Street Railway Journal.

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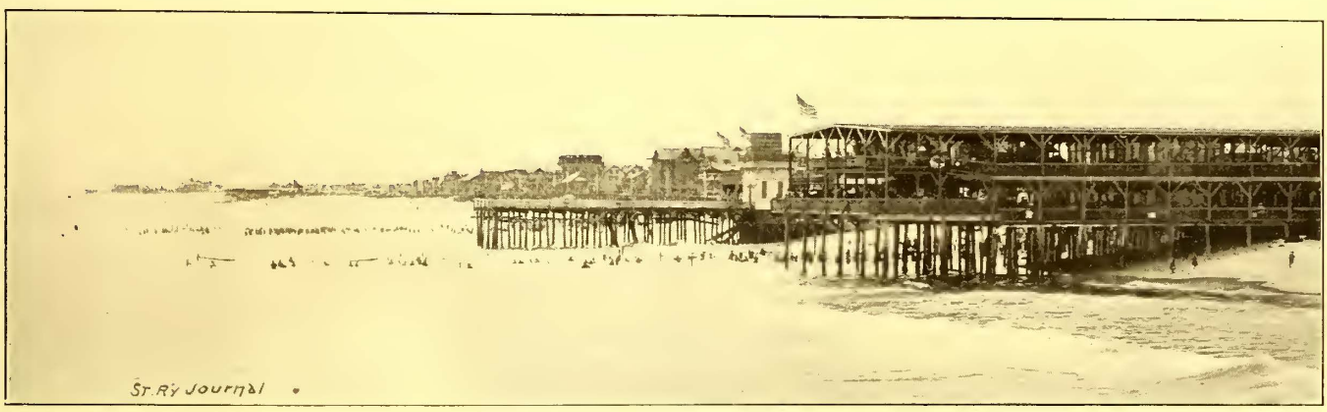
THE ELECTRIC RAILWAY SYSTEM OF THE NORTHERN COAST OF NEW JERSEY.

THE unbroken stretch of New Jersey shore extending from Sandy Hook to the mouth of Barnegat Bay has long furnished to the cities of New York and Philadelphia an accessible and attractive refuge on the ocean during the hot summer season. For a distance of forty miles south from the Hook the coast is lined with an almost continuous row of cottages and hotels. In the towns, which are a few miles apart, these buildings are set close together, and extend back from the shore for a distance of from half a mile to a mile; between the towns the houses are more scattered. The region is seemingly an ideal one for summer seaside residences, the shore being of fine white sand, while the prevailing southerly winds in summer insure for the greater part of the time a cool breeze from the ocean.

able, has suffered a decadence, but still attracts large crowds from New York and neighboring cities. More exclusive summer cities than those mentioned are Normandie, West End, Elberon (where the martyred Garfield died), to the north of Asbury Park, and many of the shore towns to the south, farther from New York.

The geographical situation of this region has been such as to make the transportation problem of passengers to and from the metropolis a particularly interesting one. For the entire distance of about sixty miles between Sandy Hook and the mouth of Barnegat Bay there is no harbor suitable for steamboats large enough for practical use in passenger transportation. Owing to this, rail has had to be depended upon, and as a result, the entire transportation of this region, up to within this year, has been carried over the tracks of one steam road, the New York & Long Branch Railroad. This company does not operate its own cars, but its tracks are used in common by the trains of the Pennsylvania Railroad Company and the Central Railroad Company of New Jersey. The latter has secured the greater portion of the business by also running between Atlantic Highlands and New York a fast line of steamers, in which way the longer rail route is avoided.

To secure part of the profitable and growing traffic in this region and between it and New York, the electric railway systems shown in the accompanying map were



A VIEW ALONG THE JERSEY COAST FROM THE PIER AT ASBURY PARK.

The largest places in the distance mentioned are Long Branch and Asbury Park. Each of these has an all-the-year population of about 7000, counting with Asbury Park the population of Ocean Grove, but this number, of course, represents only a small fraction of those who yearly visit these resorts. The average summer population of each of these places is estimated at at least four or five times that number, and each is well furnished with the usual attractions of places of their kind. Asbury Park, especially, is growing rapidly, and has a fine post office, a well equipped Salvation Army and other insignia of a city, while the many caravansaries, bathing pavilions and the omnipresent Ferris wheel indicate its character as a seaside resort during the heated season. Long Branch, formerly the fashion-

built. They are two in number, entirely distinct in ownership, and are owned respectively by the Atlantic Coast Electric Railroad Company and the Atlantic Highlands, Red Bank & Long Branch Railway Company. Both are new enterprises with this year, although part of the former system is an early Daft road, dating back to 1888.

THE ATLANTIC COAST ELECTRIC RAILROAD.

This line is designed to serve directly the coast resorts as far south as Ocean Grove, and connects with boats for New York at both Long Branch and Pleasure Bay. This, of course, brings it into direct competition with the steam lines already described, which it closely parallels. While the time required to make the through trip is somewhat

longer by the electric roads, owing largely to the fact that the connecting boats are considerably slower, the fares are about one-half for both single and excursion trips.

The line is double track throughout, and has an entire length of twenty-four miles, measured as single track. A large part of this is over the company's own right of way, and several of the trestles and bridges built by the company are shown in the accompanying engravings. That leading into Asbury Park across Deal Lake is the most extensive on the line. It is of steel plate girders mounted on steel cased piles, and was built at an expense of from $18,000 to $20,000.

The track is for the most part laid with seventy pound, 4¼ in. T rail, though some of the track in the cities is laid with girder rail. The ties are 5 ins. × 7 ins. × 7 ft., laid 2 ft. apart. The joints are connected with No. 0 copper laced bonds, with channel pins, and a No. 0 supplementary is laid in the center of each track and connected to each side every 300 or 400 ft. Two return feeders are also run from Deal Lake to the power station at Asbury Park.

The overhead construction is mostly span wire, except on the Deal Lake bridge and through a part of Main Street in Asbury Park, where a form of trussed bracket pole is employed.

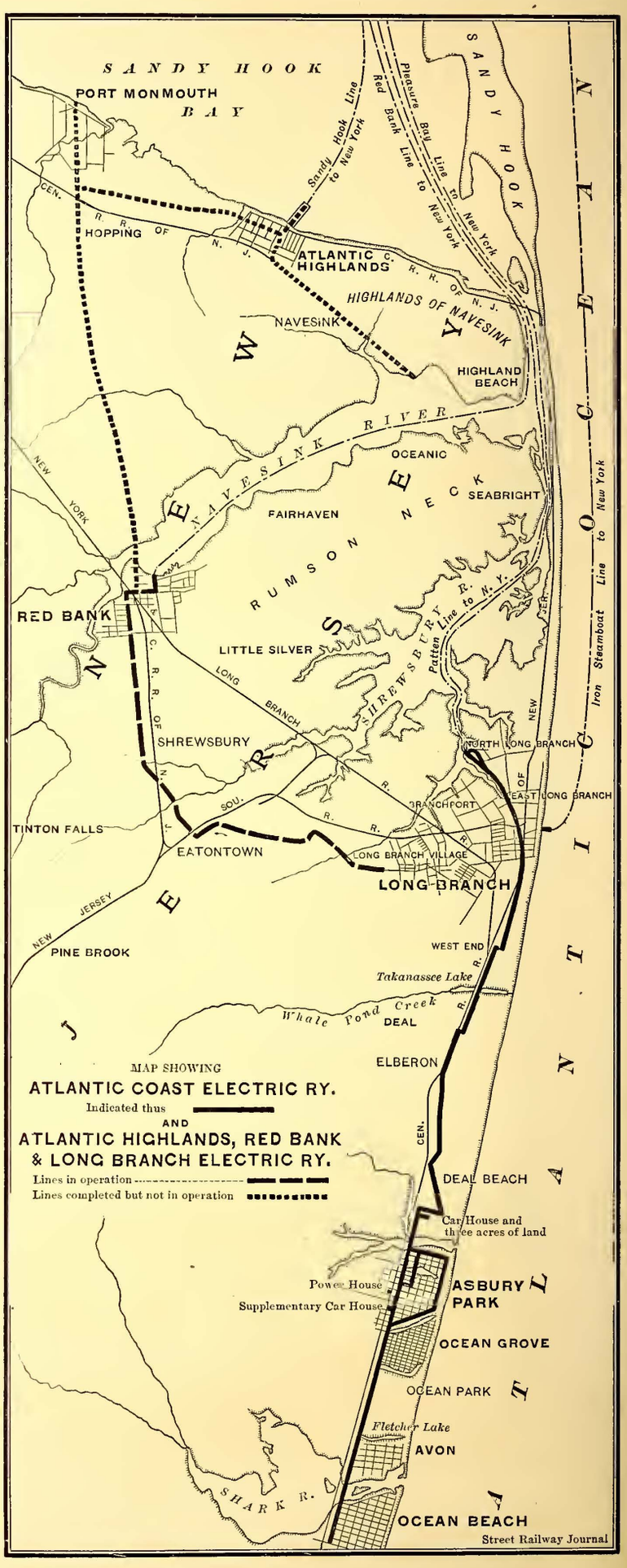
The power station is at Asbury Park, near the steam railroad tracks, and occupies the building built for the original Asbury Park line ten years ago. It contains the original plant, with some new apparatus which has been added by the present management to supply the additional current required for the extensions recently built. As the stockholders of the Atlantic Coast Electric Railway Company also control the local lighting company of Asbury Park, it is probable that a new consolidated station will be built before long, in a more desirable location, as both stations are now so far from water that they are obliged to run non-condensing.

The new engine equipment of the station is of one 20 in. and 38 in. × 42 in. Allis tandem compound engine, directly connected to a Westinghouse 400 k. w. generator. The old equipment consisted of a 20 in. and 20 in. × 42 in. Hamilton Corliss twin engine, belted to two M. P. T.-H. 200 k. w. and one M. P. T.-H. 80 k. w. generator. The former engine was built to run condensing, so that to equalize the load on both cylinders the receiver pressure needs to be increased to correspond somewhat with the effect which would have been due to the vacuum of a condenser. To accomplish this, a small by-pass with reducing valve is located around the receiver connection. This raises the pressure in the low pressure cylinder by about five pounds at the ordinary point of cut-off. If the load on the engine should increase, the valve in this by-pass cuts down the excess of live steam admitted to the low pressure cylinder.

There are three batteries of Babcock & Wilcox boilers, two of 325 h. p. each and one (added at the beginning of the present season) of 250 h. p., each connected to an iron stack, two Worthington pumps, 9 ins. × 5¼ ins. × 10 ins., one small Blake pump and a National feedwater heater of 500 h. p.

The feedwater is taken through a five inch iron pipe from Deal Lake, three-quarters of a mile distant. The pump used is of the Worthington double acting type, operated by 10 h. p. electric motor located at the lake and started and stopped from the station. This forces the water into a reserve tank with a capacity of 15,000 gals., and located in the rear of the station. The piping in the boiler room is so arranged that, if desired, either or both of the two Worthington suction pumps can be used to assist the electric pump at the lake, or either of the two suction pumps can pump water from the lake into the tank independent of the electric pump, or water can be pumped directly from the lake into the boilers, without passing through the tank, by either force or suction pumps.

The operation of the electric pump is controlled by a switch in the engine room, and it is thrown in and out of service as the height of the water in the tank may make necessary.



Before the installation of the tank, the feedwater was pumped directly from the lake into a tank holding only 2000 gals. In consequence of this smaller capacity the electric pump at the lake had to be thrown in and out of operation constantly, as the head in the tank rose above or fell below a fixed amount. An ingenious arrangement, shown on this page, was devised and constructed to do this automatically. *A* represents the feedwater pipe, a branch, *B*, from which was introduced into the base of a cylinder below a piston. The rod of this piston was weighted so that it could be lifted only when the head was that desired in the tank. The upper end of the piston rod passed through the upper end of the cylinder and moved a lever which was connected to a snap switch. The latter was in the motor circuit, so that when the piston in the cylinder rose a certain distance the motor was thrown into circuit. To admit the current gradually; a small series wound motor and a resistance box, both at the station, were also placed in series with the pump motor. The small motor was belted to a shaft carrying a pair of governor balls, and the latter raised and lowered a lever passing over the blocks of a resistance box. In this way the circuit was first closed through the resistance, but as the small motor gained speed the resistance and then the motor itself were cut out.

ELECTRIC RAILWAY TRESTLE AT ELBERON.

