212
Germantown	50	1,500,000	Q.—J.		1858	99	100
Green & Coates	50	500,000	Q.—J.	3	1858	118	120
Hestonville	50	2,050,000			1859	25	36
Lombard & South	25	500,000	A.—O.	8	1861	55	58
People's Common	25	1,500,000	M.—S.	2½	1873	49	50
Preferred	25	750,000	M.—S.	2½		49	
Philadelphia City	50	1,000,000	J.—J.	7½	1859	150	151
Philadelphia & Gray's Ferry	50	617,500	J.—J.	3½	1858	66	70
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	84	86
Ridge Avenue	50	750,000	Q.—J.	5	1872	200	205
Second & Third	50	1,060,200	Q.—J.	4½	1853	159	160
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	196	200
Union	50	1,250,000	J.—J.	9½	1864	170	180
West Philadelphia	50	750,000	J.—J.	10	1857	185	190
Metropolitan (N.Y.) Traction	100	20,000,000	Q.—F.	1		112	114
Baltimore Traction	25	5,000,000			1889	20½	21
Buffalo (N. Y.) Railway	100	6,000,000				34	36
Newark (N. J.) Passenger	100	6,000,000				29	30
BONDS.							
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	109	110
" Imp.	1892	1,250,000	M.—S.	6	1901	102½	
Germantown, 1st mort.		67,000	J.—D.	5	1904	103	
" 2d mort.		160,000	A.—O.	5	1899	103	
Hestonville, 1st mort.		300,000	M.—N.	6	1895	104	
" 2d mort.		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	
" 2d mort.		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., April 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.	Interst Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, April 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	\$6,000,000	Q.—J.	5	.....	110	110½
Mt. Adams & Eden Park	50	1,400,000	Q.—J.	5	.....	109½	109¾
S. Covington & Cincinnati	50	275,000	J. & D.	6	.....	118	120
Mt. Auburn Cable	100	300,000	.....	.....	.....	40	.....
Cin. Inclined Plane Ry.	100	500,000	.....	.....	.....	67	68
" " Pref.	100	100,000	.....	6	.....	98½	99½
BONDS.							
	Date of Issue	Amount Outstanding.	Interst Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1892	100½	102½
" " "	.....	50,000	J. & J.	7	July, 1893	102	.....
" " "	.....	50,000	J. & J.	7	July, 1894	104	.....
" " "	.....	50,000	J. & J.	7	July, 1895	.....	110
" " "	.....	50,000	J. & J.	7	July, 1896	108	112
" " extended	.....	100,000	J. & J.	4	July, 1896	.....	101
" " "	.....	50,000	J. & J.	5	July, '96	101	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	.....
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's Cable	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " "	.....	280,000	M. & S.	5	Mar. 1906	104	105
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	115	.....
" " "	.....	300,000	J. & J.	6	Jan. 1914	107	108
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	90	92½
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	95	100
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	110	114

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., April 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	.....	75	80
Union Pass. Ry. Co.	50	750,000	.....	.....	.....	.....	.....
Highlandtown & Point Breeze Ry. Co.	50	180,000	.....	.....	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	20½	21½
BONDS.							
	Date of Issue	Amount Outstanding.	Interst Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
Union Ry. Co. 1st mort.	.....	50,000	M. & N.	6	.....	105	110
" " cons. mort.	.....	1,500,000	.....	5	.....	93	100
Balto. Traction Co. (Cable)	18-9	1,500,000	M. & N.	5	1929	110	110½
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	111	111½

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., April 18. 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.	....	1863	250	275
Metropolitan R. R.	50	750,000	Q. J.	....	1864	104	113
Columbia R. R.	50	400,000	Q. M.	....	1870	63	65
Capitol & North O St. R. R.	50	500,000	Q. J.	....	1875	38	45
Eckington & Soldiers' Home	50	352,000	.....	.....	.....	35	.....
Georgetown & Tenallytown	50	200,000	.....	.....	.....	44	50
Rock Creek R. R.	100	401,700	.....	.....	.....	100	.....
Glen Echo R. R.	50	100,000	.....	.....	.....	.....	.....
BONDS.							
	Date of Issue	Amount Outstanding.	Interst Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown	1883	500,000	J. & J.	6	1893-1923	101	.....
do. do. convert.	83-91	3,000,000	J. & J.	6	1899-1929	138½	139½
Eckington & Soldiers' Home	.....	150,000	J. & D.	6	1896-1911	100	.....
Capitol & North O St. R. R.	1891	240,000	J. & J.	5	1921	109	.....
Metropolitan R. R. convert.	1891	200,000	J. & J.	6	1901	118	125