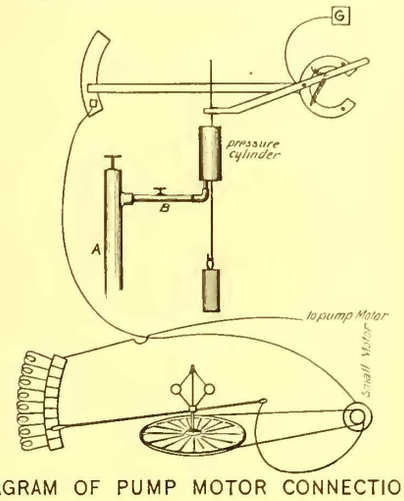
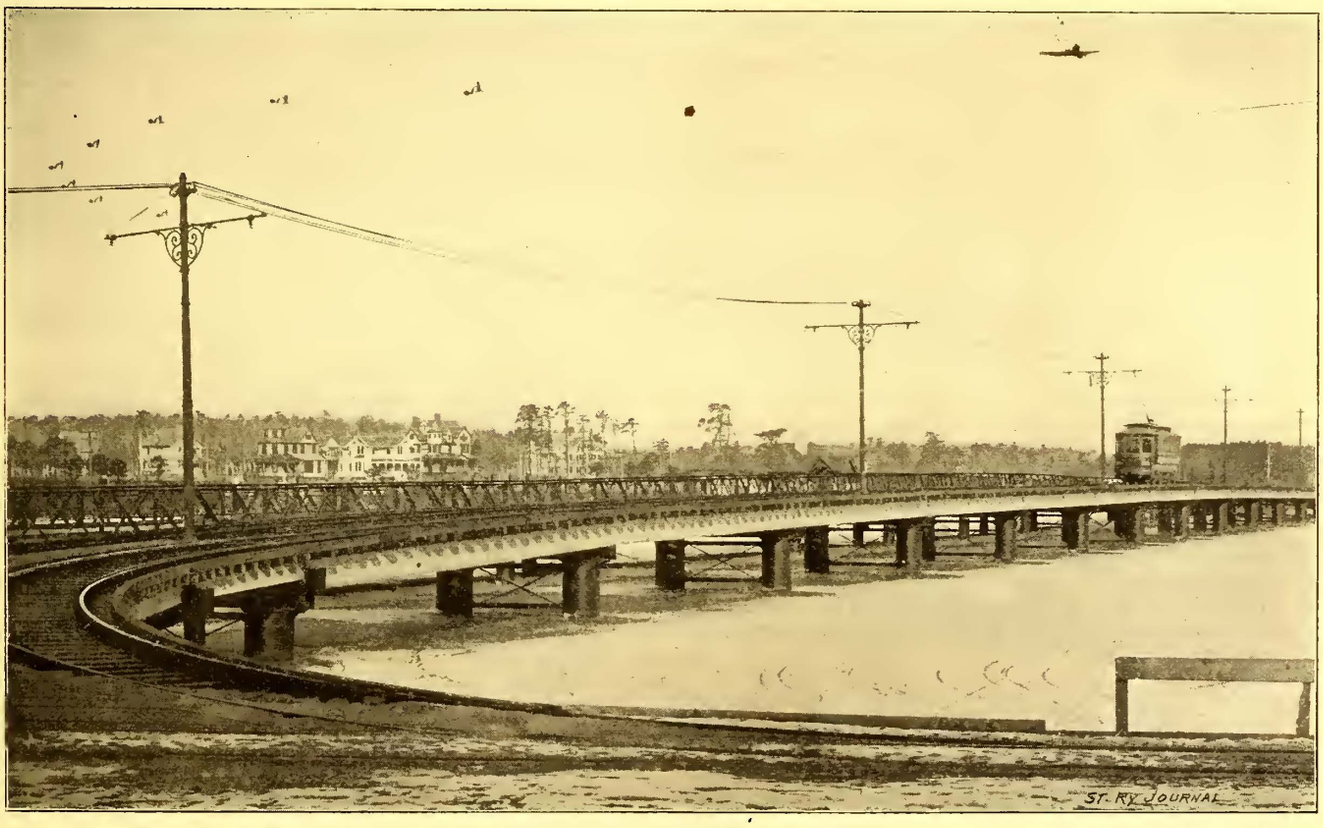


DIAGRAM OF PUMP MOTOR CONNECTIONS.

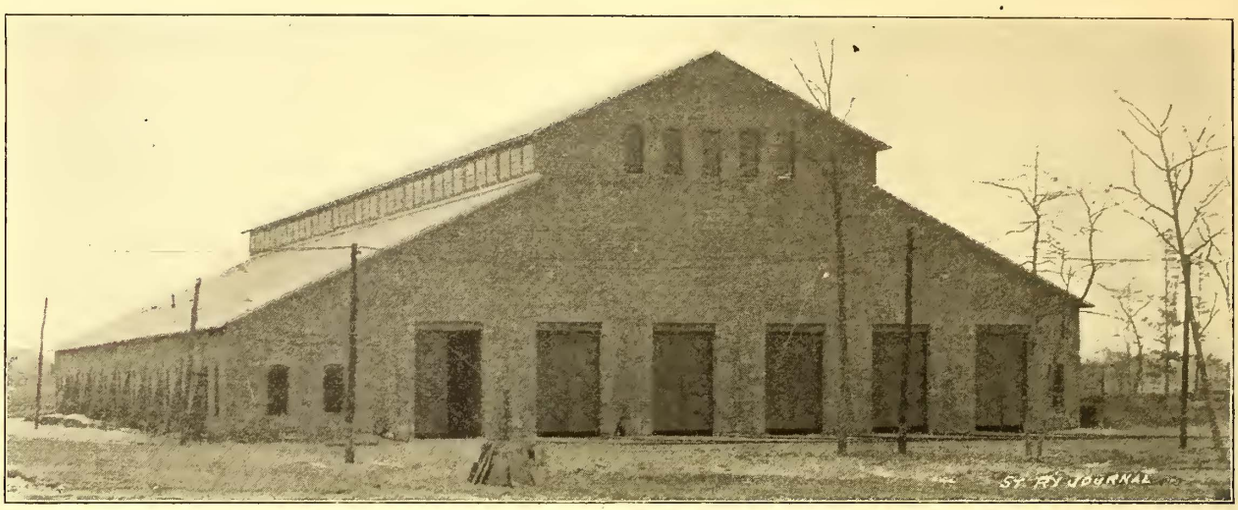
The car house of the company at Deal Lake is shown on page 508. It measures 223 ft. × 150 ft. and is of brick with iron monitor roof. It contains twelve tracks, with transfer table at the extreme end of the house.



STEEL BRIDGE OVER DEAL LAKE.

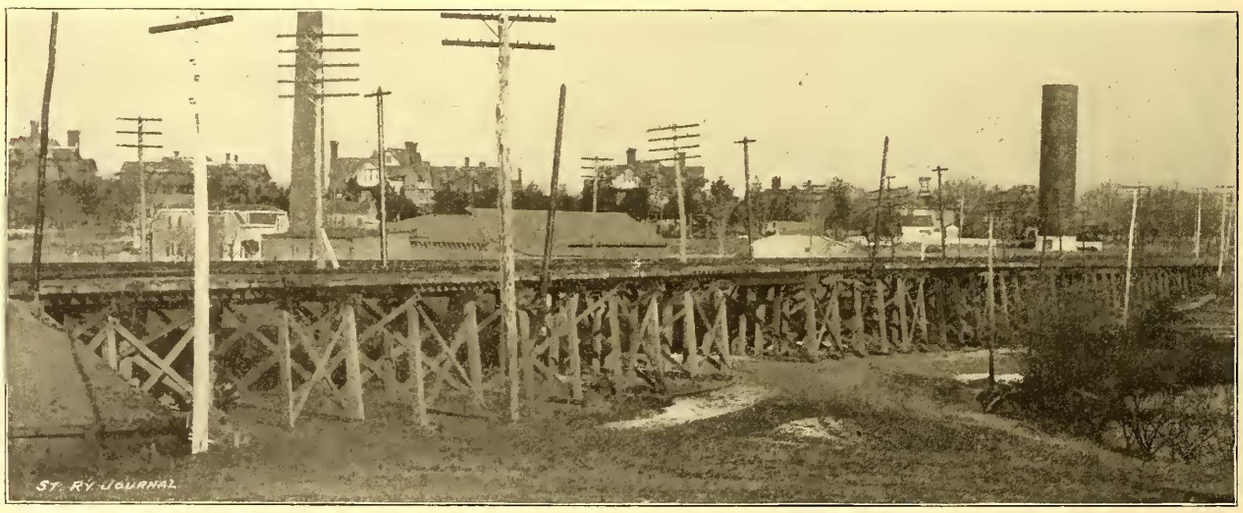
The company has in operation seventy-six cars, of which forty-four are motor cars, twenty-eight are trail cars and four are baggage or construction cars. Four of the motor cars were built by the J. G. Brill Company and are

mounted on Peckham trucks; the rest were built by the St. Louis Car Company and are mounted for the most part on St. Louis trucks. The motor equipment consists of four G. E. 800, five W. P., and thirty-five Westinghouse 12 A double equipments. Ten of the latter are supplied with G. E. K2 controllers. Trailers are run on most of the through trips, and during August the train miles were from 5000 to 6000 a day. The cars are finished in light wood painted a yellow body color, and are very attractive and substantial looking.



CAR HOUSE AT DEAL LAKE.

As stated, the nucleus of the Atlantic Coast electric railway system was the Asbury Park electric road, which was built early in the history of electric railroading. About a year ago a syndicate of New York capitalists, largely the same as that owning the Staten Island electric railway, and among whom are Col. G. B. M. Harvey and John P. O'Brien, purchased the Asbury Park line. During the fall and winter of last year the system was extended to Long Branch, and on May 10 opened through to Pleasure Bay. Besides furnishing through transportation, the system is carrying a large number of local passengers. The northern terminus of the line, Pleasure Bay, has been made a popular resort for pleasure seekers by the providing of regular concerts, afternoon and evening, and frequent exhibitions of fireworks, part of the expense of which is defrayed by the railway company. The grounds at night are tastefully decorated with incandescent lamps with varicolored globes, and an electric launch service is maintained on the bay.



TRESTLE AT TAKANASSE LAKE.

ATLANTIC HIGHLANDS, RED BANK & LONG BRANCH ELECTRIC RAILWAY COMPANY.

This company was organized in 1895 for building an electric railway between Atlantic Highlands and Long Branch, N. J. More particularly, the line was to leave First Avenue in Atlantic Highlands, run through Navesink, thence across the Shrewsbury River bridge to Oceanic, to Fair Haven, to Red Bank, which is about the center of the line, and continue through Shrewsbury, Eatontown and Turtle Mill to Long Branch, where a partial arrangement has been made for a terminus at the beach.

Before the beginning of the construction on this line, the company purchased the Eatontown & Seashore Turnpike and the Eatontown & Red Bank Turnpike, which, the managers were assured, gave them right of way from the corporation line of Long Branch to Branch Avenue in Red Bank, a distance of 7½ miles. Work was started at Eatontown and pushed to Long Branch, and horse cars were put in service between Eatontown and Long Branch July 27, 1895.

When work was started between Eatontown and Red Bank on the same turnpike, the company was enjoined from building over this turnpike, as the Attorney General of the state of New Jersey held that a turnpike company could sell to a street railway company, and convey to a street railway company the right to build, maintain and operate a street railway over its turnpike, but that a turnpike company having previously sold to a turnpike company, its rights, the purchaser had no right to sell its ac-

quired property for anything but turnpike purposes. As the Eatontown & Red Bank Turnpike had been sold to the Eatontown & Seashore Turnpike Company, the rights acquired by purchase between Eatontown and Red Bank lapsed, under the ruling of the Attorney General, so that the company, in order to reach Red Bank, had to purchase a right of way through this disputed territory, over which right of way it has completed its road, which is now in operation between Red Bank and Long Branch, a distance of 7½ miles.

This line occupies an extensive and important territory lying in Monmouth County, which at one time was rated as the richest agricultural county in the United States. The line, as contemplated, furnishes a needed means of transportation, as a permanent population of over 20,000 people between Long Branch and Atlantic Highlands has depended upon stages to take it to the railway centers, i. e., Red Bank, Shrewsbury and Little Silver.

THE PLANK WALK ALONG THE OCEAN AT ASBURY PARK.

Very strong opposition has been encountered from the day the railway company attempted to lay its tracks in Shrewsbury Township, principally because the land is largely held by wealthy New Yorkers, who have built palatial residences and who claim to have gone to that country in order to get rid of trolley railroads, and their so-called accompanying nuisances. The opposition has been developed principally by people living on Remson's Neck, that portion of land lying between the north and south branches of the Shrewsbury River, between Seabright and Red Bank. The company is now completing its track into Red Bank proper, the Chancellor having just decided that under proper restrictions the electric railway company may cross the tracks of the New York & Long Branch Railway Company.

Application for a franchise was also made to the borough authorities at Atlantic Highlands, which was finally granted, with the provisions that the electric railway company pave the street with vitrified brick, make sewer and water connections to every fifty feet of frontage along First Avenue, and use the town's electric lighting poles. This franchise was declined with thanks, and the company has now no means of reaching the dock at Atlantic Highlands, except over a private right of way.

The track and line will bear the most careful inspection, the engineering work being of the very best character, which is readily understood when it is known that the White-Crosby Company had charge of this work. The car barn is strikingly handsome.

The open cars were furnished by the Jackson & Sharp Company, of Wilmington, Del., and the closed cars by the Barney & Smith Company, of Dayton, O. All are mounted on Peckham trucks. The road is equipped throughout with Westinghouse apparatus.

That portion of the road in operation between Red Bank and Long Branch is laid with sixty pound T rail. In Red Bank, for a distance of 4500 ft., the road is to be constructed with seven inch girder rail, the franchise in Red Bank calling for a macadam pavement seven inches deep from curb to curb.

The company erected in the building of the Shore Electric Company, the necessary generators and switchboards, and hires from that company the necessary steam power.

The engineering features of the road are the trestle over the New Jersey Southern Railway at Shrewsbury, as well as the trestle over the Shrewsbury River between Red Bank and Riverside Avenue, where the company, under an arrangement with the New Jersey Southern Railway, will occupy the tracks of the New Jersey Southern Railway toward Atlantic Highlands.

The overhead work on the trestles is erected according to special plans designed by the White-Crosby Company, the whole work being done in a manner worthy of the careful attention of street railway men in general.

The principal persons interested in the company are Hon. Silas B. Dutcher, William H. Hazard, Benjamin Frick, A. B. Eldridge, A. G. Greenberg, all of Brooklyn, N. Y.; A. J. Allen, A. A. Patterson, James E. Degnan, of Red Bank, N. J.

THE Lewiston & Youngstown Electric Railway was put in operation last month. The road is 7¼ miles long, has four twenty-eight foot, nine seated open cars of Brill manufacture, and two closed combination baggage and passenger cars, seating sixteen passengers, also from the Brill works. Each car is equipped with two 1000 G. E. motors and K 10 controllers. Two miles of the road are laid with sixty-seven pound girder rail, the remainder with fifty-six and fifty-eight pound T rail.

Lewiston is the terminus of the New York Central Railroad at a point where the boat is taken for Toronto. Youngstown, six miles further down the river, is a pleasant old established little village, and the site of Fort Niagara, an old U. S. military point, where there will shortly be a full regiment of troops stationed.

The officers of the road are: president, L. D. Rumsey; vice-president and treasurer, Henry C. Howard; secretary, Karl Evans; attorney, F. R. March; chief engineer, Paul Voorhees; superintendent, R. B. Goodman; passenger and freight agent, Karl Evans.

The Electric Railway of Rome, Italy.

The trolley has invaded the Eternal City, and the dwellers on the Seven Hills now ride along the streets of Rome on the trolley car, through places sanctified by history, at a rate of travel that would have astonished the Conscript Fathers and, perhaps, even scared the immortal Cæsar himself.

The question of utilizing electricity for the operation of street cars in Rome has been debated since the completion of the electric installation, transmitting the power of the waterfall at Tivoli to Rome, and with the knowledge that electricity was in the city and available for purposes other than lighting, came a growing desire for a change from animal traction to some more satisfactory and cleanly method.

Italy had already acquired some experience with the electrical method of traction. The old Sprague road in Florence has been run satisfactorily for years, and, recently at Genoa, Milan and Varese, overhead systems of the most modern type had proven to the inhabitants of those cities the superiority of electric traction over all known methods for city use.

The opinion of the above named municipalities was requested by a Roman commission appointed in 1894 to examine into the merits not only of the different systems of traction, but also of the competing systems of electric traction. The unanimous answer not only emphasized the satisfaction of the citizens with the service rendered, but also dwelt upon that question so much debated in Europe —the disfigurement of the streets by the overhead wires. The use of ornamental poles and brackets, and the frequent use of insulated rosettes, fixed to the walls of the houses, instead of poles, had helped to render the overhead system less obtrusive upon the eye; and, furthermore, in the opinion of the above municipalities, although the overhead system is not altogether a thing of beauty, its great advantages far outweighed any considerations of mere æsthetic desire.

Other evidence was adduced, and the Roman municipality in February, 1895, authorized the substitution of the horse by the trolley. Work was not delayed and the first line was opened for public traffic on Sept. 19, 1895. It has been running most successfully since, and has proved so satisfactory to the Roman public and to the operating company that before long the entire system of traction in Rome will be on the overhead trolley system.

The line is operated by the Tramway & Omnibus Company of Rome, which purchases its current by meter from the substation of the Tivoli-Rome Transmission plant. This installation is one of the early European high tension, alternating current, power transmission, and was completed in 1892, Ganz & Company, of Buda-Pesth, carrying out the electrical portion of the work. It was erected by the Roman Gas Company as a supplementary source of current in its central station in Rome. During the hours of heaviest lighting load the Tivoli power does not suffice, and an auxiliary steam plant of 2000 h. p. capacity is operated in parallel with it.

The location of the Tivoli generating plant is on the site of the old Villa Mecenate, where about 2000 h. p. is available from a fall of about 800 gals. per second a distance of 160 ft. The water passes through a canal on an old Roman viaduct to the wheel house.

The station contains six 250 k. w., thirty pole, alternating generators directly coupled to Girard turbines running at 170 r. p. m.; and three direct current, twenty-seven kilowatt exciters directly coupled to turbines running at 370 revolutions. Each turbine is completely enclosed and is furnished with Ganz automatic regulators.

ELECTRIC RAILWAY TERMINUS AT RAILROAD STATION—ROME.

Current at 5100 volts is turned on to the transmission wires, of which there are four of bare copper. The periodicity employed is low—forty-three cycles per second.

The conductors from the Tivoli switchboard pass through the Roman Campagna for a distance of nearly seventeen miles, on oil insulators set upon iron columns, until they reach the Old Roman Wall near the Porta Pia, when they enter the transformer house. The loss in the transmission is nearly twenty per cent, which reduces the pressure to about 4000 volts. This is brought down to 2000 volts in thirty-two transformers, each of twenty-five kilowatts capacity, and the current is turned into the underground network of concentric cables, which distributes it over the Roman streets for incandescent and arc lighting.

In addition to the transformers used for lighting purposes, a set has also been installed in which the alternating current is transformed down to 400 volts. At this pressure it enters the collector rings of a number of rotary converters, and issues from the commutator side, direct current at about 550 volts.

The equipment of the substation is completed by an extensive battery of Tudor accumulators, 304 in number, with a capacity of 1000 ampere-hours. This battery is in parallel with the trolley circuit and is divided into line groups of twenty-six cells each. Each group is connected to an automatic switch, which by cutting cells in and out, maintains the pressure constant on the street car line. The

VIEWS ABOUT THE ELECTRIC RAILWAY IN ROME, ITALY.

continuous current side of the converters is so connected at the switchboard that the cells are in constant receipt of the excess of current and thus the necessity for a special charging dynamo is obviated. The load on the continuous current machines is also kept constant by means of the equalizing action of the storage battery.

The railway line is about two miles long, runs from the Railway Station as far as the Piazza San Silvestro, and practically connects the old city to the new Rome. The grades are numerous and severe and range from .35 per cent near the station to 2.6, 7 and 8.32 per cent near the Piazza San Silvestro. The curves are also numerous, the sharpest, with a radius of 78 ft., occurring at a point on the line where the grade is 8.32 per cent.

The trolley wire depends from span wires which in a few places are carried between ornamental poles. but for the most part attached to ornamental rosettes fixed to the walls of houses. American overhead devices are used. In the rail bonding, the rails have a supplementary wire with a capacity almost as large as that carrying the current brought to the overhead wire. The Chicago bond is employed. Each of the ten cars in use is equipped with two G. E. 800 motors and type K 2 controllers, electric headlights, etc. The average speed through the city streets is about six miles an hour and the cars run under a headway of about four minutes. Each car has places for forty passengers.

ELECTRIC CARS IN A ROMAN STREET.

Within the past two months, the municipality of Rome has approved a further measure compelling the Roman Tramways Company to entirely discard its system of animal traction and to substitute electric traction on its entire network both city and suburban. This is the best possible evidence that could be adduced to show how favorably the Romans look upon the new system. The Tramways Company is not averse to the mandate, its experience with electricity already showing a decided increase in receipts and diminution of expenses. Four years have been given to the company to effect the change.

The overhead trolley system will be extended over the majority of the lines, the underground conduit system being adopted for the principal thoroughfares. The contract for the electric work has been awarded to the representatives of the General Electric Company in Europe, and to Siemens & Halske, of Berlin.

Large Long Distance Transmission Plant in Mexico.

A large electric plant for transmitting water power will be installed shortly at Regla, in the State of Hidalgo, one hundred miles north of the City of Mexico. The water is taken from a mountain stream having a minimum supply of 1500 cu. ft. per minute. A natural rock dam, at a favorable point in the canyon, impounds the water sufficiently to admit of its being carried by a cut through the bluff into a canal, which follows mainly the contour of the mountain for the distance of 1½ miles. The work of creating this canal involved the cutting of ten tunnels, aggregating a length of 1200 ft., through solid rock.

From the terminus of the canal the water is carried to the power station, located at the bottom of the ravine, through 1700 ft. of thirty inch pipe, which affords a vertical head of 887 ft. This pipe is of varying thicknesses to correspond to the pressure at various points on the line, the lower portion being of steel ¾ in. thick.

The power station has five Pelton wheels, forty inches in diameter, of capacity of over 400 h. p. each, directly connected to the same number of twelve pole, 350 k. w. General Electric three phase generators. The latter run at a speed of 600 r. p. m., and deliver the current at a pressure of 700 volts. There are also two twenty-four inch wheels speeded at 1700 r. p. m. for running the exciters. The step-up transformers are wound for a ratio of 1:15, making the line potential a little over 10,000 volts at the generator end.

The station is to be used to supply power to the mines of the Real del Monte Company, one of the most extensive mining organizations in the world, employing upwards of 8000 men. The power will operate mining machinery such as stamp mills, crushers, pumps, hoists, ventilators, etc. The mines of this company, said to be the richest in Mexico, are located within a radius of twenty-three miles, the mean distance being about eighteen miles.

Various other mines in the vicinity will also be supplied with power from this station, and the City of Pachuca with light. The mine owners will pay to the Power Company $250 per year per horse power, and as 1200 effective h. p. will be delivered at Pachuca a handsome profit will be derived.

The Street Railway Journal is indebted to T. H. McLean, general manager of the street railway system of the City of Mexico, for the above data.

Hasty judgments are sometimes formed that wattmeters are incorrect when two instruments, run in parallel on the switchboard, show different results. In such cases the cause for the difference may often be found in a difference in resistance of the leads. An easy way of testing the working of wattmeters in parallel is to introduce an amperemeter in the circuit of each and note whether the readings of these meters are the same.

The Baltimore, Middle River & Sparrows' Point Railroad has been extended to the rear of Paterson Park, Baltimore, and now connects with phaetons with the Baltimore Traction lines. A number of other extensions are also contemplated.

The Street Railway System of Hanover.

By C. O. MAILLOUX.

The city of Hanover, Germany, has attracted the attention of electrical engineers the world over for some years past, on account of the novel and interesting features of its electric light central station, which was one of the first and is still one of the largest and most successful European central electric stations using storage batteries. It was for this reason that the writer while on his way to Berlin last October, had arranged to pass through Hanover, and stop over for a few hours between trains. He had occasion to discover in these few hours, that Hanover also has one of the most novel and interesting street railway systems in Europe. It is a combined overhead and storage battery line, the batteries being used in the central portions of the city and the overhead wires outside. The poles for carrying the overhead wires are extremely artistic in design and produce an effect which puts to shame our own best efforts in making overhead line work attractive.