ROCHESTER, BUFFALO, PATERSON AND NEWARK STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Rochester (N. Y.) Ry.	100	5,000,000	.....	.....	1890	31	35
Buffalo (N. Y.) Ry.	100	6,000,000	.....	.....	1891	39	40
Paterson (N. J.) Ry.	100	1,250,000	.....	.....	1891	.....	25
Newark (N. J.) Pass. Ry.	100	6,000,000	.....	.....	1890	26	30
BONDS.							
	Date of Issue	Amount Outstanding.	Interst Paid.	%	Principal Due.	Bid.	Ask'd
Rochester (N. Y.) Ry.	1890	3,000,000	A & O	5	1930	90	95
Buffalo (N. Y.) Ry.	1891	5,000,000	F & A	5	1931	94	97½
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	.....	100
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	89½	90

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., April 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R.	100	1,000,000	.....	.....	.....	106	110
Brooklyn St. R. R.	100	310,000	.....	.....	.....	176	175
Cleveland City Cable, common	100	4,000,000	.....	.....	.....	22½	25
" " pref'd	100	.....	.....	.....	.....	95	105
East Cleveland R. R.	50	2,000,000	Quart.	1½	.....	82½	85
Woodlawn Ave. & West Side	100	1,100,000	Quart.	1½	.....	145	150

Financial.

THE Tacoma (Wash.) Railway & Motor Co. propose an increase of capital to \$750,000.

\$ \$ \$

THE New Bedford (Mass.) Union Street Railway Co. declared a dividend of 2½ per cent. April 1.

\$ \$ \$

THE Newburyport (Mass.) & Amesbury Street Railway Co. have filed a mortgage deed of \$350,000 with the International Trust Co., of Boston, to secure an issue of bonds.

\$ \$ \$

THE stockholders of the York (Pa.) Street Railway Co. have decided to increase the capital stock of the company to \$200,000. This action was taken with a view to the adoption of the trolley system.

\$ \$ \$

THE sale of the Macon (Ga.) City & Suburban Street Railway Co. and the Central City Street Railway Co. has been postponed until May 14. It is thought that the two systems will sell for about \$225,000 or \$250,000.

\$ \$ \$

THE Continental Trust Co., of New York, last month applied to the United States District Court for a receiver for the Lansing (Mich.) City Electric Street Railway, claiming that the company must be reorganized.

\$ \$ \$

THE sale of the Keokuk (Ia.) Electric Street Railway & Power Co.'s property appointed for March 21 was postponed for thirty days, on application of S. P. Townsend & Son, of Hartford, Conn., who hold \$60,000 of the mortgage bonds.

\$ \$ \$

SALES of stock of the Alley L road in Chicago have been recently made at 96. Such a price for the stock of a carrying company not yet in operation is almost without a precedent. It is stated that the stock is not easy to secure even at these high figures.

\$ \$ \$

THE directors of the Baltimore (Md.) Traction Co. passed the quarterly dividend due April 1, in view of the extraordinary expenses already made and to be made in extending and improving the plant of the company and the non-completion of the new cable extension.

\$ \$ \$

THE receipts of the Lynchburg (Va.) Street Railway Co. from June 12, 1891, to January 1, 1892, were as follows: Cash fares \$11,906.17; tickets sold, \$2,117.09; from other sources, \$26.14. Total receipts, \$14,049.49. Number of cash fares, 238,131; number of tickets sold, 61,712; total number of paying passengers, 299,843.

\$ \$ \$

THE Essex Electric Street Railway Co., of Salem, Mass., have petitioned the Railroad Commissioners for leave to increase their issue

of bonds from \$100,000 to \$180,000. The road is capitalized at \$50,000. Civil Engineer Doane presented a statement of the present property of the road, amounting to \$178,894. It is proposed to add electric equipment, buildings, etc., making the entire value \$233,028.