The designs for the poles, both single and double bracket, were made by the street railway company's engineers, and the work was done by Hanover firms. The framework and crossarm of the single bracket pole are of wrought iron, including a skeleton portion of structural iron and an ornamental portion in hammered iron, such as used in decorative iron fixtures. The whole is supplemented by "repoussé" and moulded sheet copper ornaments in the form of vines, twined gracefully here and there through the ironwork with protruding stems, leaves, buds or clusters. Some further idea of the workmanship bestowed on these trolley supports may be obtained from the fact that their average cost was over $100 apiece, which would correspond to a cost in America of probably not less than $150. And yet, even with all these honest and intelligent efforts to make the overhead trolley acceptable, it has failed to secure permission to spread, and it is, on the contrary, being restricted and curtailed by the city authorities who are evidently prejudiced in favor of the storage battery system for use in the central portion of the city.

Through the courtesy of Herr Krueger, president, and Herr Adam, the engineer-in-chief, of the Hanover Street Railway Company, the following notes concerning the street railway system of the city were obtained by the writer.

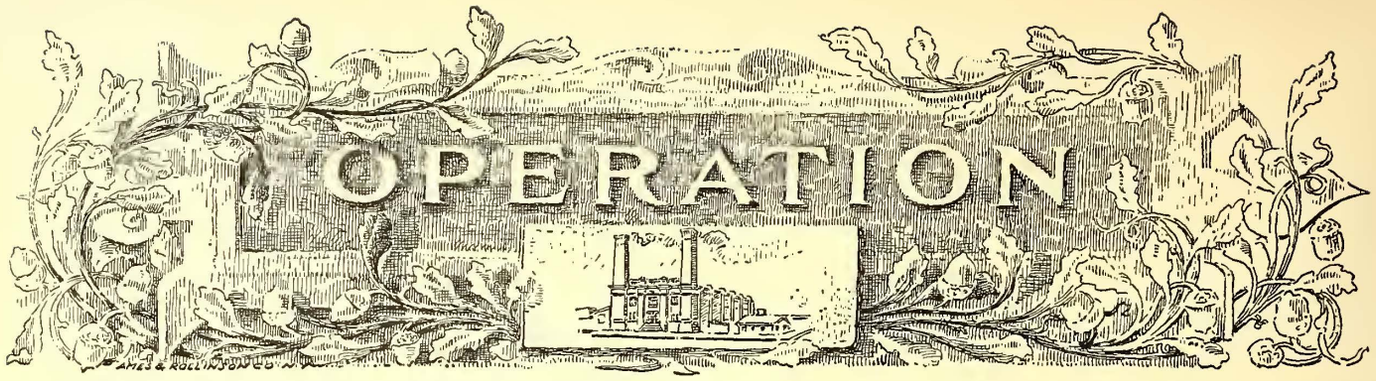
The city of Hanover, with its suburbs, has a population of some 250,000 people. The street railroads are all controlled by one company, the Hanover Street Railway Stock Company already mentioned. At the time of the writer's visit, there were in operation approximately thirty miles of line, of which only about ten miles had been converted into electric traction, the rest being still operated by horses. The rails are of different forms, mostly Haarman or Phœnix, 14a sections.

On the electric portions of the system, there were then thirty-two motor cars in use. As previously stated, the cars are operated partly with storage batteries, and partly by the overhead trolley system. At the time of the writer's visit, there were only eight of the cars equipped with accumulators. Each of these cars contained 196 lead accumulator cells of the "Tudor" type, specially made for this service, by the Akkumulatoren Fabrik Aktiengesellschaft, of Hagen, Westphalia, and having large plate surfaces so as to admit of rapid charge and discharge. The batteries are placed under the seats and are not intended to be removed except when absolutely necessary for repairs, etc. In practice they seldom have to be disturbed, but are merely inspected at the end of the day, or before the next day's work, the same as the rest of the motor equipment. The total weight of the battery is about 2½ tons per car.

The batteries obtain their charge from the trolley at such times when the car runs into the suburbs, and passes over such portions of the line as are equipped with the overhead trolley. The number of cells is just sufficient, so that the potential carried on the trolley line (about 500 volts) will send the normal charging current through the batteries. It is found, however, that this charging current varies according to the consumption of current on that car, or on other cars on the same line; in fact, the storage batteries inside the cars serve, to a great extent, as automatic compensators for the fluctuations of electric output, the result being that the load on the engines at the power station, is rendered much more steady than it would be, were not these batteries coupled to the trolley line. As the steadiness of load tends to increase the efficiency of the generating plant, it follows that the total fuel consumption remains substantially the same as it would be if the additional weight of batteries were carried by the car. It should be stated, however, that the gain in efficiency is due, in considerable measure, to a new form of car motor controller devised by Herr Adam, the engineer-in-chief, by the use of which some economy is effected in the current required to propel the car. The accumulators showed no diminution in their capacity up to the time of my visit after being in use several months. The only difficulty was with the boxes containing the accumulators, and the difficulty of preventing the acid from leaking or splashing. This was considered, however, as a detail of relatively trivial importance, and is likely to be fully remedied in the near future. The results had been sufficiently satisfactory to warrant the company in agreeing with the city of Hanover upon the adoption of storage batteries as the mode of traction for all street car traffic inside the city limits. Thirty more accumulator cars have been ordered, while fourteen of the present trolley motor cars were being changed into accumulator cars. It was therefore expected that there would be fourteen accumulator cars in service by the present summer.

DOUBLE BRACKET POLE—HANOVER.

The present equipment of the power station includes three water tube safety boilers of about 175 h. p. each, running under a steam pressure of about 145 lbs. There are two horizontal compound engines, each of 200 h. p., operating railroad generators. There is also a 40 h. p. engine for running the tool machinery in the tool shop, which latter is very well equipped with all the necessary appliances for making incidental repairs of the machinery. Some extensions in the power house were also under contemplation, and will doubtless be carried out shortly.



Organization and Operating Methods of the Metropolitan Street Railway Company, of New York.

The cable, electric and horse railway lines in New York City operated by the Metropolitan Street Railway Company, and controlled by the Metropolitan Traction Company, form a system which undoubtedly is, in its present earning power and in the possibilities of its future development, the most valuable street railway property in the world. A brief account of the company's history and its scheme of organization, a study of the traffic conditions of Manhattan Island, so far as they affect this system, and an outline of the plan of operation and development which has been worked out by President Vreeland during his three years' administration of the property is of unusual interest to all students of municipal transportation problems, for the reason that the system stands to-day as an exponent of the best horse railway practice, cable railway practice and underground electric railway practice to be found in this country or abroad.

HISTORY.

The Metropolitan Traction Company was chartered in 1892 under the laws of New York (originally, in 1885, under the laws of New Jersey), for the purpose of purchasing, constructing and controlling various street railway properties in New York City by ownership of stock. Its authorized capital stock is $30,000,000, of which $28,366,600 has been issued and paid in.

In carrying out the purposes of its organization the Traction Company has, at various times, purchased the entire capital stock of eight New York City street railway companies and a controlling interest in five others. Six of the properties owned *in toto* by the Traction Company have been consolidated into the Metropolitan Street Railway Company, to which have been leased all of the other properties controlled by the Traction Company, except the Thirty-fourth Street Crosstown Railway and the Fulton Street Railroad, which are still operated independently, but by the Metropolitan Street Railway Company. The last named company also leases the Sixth Avenue Railroad, the Ninth Avenue Railroad, the Eighth Avenue Railroad and the street railway division of the New York & Harlem Railroad Company, operating on Fourth and Madison Avenues, but the Traction Company has no holdings in the capital stocks of these four lessor corporations.

The company's present system is earning over $9,000,000 per annum gross, of which about thirty-nine per cent is earned by the 32 miles operated by mechanical motive power, while sixty-one per cent is earned by the 153 miles operated by horses. The possibilities of increased earning power due to the equipment of the horse lines with improved forms of motive power, together with the natural increase caused by the rapid growth of population reasonably to be expected, makes the statement that this is the most valuable street railway property in the world seem sufficiently conservative.

SCHEME OF ORGANIZATION.

By reference to the diagram (Fig. 1) a general understanding of the company's organization may be obtained. At first sight such an organization might impress the average street railway manager accustomed to rigid economies in the matter of salaries, as complex and perhaps a somewhat questionable application of railroad methods to street railway practice. A more careful understanding, however, of the way in which this organization works together for combined gross business and operating economy would satisfy even the most prejudiced believer in "personal administration" that the problems of handling a traffic of over 200,000,000 passengers per annum demands a "machine" which will work with perfect smoothness and regularity under the delicate touch of a master mind which is freed as far as possible from the petty details of routine work in order to take up the broader problems necessary in a successful administration.

For nearly three years past President Vreeland has been steadily working to unify the system in every detail so as to raise the efficiency of the weaker lines to that of the stronger, and in every respect to weave the whole network of formerly independent lines into one coherent and consistent whole. This has now been substantially accomplished, Mr. Vreeland has turned over the general operating management to H. M. Littell, and the president will henceforth be free to care for the development of the system in every direction. It may be said in this connection that Mr. Vreeland is president not only of the Metropolitan Street Railway Company, but also of the controlling organization, the Metropolitan Traction Company.

A brief outline of the duties of the company's officers will serve to further explain the diagram of organization.

The President.—The functions of this office have been already outlined.

First Vice-President and General Manager.—H. M. Littell has general operating charge of the system.

Second Vice-President.—D. B. Hasbrouck has certain general duties, including the placing of insurance, questions of taxation and some branches of litigation.

Secretary.—C. E. Warren has entire charge of the company's books and is practically its comptroller. He is, in addition, secretary of all the companies controlled by the Metropolitan Traction Company which still retain their separate organizations.

Treasurer.—H. S. Beattie performs the duties usually appertaining to this office, not only for the company, but also for the controlled companies.

Auditor.—W. C. Kimball passes upon all bills presented to the company.

Stock Transfer Agent.—R. L. Anderton, Jr., issues stock certificates and records all stock transfers.

Attorney.—H. A. Robinson is in charge of the company's legal business.

General Superintendent.—F. D. Rounds has a number of general duties to perform, in addition to which he is in direct charge of Division No. 1, embracing the company's "Mechanical System."

General Purchasing Agent and Storekeeper.—A. C. Tully performs the duties of this position.

General Master Mechanic.—Thomas Millen has charge

of all repairs and general machine work in the operating department.

Assistant Chief Engineer.—The engineering department of the Metropolitan Traction Company, of which F. S. Pearson is chief engineer, is in charge of all new construction. M. G. Starrett, as assistant chief engineer, is detailed to take charge of all electrical and mechanical engineering work connected with the operation of the system.

Engineer Maintenance of Way.—W. B. Reed is in charge of all track work, under general instructions from the engineering department of the Metropolitan Traction Company.

Chief Inspector.—James Parker performs the duties of this office, which will be described in detail later on.

Division Superintendents.—L. P. Foulke is in charge of Division No. 2; H. A. Newell, Jr., of Division No. 3; T. E. Delaney, of Division No. 4; John Sitter, of Division No. 5; H. A. Newell, of Division No. 6, and J. H. Oakley, of Division No. 7. They have charge of all men employed by the company for service on their respective divisions, issue requisitions upon the purchasing agent for supplies of all kinds, and handle the cars to meet the traffic requirements. They are also directly responsible for the employment of horse car drivers and stablemen under a system to be described in another place.

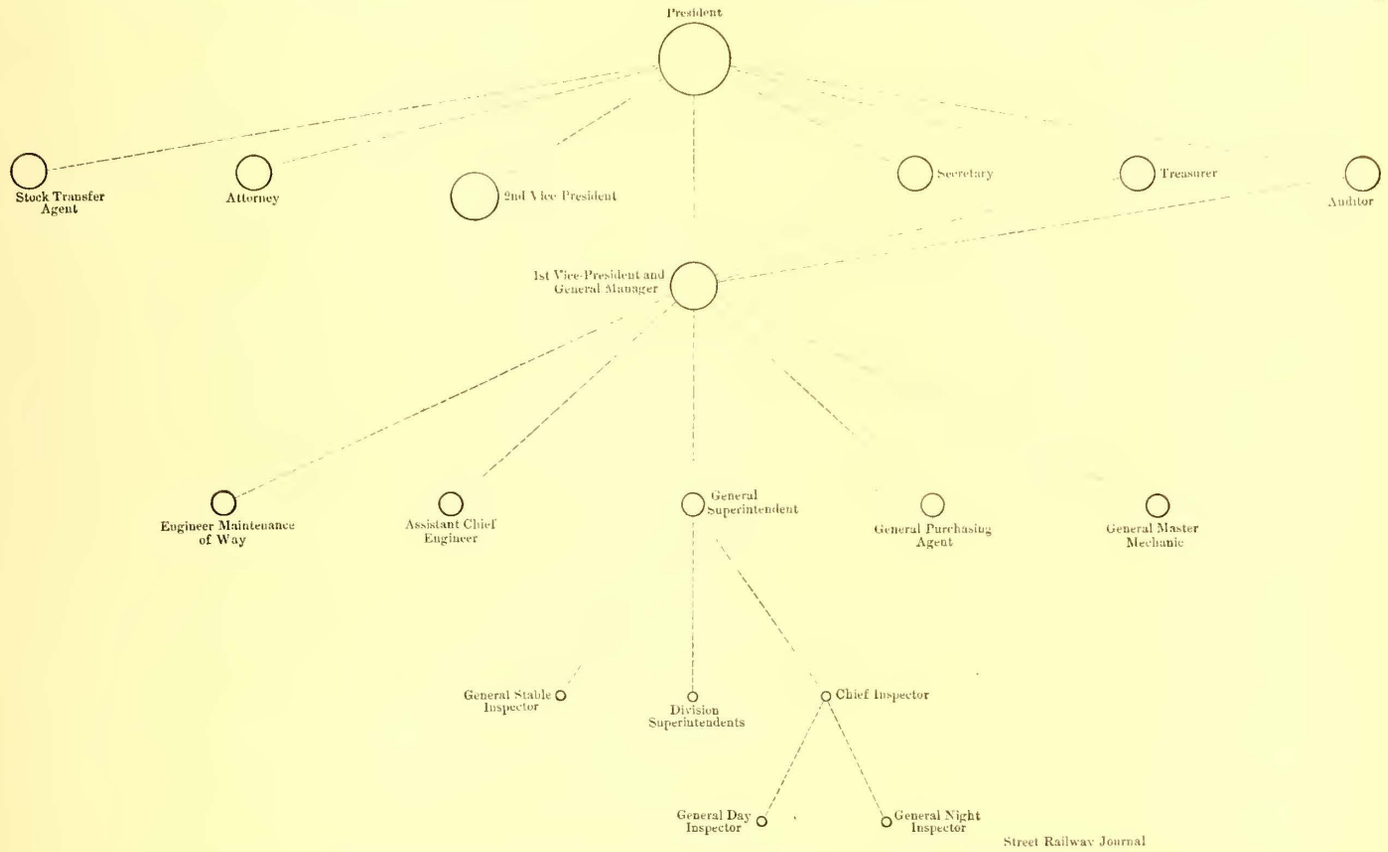


FIG. 1.—SCHEME OF ORGANIZATION OF THE METROPOLITAN STREET RAILWAY CO.

THE WORKING FORCE.

Early in his administration Mr. Vreeland, after a careful study of the conditions met with in New York City, came to the conclusion that nearly all the company's working force in the transportation department should be engaged at headquarters by a single man—not by the division superintendents. The reason for this was found in the fact that it would otherwise be impossible to maintain upon all the company's lines an equal degree of efficiency in the working force, for in spite of the utmost care and effort on the part of division superintendents to secure the best employes possible to obtain, local conditions found in a city as large as New York would inevitably govern results. Men residing on the extreme West Side, for example, would most naturally apply to the superintendent of the line running through that district, and pressure from local politicians might be brought to bear so that there would naturally be formed on that particular line a force which might easily become isolated from the rest of the system in feeling and in interests, while, by pursuing the opposite plan, men of the best types to be found in the entire city would be distributed over the system to the company's advantage and their own.

All conductors, motormen and gripmen are appointed at the central office by the head of the Employment Bureau, J. J. Swan, who has been with the company for many years. All applicants to this bureau are cordially welcomed, not repelled, since there is always a demand for good men and a desire to give every applicant a chance to prove his value. The references of all applicants are carefully investigated, and names are finally placed upon a waiting list to receive the first position as "extra" that becomes vacant. The men usually work for several months as "extras," and are paid during this time at a rate per trip averaging $2 for a whole day's work. Upon being given a regular run, cable gripmen, motormen, horse car drivers and conductors are paid $2 per day for the remainder of their first year's service of the company. After this time, if their record is good, gripmen are advanced to $2.40 per day, and motormen, and conductors on the cable lines, to $2.25 per day, while the pay of employes on the horse car lines, together with conductors on the electric lines, remains the same as in the first year. It is worthy of note that this system of increasing the pay of conductors, motormen and gripmen on the company's "Mechanical System" has been one of the strongest influences tending to increase the efficiency of the force, to prevent the "knocking down" of fares and to reduce the number of accidents. There is naturally an earnest desire on the part of all the employes to keep their records clean, and thus to secure the larger pay, while the higher figures, moreover, are considered "good pay," so that the inducement to theft is largely removed.

The employment of horse car drivers and all stable employes is placed in the hands of the division superintendents who report weekly to the company's central office upon all men hired, giving their names and the names of their "backers."

The company's force of inspectors is an important agency in the management of the property. It has three general classes of duties to perform, the first being the training and inspection of employes; the second, the duty of carefully watching and reporting upon the conditions of operation on the several divisions; and the third, the study of the local traffic conditions of the city from day to day. The first and second functions may be described at this point.

At the head of the force is the chief inspector who has two assistants, one the general day inspector and the other the general night inspector. There is also a general stable inspector who is besides the regular foreman of the barns of Division No. 1. Each division has its own local inspectors who are directly in charge of the training of employes on these divisions. All conductors, motormen, gripmen and horse car drivers appointed by the central office or the division superintendents for service on a particular division, are first put in charge of the division inspectors who train them in their duties and report to the division superintendent upon their efficiency and ability to discharge their duties. These reports usually decide the question as to whether or not an appointee shall remain upon the force. As a further check upon these decisions the general day inspector and general night inspector are detailed from time to time to examine the men on the different divisions and render an independent report to the central office upon their efficiency. This general inspection serves as a check upon the division and largely prevents favoritism and the exercise of undue influence locally, since a division inspector knows that his work is to be reviewed by a higher power. Stable appointees of the division superintendents are subject to inspection by the general stable inspector, who usually spends his afternoons in visiting the different stables of the system, and his mornings in his own work as foreman of the division stables.

The general day inspector and general night inspector are also charged with the duty of studying the methods of operation on different divisions, and their reports thereon to the central office serve as a guide to the general manager in his suggestions to division superintendents.

By this system of careful inspection and mutual check the working force of the Metropolitan Street Railway Company is probably not surpassed in efficiency by any in the country. The *morale* of the men is excellent. They are proud of their positions, anxious to retain them, generally satisfied with their treatment by the company, and it is believed that it would be very difficult to work up any considerable strike sentiment among them. In fact, a recent attempt on the part of a labor organization to bring about a strike resulted in conspicuous failure, for, in the words (exclusive of profanity) of the organization chief, "I was a —— fool to come here. These —— men on this system are so attached to that —— Vreeland that they won't stand up for their own interests."

GENERAL TRAFFIC CONDITIONS.

The entire population movement within the present limits of New York City, exclusive of ferriage, stages and cab service, amounts to nearly 500,000,000 per annum, of which thirty-eight per cent is handled by the elevated railway system, thirty-seven per cent by the lines of the Metropolitan Street Railway system as at present constituted, thirteen per cent by the lines of the Third Avenue Railroad Company, four per cent by the lines of the Second Avenue Railroad Company, and eight per cent by three other smaller systems. The elevated railway system naturally has a practical monopoly of the long distance riding between the two ends of Manhattan Island, combined with what has been, until within the last three years, a considerable amount of short distance traffic—the most profitable, of course, for any transportation system offering a uniform fare. The short distance traffic has, however, been largely deflected of late to certain surface lines of the Metropolitan Street Railway system and the Third Avenue Railroad Company, because of the introduction of the cable system on several through routes presently to be described, and the result on the Manhattan system is seen in a large decrease in the gross receipts and in a gradual increase in the percentage of operating expenses to gross receipts, due chiefly to the greater proportion of long distance riding to the total traffic.

Manhattan Island is long and narrow (see Fig. 2). The business, financial, and to a large extent the manufacturing district is south of Forty-second Street, while the great residence section is north of Fifty-ninth Street, the intermediate district being a mixture of residential and business areas. The general result of this distribution of business and residential areas is an immense south-bound movement of passengers in the morning, a north-bound movement returning at night, and a large theatre traffic in the evening hours, which will be referred to in detail in another place. Now this total north and south bound movement is limited to fourteen "through" avenues, of which the Metropolitan Street Railway system controls, or holds the key to the surface lines on eight, other surface railway companies on three, while of the remaining three avenues one is, and probably will be for years to come free from railroad tracks of any kind, and another is devoted, above Forty-second Street, to the tracks of the New York Central Railroad Company. In addition to these north and south lines the company operates a belt line, skirting the city from the Battery to and through Fifty-ninth Street, together with a number of crosstown lines and others running irregularly between important ferries and other terminal points.

The backbone of the company's entire system is the cable railway running from the Battery, north through Broadway and Seventh Avenue to Fifty-ninth Street and Central Park. This is undoubtedly the most valuable single street railway line in the world. At the battery it obtains nearly all the traffic of seven ferries running to various points of Long Island and Staten Island; it passes thence through the heart of the great financial district of the American continent, of which Wall Street is the type and center; runs past the Astor House, Post Office, City Hall and the great newspaper offices of the city; thence serves the great wholesale district; reaches the heart of the retail drygoods and general ladies' shopping district of the metropolis; runs through that beautiful hotel and theatre section which is the wonder and delight of visitors the world over; and finally reaches the city's great playground, Central Park. Surely such a combination of traffic inducing influences is found in no other city of the world concentrated on a single line, and when it is further understood that, in addition to the enormous amount of short distance traffic between the terminals of this line, it serves as the trunk line for a large number of feeders crossing or connecting with it at numerous points, the tremendous importance of the Broadway line in the transportation system of Manhattan Island may be more readily grasped.

On the west side of the city the Columbus and Ninth Avenue cable line, also owned by the company, runs from Morningside Park through Ninth Avenue and Fifty-third Street to the Broadway line, and its cars pass over the latter to the Battery. On the east side of the city the Lexington Avenue cable system runs from 106th Street through Lexington Avenue and Twenty-third Street to the Broadway line and its cars also pass down the latter to the Battery. Above 108th Street, on the west side, is an underground electric system on Lenox Avenue, Lexington Avenue and 116th Street, all three lines running to the Harlem River. These four lines comprise the "Mechanical System" of the company, all its other lines being still operated by horses, though improvements in motive power are planned on a comprehensive scale.

STATISTICS OF TRAFFIC.

Some idea of the magnitude of the transportation problems connected with the operation of the "Mechanical System" may be obtained from the following figures:

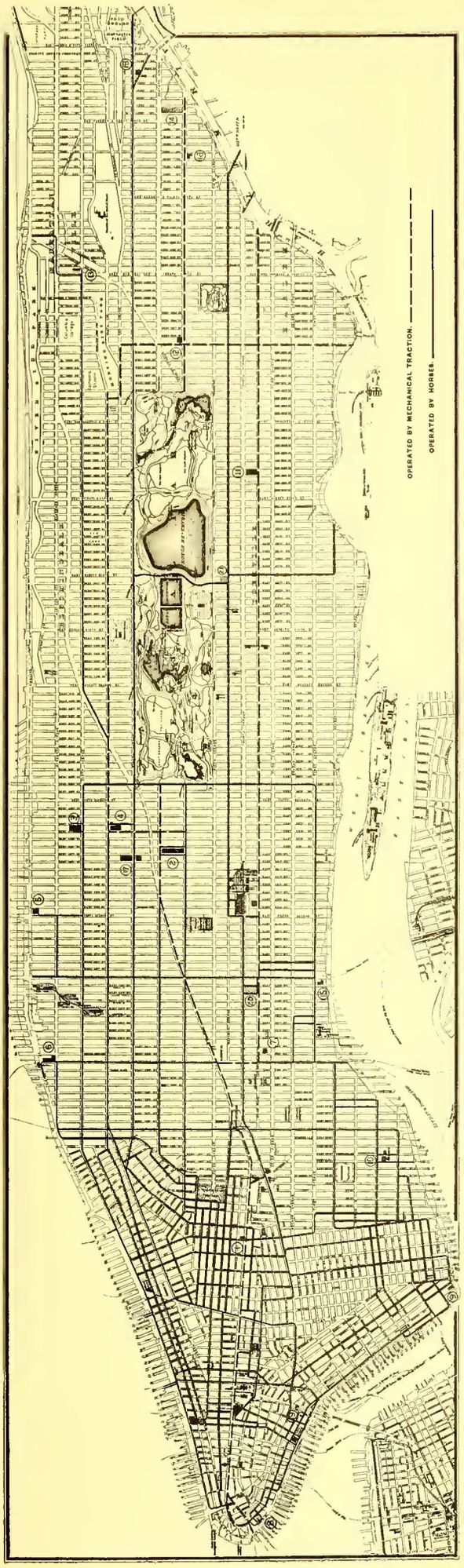


FIG. 2.—MAP OF MANHATTAN ISLAND, SHOWING THE LINES CONTROLLED BY THE METROPOLITAN TRACTION CO. AND OPERATED BY THE METROPOLITAN STREET RAILWAY CO.