\$ \$ \$

THE West Chicago Street Railway Co. have issued \$1,000,000 6 per cent. debenture bonds. They are dated December 1, 1891. The proceeds from the sale of the bonds will be used to pay for the construction of about forty miles of new lines, ordinances for which were passed by the City Council March 31 last, and which the company have accepted.

\$ \$ \$

A SYNDICATE of Philadelphia capitalists headed by E. W. Clark & Co., bankers, of that city and J. & W. Seligman & Co., and H. B. Hollins & Co., bankers, of New York, have purchased the street railway lines of Columbus, O., and organized a corporation known as the Columbus Railway Co. It is understood that the price paid for the property was about \$2,250,000. The new company will issue \$3,000,000 consolidated, first mortgage, 5 per cent., forty-year gold bonds, and \$3,000,000 capital stock.

\$ \$ \$

THE annual report of the Douglas County Street Railway Co. of West Superior, Wis., shows that the earnings in 1891 were \$47,221; expenses, taxes and interest were \$35,589, including payment of \$375 for supplies on hand January 1, 1892. This deducted, there remains net \$12,007 for the year. The capital stock January 1, was \$100,000. There were, besides, \$118,000 20-year fives and \$50,000 convertible fives besides a note of \$3,500 without interest, a total capital of \$271,500. The company have paid 7 per cent. on the stock from the earnings of 1891, which did not enter the accounts for that year. The charges to operating for the year, including interest, taxes, and a small sum for betterments, was about 75 per cent. of the gross income.

The earnings of the road thus far in 1892 were, from January 1 to March 31, \$14,537; expenses, \$10,225; net, \$4,312. The charges were \$3,037, leaving a surplus of \$1,275. During the same period in 1891 the figures were: Earnings, \$7,307; expenses, \$6,542; net, \$765; changes, \$1,181; deficit, \$422.

\$ \$ \$

THE Chicago Tribune in a recent issue published an article in which it alleged that \$530,000 had been misappropriated by persons connected with the West Chicago Railroad Co. The disproof of the charge is given by the Economist, the financial paper of Chicago in these terms: "The evidence presented in support of this charge consisted of conveyances of real estate which are a part of the public records and the existence of which nobody denies. These conveyances are, however, like hundreds of others that go to the records every year in naming considerations for property in excess of the amount actually paid. The motive for such action is various in different cases. Sometimes it is done to give property the appearance of value greater than its actual worth, and sometimes because the trade is an exchange and mere arbitrary figures are used to express the price. In this instance the transfer was made to the company at figures greatly above those paid, for the purpose of including the power houses to be erected on the land. There is no evidence that any person has bought land at one price, sold it to the company at a higher price and pocketed the difference. Yet this grave crime is charged against the officers of the company and an effort is made to heighten its effect by taunts and innuendoes. The publication of this article precipitated a sharp but temporary decline in the stock of the company. A considerable number of weak holders ordered their stock sold for what it would bring. Speculators, who may have been short of the stock or waiting to buy at a low price for the long account, at once saw their chance to profit by the fright of those having less knowledge of affairs or less courage. It was a golden opportunity for the man who knew the property and its management, a cruel blow at the amateur investor or speculator. At the same time the article was so written as to probably evade the operation of laws designed to protect the characters of men from wanton attack. The effect of this article is a striking illustration of the weight in the popular mind of any utterance of a newspaper of high standing no matter how foolish or false that utterance may be or how unfair in tone.

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WANTED.—A position as Superintendent or Assistant with an Electric Road, by a young man thoroughly competent in all branches. Address J. E. M., P. O. Box 792, Syracuse, N. Y.

WANTED.—Position as M. M. or Superintendent of an Electric Railroad by a man who has had large experience in steam and electric railroading. At present superintendent electric railway equipment factory. Address "RAIL-ROADER," care of STREET RAILWAY JOURNAL.

WANTED.—A man with over 10 years' experience, desires a position to take charge of the inspection and detective department of a street railway company in any part of the country. Can furnish the best of references regarding ability, etc. Address "W. F. G.," care of STREET RAILWAY JOURNAL. 4t

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WANTED.—About one mile of track of good second hand 35 or 40 lb. steel T rail. Box 73, Syracuse, N. Y. 1t

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Mark Twain and the Berlin Street Cars.