During the year ending June 30, 1893, the company gave an exceptionally perfect horse railway service on the main trunk line from the Battery to Fifty-ninth Street. Well kept, attractive cars were run at one minute intervals during the business hours of the day, at an unusually high speed for horse cars. This line carried nearly 30,000,000 passengers (including transfers) during this year, an average of about 82,000 passengers per day for 365 days. In May, 1893, the company first began putting cable cars on this Broadway line, running them in between horse cars, but it was not until July 1 that the horse cars were entirely withdrawn and the line operated exclusively with cable cars. The number of cable cars originally started was 125, but was increased to 150 during the year, and the time interval between cars was reduced to forty seconds. The total number of passengers (including transfers) carried during this first year of cable operation, including the passengers carried on a few horse cars on the new Columbus Avenue line for the last two months of the year, amounted to over 36,000,000, an average of about 100,000 passengers per day.

In September, 1894, 100 cable cars were put upon the Columbus Avenue line, and a one minute service was given. The traffic figures jumped at once 34,000 passengers per day. The Lexington Avenue track was completed in April, 1895, and the company commenced operations with horse cars, and at about the same time the Lenox Avenue electric line also commenced operation with horse cars. Over 50,000,000 passengers, or 138,000 per day, were carried during the year ending June 30, 1895, by the Broadway trunk line, the Columbus Avenue cable line and the horse cars operated for three months on Lexington Avenue and two and a half months on Lenox Avenue.

One hundred and seventy-five cable cars were put upon the Lexington Avenue line in October, 1895, and the traffic of the mechanical system immediately increased 86,000 passengers per day. During the six months ending June 30, 1896, the present mechanical system, including the Broadway, Columbus Avenue, Lexington Avenue, Lenox Avenue and 116th Street lines, has carried over 45,000,000 passengers, an average of 245,000 passengers per day. This portion of the entire system will undoubtedly carry over 100,000,000 passengers during the next financial year.

The service given on these cable and electric lines is amazing. 425 cable cars and 35 electric cars are in regular and special operation over the entire thirty-two miles of trackage, the cars being thus spaced at an average distance of 365 ft. at the times of maximum service, with average distances on Broadway itself of from 150 ft. to 200 ft. The time intervals between cars on the heavy hours of ordinary days are about as follows:

Broadway line, to Houston St.	20 seconds.
" " Houston St. to 23d St.	15 "
" " 23d St. to 53d St	30 "
" " 53d St. to 59th St.	60 "
Columbus Ave, line, from Broadway and 53d St	60 "
Lexington Ave. line, from Broadway and 23d St. to 106th St.	20 "
Lexington Ave. line, from 106th St. north	120 "
106th St. line	120 "

The company's horse railway lines are also well patronized as they serve streets which have a large local traffic, while it has been possible, moreover, by the liberal system of transfers which the company has established, to attract business from every section of the city by way of the crosstown lines to some one of the main avenues north and south. The Sixth Avenue and Ninth Avenue lines south of Fifty-ninth Street pass through excellent street railway territory and reach a terminus at the Post Office through a network of busy streets where a large short distance travel is obtained. The Belt line passes through the shipping and steamboat streets at the edge of the city, and also obtains a great deal of traffic between steamboats and ferries, while the crosstown portion of the route at Fifty-ninth Street has proven a great convenience to the residents of the East and West Sides, since it is the only crosstown line between Forty-second and Eighty-sixth Streets.

The company's other crosstown lines on Thirty-fourth Street, Twenty-third Street and Fourteenth Street obtain an immense traffic, situated as they are with ferries at both ends and the great shopping, theatre and hotel district in the center, while the four or five more southerly crosstown lines also obtain not a little "pick-up traffic."

HOW TRAFFIC IS HANDLED.

The immense value of the territory served by the company's lines has been shown in the preceding discussion. The responsibilities involved in the handling of an enormous traffic of this kind are such as to call for the greatest skill and ability on the part of the managing head and the most perfect executive machine to carry out his instructions. The least slip in any one of the innumerable cog wheels of such a machine involves serious consequences—annoyances to the public, loss of traffic, and virulent criticism on the part of the press which, when it comes to street railway companies, notes not good things but only bad.

Moreover, the management of the Metropolitan Street Railway Company has not been content to sit still and simply care for what traffic has been offered to its cars. On the contrary, every effort is made to secure business, and the maximum amount of business, and the story of the various ways in which the traffic conditions of the city are thoroughly studied and met from day to day is, in itself, a lesson in street railway management which serves to illustrate the value of adapting certain steam railroad methods at least to street railway operation of this magnitude.

In the first place, the division superintendents are supposed to be cognizant of most of the extra traffic requirements which their respective divisions have to meet. But the full responsibility is not left with them. One of the most important functions of the chief inspector's office is to have accurate information of every harbor excursion, picnic, encampment, etc., requiring local transportation, together with an intimate knowledge of the "evening business," of New York City, at all points of entertainment. This information, the chief inspector obtains from the newspapers and other sources, and "passes the word" to the division superintendents who have extra cars ready to transport all out-going, or to meet all in-coming excursions at precisely the right time. The sections of the city to which excursions of various kinds will look for patronage have come to be known by the chief inspector, and miscalculations of the requirements are rare.

Few people who leave Daly's Theatre or Abbey's at 10:45 P.M., on a winter's night and find directly opposite the door a number of practically empty cars inviting their patronage, have any idea of the intricate and carefully balanced system necessary to accomplish this result. In no other city of the world are the conditions so difficult to meet. From 7:45 to 8:15 P.M., the great entertainment-loving population of the upper West Side crowds the Columbus Avenue cable line and the Ninth Avenue elevated line overhead in a struggle to reach the footlights of the theatre district before 8:15 P.M. The cable cars are brilliantly lighted, perfectly clean, and more attractive, particularly to ladies, than the elevated cars above; every street corner is a "station" and every theatre a stopping point, and the consequence is that in spite of several switchbacks, placed at intervals along Columbus Avenue, providing for sectional travel, together with twenty-five second intervals between cars, it is simply impossible to prevent serious overcrowding during this half hour. A similar condition obtains on the Lexington Avenue cable line on the east side of the city. The problem at this time, however, is not so difficult as that of handling cars for the return trip from the theatre district in the thirty minutes from 10:30 to 11 P.M. The difficulty comes from the fact that within the comparatively short space of thirty-two blocks extending on and in the close vicinity of Broadway from Forty-fourth Street on the north, to Twelfth Street on the south, are found over thirty theatres, roof-gardens, vaudeville and other places of entertainment all disgorging upon this one main thoroughfare nearly all their human contents during this short time interval.

It is here that the third class of duties, previously referred to, that the force of inspectors is called upon to fulfill comes most effectively into play. At about ten o'clock at night the chief inspector, the general night inspector and a special detail of division inspectors arrive on the scene, and are quickly distributed throughout the theatre district, men being detailed to every Broadway theatre and other points of concentration of the theatre goers. The entire force knows almost to a minute the time at which each theatre, running on the particular piece of the week, drops its curtain, and works together to push the cars through to the proper loading points. A long line of cars starts down Broadway from the Fiftieth Street car houses at a time such that they can take the switchbacks at Fifteenth, Twelfth and Houston Streets so as to approach the theatre district from the south at a time when the rush begins. As this northbound line of cars approaches the different inspectors stationed along the street, the cars are passed on or stopped by a word so as to be at exactly the right points at the right moments. An inspector whose theatre crowd is upon him will, for example, stop the line long enough to load up one or two cars, will start them on with three or four empty cars following to a point further north, then load up one or two cars more, according to the requirements. The general result is, not that every one obtains a seat, for this would be a physical impossibility, but that every would-be passenger becomes a *de facto* passenger and is not left on the corners to gnash his teeth at a mismanaged company, or to walk two or three blocks to another line. Another result is that the burden of responsibility is taken off the gripmen who have nothing to do but to obey orders and attend to their grips, so that the line of cars is constantly kept moving, and blockades avoided.

TRANSFER SYSTEM.

The force of inspectors is also used by the manager for the purpose of studying the permanent requirements of traffic in all parts of the city, and it is largely upon their reports that the immense transfer business of the company has been developed, transfer points established, and overcrowding of particular lines of communication avoided.

It was in 1890 that the company first began giving transfer privileges on certain lines, but in a guarded and conservative way, the idea being to experiment carefully to determine results before going too far. The results, however, were so remarkable that the system has been rapidly extended until now over 150,000 transfers are issued daily and 32,000,000 were issued in the last financial year. It is probable that in the near future general transfer privileges will be granted, enabling a passenger to ride from any point on the system to any other, and, in fact, this is nearly accomplished at the present time.

GENERAL RESULTS.

It is commonly held by hard headed men of affairs that *success* is the best proof of good management. Judged by this standard, President Vreeland may well be held to be a successful manager. In his three years of administration he has made one great system out of a number of comparatively petty ones; he has built and equipped what is probably the most perfect cable system in the world; he has given the public a service such as it never knew before; and he has built up the earning power of the property to an amazing extent. The gross receipts in the last three years have increased nearly forty per cent, and the earnings from operation over ninety per cent. The percentage of the operating expenses of the entire system to its gross receipts was, in 1893, sixty-six per cent, and in 1896, fifty-four per cent, while in the latter year the percentage of the operating expenses of the mechanical system to its gross receipts was but forty-three per cent. Such a statement is stronger than words.

Power Distribution for Electric Railroads.

By LOUIS BELL, Ph. D.

VII.—Special Methods of Distribution.

It is quite obvious that the use of about 500 volts as working potential for railway purposes entails a very serious cost of copper on lines of any considerable length, for in general the cost of copper for a given proportion of energy wasted varies inversely with the square of the voltage.

For instance, to deliver 500 amperes at ten miles distance would require, even with a gross drop of 150 volts, about 2,000,000 c. m. of copper area weighing about three tons per 1000 ft.; in all over 150 tons, costing not far from $45,000, about $225 per kilowatt of energy delivered.

It is, of course, highly desirable to find means for reducing this excessive cost and all sorts of expedients have been tried to that end. The gross loss above assumed is about as great as can be permitted, since on a line with distributed load more loss and greater overcompounding is likely to interfere with the proper performance of the motors and the regularity of the schedule. Very heavy overcompounding increases the cost of the generators and leads to extremes of voltage. In dealing with such a case as that just cited the most frequently advantageous method would be to fall back on some of the regular methods of power transmission which will be described later, but under some circumstances the substation involved in these methods is undesirable, and one must either stand the heavy expenditure for copper or adopt some special means for reducing it.

There are several of these that are in fairly successful use. Of those which require no special devices in connection with the motors the most generally applicable are the so called "booster" system and the Edison three-wire system worked 500 volts on a side. We will first consider the former. Fig. 45 gives a general idea of its character. A B is the line which it is desired to feed, C the main generator connected to the track and ground return at E, and D the boosting generator for raising the voltage on A B.

This booster is a relatively small dynamo connected in series with the main one. Its voltage is proportioned to the extra voltage desired on A B, and its capacity in current is equal to the demands of A B. Its function is to supply the energy which must be lost in the line in order to reduce the cross section of the line copper while preserving the proper voltage and output at B. It is driven by any convenient motive power, sometimes when small by an

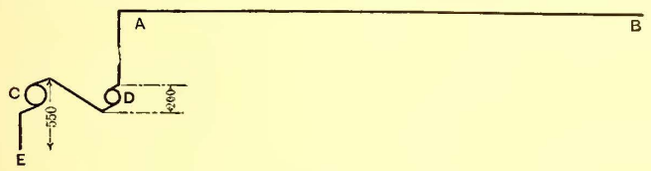


FIG. 45.

electric motor. In Fig. 45 the booster voltage is taken at 200, while we will assume that 500 amperes are to be delivered as in the case just discussed. The capacity of the booster would then have to be 100 k. w., while that of the main generator might be anything that local conditions on the system should demand. The effect of the boosting system is quite obvious. The initial combined voltage would be 750, of which 300 volts might be lost in the line. The result would then be to reduce the copper needed in the line to one-half of its former amount. The cost of the booster and its equipment including motive power would be $3000 to $4000, so that there would be a net gain of nearly $20,000 in first cost of equipment. Reckoning, as in our previous example, interest and depreciation on this at ten per cent, there is a gross saving of about $2000 per year to offset the cost of the extra power lost in transmission. This extra loss amounts to seventy-five kilowatts. At two cents per kilowatt hour the cost of the lost energy is $1.50 per hour of continuous service. If the booster were a part of a system demanding the output rather steadily for the full day's run, say eighteen hours, the cost of energy lost would be no less than $9855 per year. This simply means that it seldom or never pays to lose so great a proportion of energy in transmission. It is evident, however, that it will pay to use the booster up to about three hours per day of service at full load. It is, therefore, well suited for helping to tide over the times of unusually heavy traffic.

We have already seen that these extreme loads really determine the copper necessary for feeders, so that the booster system, if used judiciously, may save a large investment in copper at the cost of an amount of wasted energy that is well within the bounds of economy. The system is, therefore, much better suited to the operation of long feeders than to the more general use of a station. Such indeed was its original use in incandescent electric

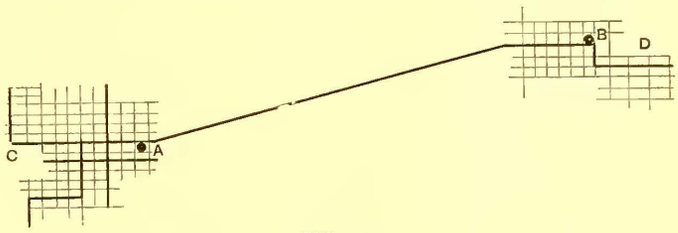


FIG. 46.

lighting at low voltage. It has proved for this purpose very useful indeed, rendering it possible to take up the loss in long feeders at times of heavy load, and to operate lines too long to form a proper part of the main system. It thus has a very useful field in connection with existing plants, but it is distinctly an adjunct, not a proper general method. Line losses which necessitate the continuous waste of more energy than can be compensated by the ordinary compound wound generators are seldom or never justifiable even in a portion of an extended system. If thus partial they are simply less bad than if the whole plant violated the conditions of economy. In its proper sphere the booster accomplishes the same end as the employment of extra voltage in the generators in a case such as was suggested in the last chapter.

As in every other case of heavy drop in the line the boosting system involves certain difficulties in preserving sufficiently uniform voltage along the whole line. When properly applied for railway purposes it should become the equivalent of an enormous overcompounding applied, not to the whole system, but only to such parts of it as require reinforcement. Take the case of a simple interurban road (Fig. 46). Its office, let us suppose, is to connect cities C and D in addition to handling a considerable local traffic in D and a larger one in C. The power station, at A, was originally devoted to the local work in C and now has to be utilized to operate the whole system. The distance from A to B, the center of distribution in D, is ten miles. Under what circumstances and how may the boosting system be profitably employed? Let the maximum sustained output in D be 500 amperes, including both local traffic and interurban cars. From what has already been said it is clear that if these 500 amperes were needed continuously the booster system would be simply a rat hole into which the management would pour about $8000 per year. On the other hand if the 500 amperes is a maximum load reached normally only a couple of hours a day, boosting could be profitably employed. No system is better fitted for furnishing additional power over moderate distances during brief periods of excessive load. Just how long boosting could be used to advantage would depend on the character of the variations in the load. The general rule regarding the economics of the matter is that a drop in the line great enough to necessitate boosting at average load is never justified, while if at an economical average drop the drop at maximum load is too great to be

conveniently overcome by ordinary compounding, boosting is eminently useful.

If the line A B (Fig. 46), when designed for a certain drop at average load, say, five per cent, gives no more than fifteen per cent or so at maximum load ordinary overcompounding will answer admirably. If, however, the maximum load rises to five or six times the average for which the line was designed boosting is by far the simplest way out of the difficulty.

Suppose now A B to be fifteen or twenty miles long and to have a heavy and fast interurban traffic. Could it be worked to advantage by supplying current directly to that part of the line comfortably near the power station and feeding the rest of the line by boosting, in sections using boosters of different voltage if necessary? At first thought one might be tempted to say "Yes", for in such case each section would be in full action for but a short part of the day. On the other hand it should be noted that *all* the energy supplied to the distant sections, be it little or much, is supplied under very wasteful conditions, and while such an arrangement would allow a very long line to be served there is generally no excuse in the present state of the art for a device so clumsy and wasteful.

It must not be understood from this that there are no cases in which direct transmission at more than usual line loss is to be preferred to indirect transmission with reconversion. Such certainly exist, but since at the present time it is possible to transmit power at high voltage and reconvert to direct current with a loss not exceeding fifteen to twenty per cent, the field for direct transmission at much greater loss is very limited.

Boosting is perferable to heavy overcompounding, when unusually long feeders are exposed to great changes of load, for the reasons already suggested, and it must not be forgotten that when the only loss is that in the line which varies inversely as the load, the all-day efficiency of the system may be fairly high. This matter will be taken up again in connection with the application of the methods of alternating current transmission to cases like that of Fig. 46.

Better than any method of increasing the loss in the line are various methods of increasing the working voltage. These effect the same or greater economy in copper with less loss of energy and are in very many cases preferable to any boosting scheme. Some of them are simply applicable without any changes in the arrangement of the motors, while others require special motors or special arrangements of them.

The application of the Edison three-wire system is the most generally known of these. Its principles are by this time very familiar to the public, consisting virtually of

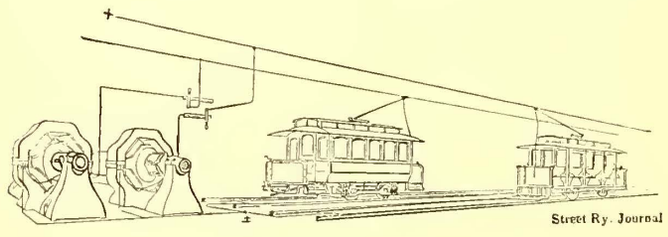


FIG. 47.

employing two working devices in series as regards the voltage of transmission, while each separate device, connected between one of the transmission wires and the neutral wire, receives only the voltage for which it is designed. The application of this device to railway work is well shown in Fig. 47. The outside terminals of the two generators are connected to two trolley wires while the neutral is connected to the track system. Hence each motor works on about 500 volts, while the transmission of the total energy is at 1000 volts.

In this case the neutral wire is the track, which ordinarily, as we have seen, has a rather good conductivity so that the saving in copper is very material. If the loads on the two sides of the system were perfectly balanced so that there would be no steady flow through the neutral wire, the feeder copper could obviously be reckoned as if we were dealing with a 1000 volt transmission through a complete metallic circuit. For the same percentage loss of energy the copper required will be rather less than half that needed on the 500 volt system. The case is slightly different from that of a lighting circuit since in the latter we are comparing two complete metallic circuits, one of double the voltage of the other, while in the former we are

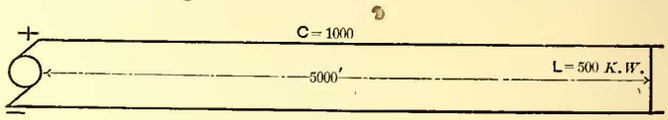


FIG. 48.

comparing a very good "grounded" circuit with a return circuit of double the voltage. In other words the track, which as a return conductor serves a very important purpose, as a "neutral" is in use only so far as the system is unbalanced and to serve the purpose of a local conductor between cars. To illustrate by a concrete case, suppose a load of 500 k. w is to be operated at a distance of 5000 ft. from the station. For simplicity we will suppose it to consist of a mass of cars bunched on a double track. With the ordinary system we have the state of things shown in Fig. 48.

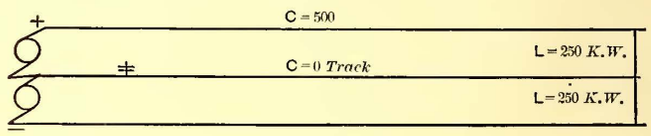


FIG. 49.

Using the constant 13 in our stock formula, the total area of copper comes out 1,300,000 c. m. As a three-wire system in complete balance we have the conditions set forth in Fig. 49.

Here we employ the ordinary formula for metallic circuits and, of course, the constant 11. The copper consequently amounts to 550,000 c. m. in area and since both leads must have this area the total weight of copper necessary is as 11 to 13 compared with the 500 volt arrangement. The enormous conductivity of the neutral, however, renders the matter of balance of comparatively little importance in this case.

The somewhat anomalous character of this result has its origin in the fact that the track, which is or ought to be a first class conductor, is fully utilized in Fig. 48, while in Fig. 49 it can only come to the rescue when the system is unbalanced.

This arrangement of the three-wire system is capable of accomplishing a notable saving of copper only when the track is so poor as a conductor that 14 or 15 has to be used as the constant in the computation concerning Fig. 48. There is, however, another distinct species of three-wire system which is capable of giving greater economy for certain work.

Suppose we make connections as in Fig. 50. Here the outside wires are connected, one to an overhead line, the other to the track, while the second overhead line serves as the neutral. The motors may then be connected either on 500 or 1000 volts, an arrangement which would be valuable for interurban work with special motors. This arrangement is not, however, suited for general use, and should be regarded as a mixed system, which, however, is excellently fitted for certain otherwise difficult work. It is closely related to a booster system, the booster not being used in the ordinary way to compensate for line loss, but to give a higher working voltage on lines where it is needed. The two dynamos need not be of the same voltage.

The regular three-wire system of Fig. 49 is capable of saving from twenty to forty per cent in copper according to the character the track return. If well balanced it, of course, tends to greatly diminish the electrolytic action on buried conductors and hence is desirable *per se*. The saving in copper, while by no means as great as in the

three-wire system for lighting is still enough to pay for the extra trouble of installation and the expedient has been adopted by various roads. Balancing is accomplished by various means. The simplest is shown in Fig. 51. Here we have a single track road with two lines, A B and C D. The tracks are connected to the neutral lead while the + and — feeders run to the separate branches as shown. This balancing is not very close since it is no easy matter

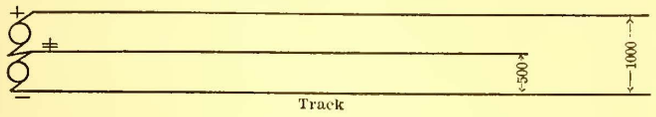


FIG. 50.

so to divide a branched road that the loads on the two parts shall be equal. Another arrangement less simple, but giving more uniform balance, is shown in Fig. 52. Here the whole track is divided into sections alternately + and —. On double roads either one track is supplied from the + feeder and the other from the —, or each track is subdivided as in Fig. 52, the latter being the preferable method as it preserves the loads on the two sides more uniformly.

A zonal system might be used in large systems, all track within one zone being supplied from the + side, all in the next zone from the — side and so on. In general however the plan of Fig. 52 carried out on all the lines as systematically as the location of the track allows is the best method. The sections may properly vary from a few hundred to several thousand feet in length according to the nature of the car service and local conditions. Very many sections should be avoided as the break pieces in the trolley wire are somewhat annoying.

The three-wire system was tried as far back as 1889 in Milwaukee and more recently has been successfully employed in Portland, Ore.; Bangor, Me.; St. Louis, and elsewhere.