In one of his recent letters Mark Twain devotes considerable space to a humorous description of the street railway system of Berlin. He says:

There is a multiplicity of clean and comfortable horse cars, but whenever you think you know where a car is going to you had better step ashore, because that car is not going to that place at all. The car routes are marvelously intricate, and often the drivers get lost and are not heard of for years. The signs on the cars furnish no details as to the course of the journey; they name the end of it, and then experiment around to see how much territory they can cover before they get there. The conductors will collect your fare over again every few miles and give you a ticket, which he hasn't apparently kept any record of, and you keep it till an inspector comes aboard by and by and tears a corner off it (which he does not keep); then you throw the ticket away and get ready to buy another. Brains are of no value when you are trying to navigate Berlin in a horse car. When the ablest of Brooklyn's editors was here on a visit he took a horse car in the early morning and wore it out trying to get to a point in the centre of the city. He was on board all day and spent many dollars in fares, and then did not arrive at the place which he had started to go to. This is the most thorough way to see Berlin but it is also the most expensive.

But there are excellent features about the car system, nevertheless. The car will not stop for you to get on or off except at certain places a block or two apart, where there is a sign to indicate that that is a halting station. This saves many bones. There are twenty places inside the car; when these seats are filled no more can enter. Four or five persons may stand on each platform—the law decrees the number—and when these standing places are all occupied the next applicant is refused. As there is no crowding and as no rowdyism is allowed, women stand on the platforms as well as men. They often stand there when there are vacant seats inside, for these places are comfortable, there being little or no jolting. A native tells me that when the first car was put on, thirty or forty years ago, the public had such a terror of it that they didn't feel safe inside of it or outside either. They made the company keep a man at every crossing with a red flag in his hand. Nobody would travel in the car except convicts on the way to the gallows. This made business in only one direction, and the car had to go back light. To save the company the city government transferred the convict cemetery to the other end of the line. This made traffic in both directions and kept the company from going under. This sounds like

some of the information which traveling foreigners are furnished with in America. To my mind it has a doubtful ring about it.

A Luxurious Car.

Speaking of the Private Compartment Cars, we quote from the San Francisco *Daily Report* of January 20, 1892, the car being identical with those in daily service on the New York & Chicago Limited over the Lake Shore Route:

"Isn't this too lovely for anything!" exclaimed a very pretty Oakland girl yesterday afternoon as she entered the Wagner compartment car attached to the Wagner vestibule train of sleepers which brought out the Eastern press delegates last week.

A D. R. reporter, standing near, at once became interested, for whatever receives so favorable a comment from an æsthetic damsel residing in the Athens of the Pacific must needs be lovely. The girl was right. Standing in one of those luxurious compartments, with everything so bright, attractive and comfortable, an irresistible desire to travel in a Wagner car seized the reporter. "All the comforts of home" and everything that the heart of the traveler could desire was there. Hot and cold water within two feet of him as he reclined indolently on what in the daytime was the most comfortable of lounges and at night is miraculously changed into the softest and most sleep inducing kind of bed. Cut off from the curious stare of his fellow travelers, the tourist can gaze his fill at the passing scenery and, when wearied of that, he can turn his gaze inward and amuse himself by wondering how the ingenuity of the Wagner people must have been taxed to devise so many comfortable things and put them in so small a space.

Even the most æsthetic tastes could not find subject matter for offense in a Wagner compartment car. All the colors blend nicely, the dark, handsomely stained wood of the car harmonizes with the elegant frieze covering of the seats.

The compartment car is in the same style as those run on the famous limited train between New York and Chicago. It has ten connecting staterooms, furnished in different styles of woods, upholstered with silk damask to correspond with the wood. The seats are covered with the finest kind of frieze plush.

The car is steam heated, and each compartment is lighted by gas and contains a lavatory, hot and cold water, closet, etc.

Oh, yes—the reporter forgot about that pretty Oakland girl. He was just in time to catch her last sentence as she stepped off the train, and this was it, honor bright: "I vow, I'll never travel in a Pullman sleeper again."

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