Practically, balancing with all needful accuracy is not a difficult matter and, as has already been noted, an approximate balance is quite sufficient on account of the

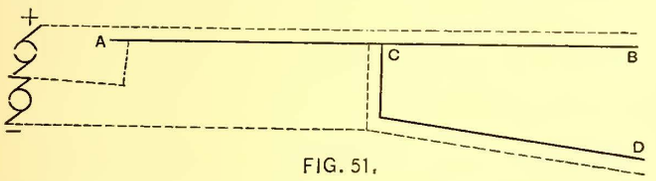


FIG. 51.

great capacity of the neutral, particularly on double track roads.

On the whole the three-wire distribution is a very useful one. The saving in copper is very material and entails no sacrifice of efficiency and but little added expense if the station is large enough to make the use of two dynamos instead of one, of little moment. Above a certain size the price of dynamos increases almost directly as their output, so that a pair of machines for three-wire work would be little if any more expensive than one large one of equal capacity.

A curiously modified three-wire system has been suggested for heavy interurban work, although it has not yet come into use. This is connected like Fig. 51, except that both + and — sides of the system are connected to trolley wires over the same track. Two trolleys are used on each car so that the car is a unit balanced in itself, the two motors taking current from the + and — wires respectively. Fig. 53 shows this arrangement in diagram.

Here A and B are the generators connected respectively to + and — trolley wires, and the track forms the neutral. The motors C and D upon the same car take current from the trolleys E and F and are grounded upon the track neutral in the ordinary way. The neutral only comes into service in the case of need for cutting out one motor, or when one motor slips or develops faults that might cause trouble were the motors simply in series. The track need not be heavily bonded with this construction since it has to carry only occasional and moderate currents. The saving in copper is the same as that already indicated for the regular three-wire system, with the additional advantage that the track connections are easily made and do not require so great and constant care as is the case when a full track return is used.

The employment of two trolleys would be considered a first class nuisance by most electric railway managers, but for heavy work when large currents, say a couple of hundred amperes, are to be dealt with, there is something to be said in favor of trolley contacts in duplicate. These granted, they can be made on two trolley wires without much extra trouble.

This self contained three-wire system seems well adapted for heavy interurban service, particularly in conjunction with local service at the termini. As the motors are comparatively independent of ground connections the track could be more easily kept in operative condition through the winter. The system lends itself very readily to cases like Fig. 46, in which the interurban cars could well be connected in the manner described and the local cars in the ordinary fashion of three-wire roads.

None of the methods so far described are able to effect a really satisfactory saving in copper, without involving

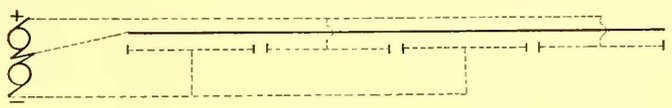


FIG. 52.

special arrangements that are somewhat serious in general practice. Boosters, using the word in its ordinary sense, waste energy in a very objectionable manner, increasing the drop without raising the working voltage at the motors. The ordinary three-wire system involves complication in the general wiring and does not secure nearly as much economy in copper as would be desirable; the system of Fig. 54, while giving considerable economy on the high voltage side requires a special arrangement of motors; and finally the self contained three-wire system, with several excellent properties, demands two trolleys.

What is really wanted for long interurban lines is some way of raising the working pressure on the line, without wasting much energy or introducing troublesome complications. It must be clearly understood that as a matter of economy the higher the voltage the better, providing that voltage can be utilized. If there were no practical objections to employing a 2000 volt trolley system it would certainly be used in preference to juggling with a nominal 500 volt system in the rather vain attempt to cheat Ohm's law out of its due tribute of copper. By far the simplest way of dealing with the long distance lines now frequently found is to face the matter squarely and see what can be done in the line of a higher working pressure on the line and at the motors. It is all very well to work out the most economical methods for supplying 500 volt motors at long distances, but all such are wasteful in the extreme compared with systems working, so far as transmission is con-

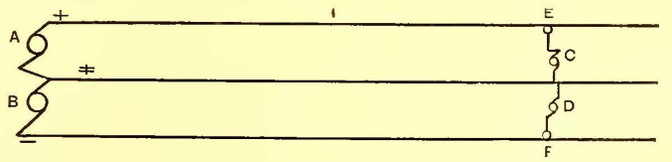


FIG. 53.

cerned, with 1000 volts or more. Boosters and the three-wire system merely make the best of a very bad matter.

In the early days of electric railways even 500 volts was considered rather too high a voltage for motors and dynamos adapted to the severe strains of railway work. A few years of experience have shown that with proper care 500 volt apparatus is entirely reliable and in very many railway systems the working pressure is, save at

times of very heavy load, nearer 600 volts than 500. The saving in copper introduced by even a moderate increase in working pressure is very considerable, since, *other things being equal*, the weight of copper required is inversely as the square of the voltage. The following table gives the relative amounts of copper required for a few voltages, that necessary at 500 volts initial pressure being taken as 100. The same percentage of drop is assumed in each case.

Volts.	Copper.
500	100.0
550	82.6
600	69.4
650	59.1
700	51.0
750	44.4
800	39.1
850	34.6
900	30.8
950	27.7
1000	25.0

The actual results are slightly better, even, than these figures indicate, since the track return gets relatively better and better as the voltage rises and the current diminishes. To show this we may profitably take a concrete example. Fifty kilowatts is to be transmitted 25,000 ft. for railway purposes. The track is of sixty pound rail, and we will for simplicity assume that the bonding doubles its resistance. The conductivity of the track return is then that of one continuous line of sixty pound rail which equals 1,000,000 c. m. of copper. At 500 volts initial pressure and twenty per cent gross loss, the drop through the track circuit would be 27.5 volts, leaving 72.5 volts drop for the overhead line. This requires about 379,000 c. m. At 1000 volts initial pressure the drop in the track circuit would be but 13.75, leaving 186.25 for the overhead system, which corresponds to nearly 74,000 c. m., a trifle less than twenty per cent of the copper needed for 500 volts, instead of twenty-five per cent as called for by the table.

Obviously this difference depends on the fact that one side of the circuit is a fixed quantity of equal conductivity for all voltages and currents, while this conductivity is a factor entering the computation of the rest of the circuit where different circuits are under consideration.

The economic value of working at higher voltages than customary is thus very evident, even if one may not be prepared for boldly advancing to 1000 volts or more.

So far as apparatus is concerned the difficulty of somewhat higher voltage does not appear to be very serious. With comparatively little modification the type of railway motor now common could be rendered suitable for pressures up to 750 volts certainly. The principal changes would be in the armature winding and the commutator, which would have to be arranged with more segments to bring the voltage per bar within safe limits. With the large and powerful motors likely to be used on long interurban roads the task is by no means formidable, and should not involve any serious increase of cost. As regards the generators the case is similar. On very large units 1000 volts would probably involve difficulties of some moment, since in designing machines for great outputs, 1000 k. w. and the like, it is somewhat troublesome to keep the volts per commutator segment within reasonable limits even for 600 volts. But under ordinary conditions a generator for 750 to 1000 volts is entirely feasible, and for very large capacities the direct coupled units, consisting of one engine and two dynamos, already largely used, are entirely available. Such a combination, shown in Fig. 54, may be very readily operated with the generators coupled in series, giving 1000 volts across the mains, or if convenient, 500 volts on each side of a three-wire system. In some cases, where so much as 1000 volts is not desired, a boosting dynamo may be used with great advantage in connection with a 500 volt generator.

At all events the question of supplying current at a pressure considerably in excess of 500 volts is very simply answered in any of the ways mentioned.

One instinctively asks, too, why ordinary railway motors should not be operated regularly in series for work on long lines, as they are very extensively employed now with series-parallel controllers. There is no good reason why this should not be done, save the danger of excessive and destructive voltage in case of accident to one motor.

Of course, in ordinary series-parallel working, no accident could throw on a single motor more than the 500 volts or so for which it is designed, while if both motors were in series on a 1000 volt circuit, a short circuit in one of them, would probably cripple its mate. Even slipping of one might overload the other and imperil both. On the other hand, serious relative slipping, throwing the load on one motor when operating in series, is not common on the dirty city streets where the series connection is most used, and would be still less likely to occur on the comparatively clean and unobstructed tracks of a long line. When one set of wheels slips the other soon follows suit, from the same cause, and there is usually a strong mechanical tendency to equalize slipping. Even admitting the difficulty, there would certainly be no serious trouble of this sort if both motors were constructed with a larger factor of safety for temporarily enduring high voltage than is now the custom.

There is no momentous difficulty in the way of building a motor to work regularly at 700 to 750 volts, and still less in producing one to stand that pressure for temporary running. And motors which will stand 750 volts at a pinch can safely be operated two in series on 1000 volts with a quite moderate rheostat capacity.

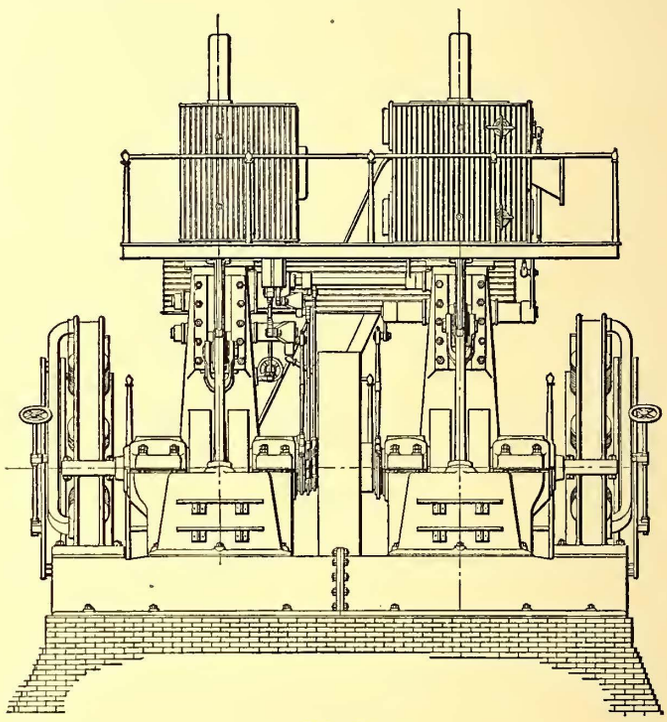


FIG 54.

Of course, the question of safety enters into any and all plans for operating at increased voltages.

Of 500 volt currents it can safely be said that they have never caused the death of a human being in normal health. Of shocks to employes there are thousands yearly and the author has yet to hear of a fatal one. The deaths from this cause heralded in the newspapers generally turn out to have been due to other causes. One loudly proclaimed from Maine to California, was due to a gasoline explosion in a car house, another to a collision with an electric railway pole, and so on.

Whether this immunity may be extended to double the usual voltage is decidedly open to question. Currents of 750 to 1000 volts cannot on the other hand be classed as extremely dangerous. In any case there is no good reason why they should not be freely employed with good construction and proper inspection. In interurban work the tendency is for the road to own its right of way as in the case of steam roads, and in such case any desired voltage

ought to be permitted, provided it be installed with due precautions.

To summarize the matter, there is no sufficient reason, electrical, mechanical or ethical, why roads of the interurban class should not be regularly operated at from 700 to 1000 volts, either with special motors or with special arrangements for series running.

A rise from 500 to 750 volts would more than cut the cost of copper in two, while retaining at least the efficiency reached at the lower voltage. At 1000 volts more than three-fourths of the copper would be saved, with the additional advantage of using standard generators instead of those of somewhat abnormal voltage.

It is a fact to be regretted that in spite of the great advantage of even moderate increases in voltage most of the existing interurban roads have hastily gone ahead and equipped themselves with 500 volt apparatus. There is

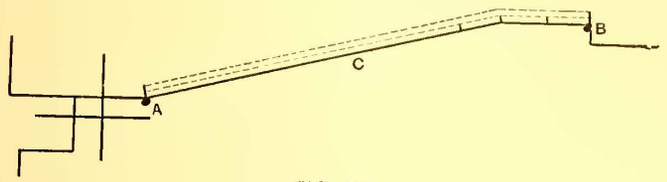


FIG. 55.

generally some conservative adviser to say, "Well I think copper is a pretty good investment; let us stick to the well tried 500 volt apparatus." True, copper is a very safe investment, so safe that money once locked up in it never gets out again, and 500 volt apparatus is "well tried," but so also is 110 volt apparatus, and for a still longer period. The point of the matter is that most men do not realize that standard apparatus can be made to give good results in more than one way.

A short investigation of the interurban line shown in Fig. 46 will show how terribly uneconomical is the method of operating too often employed, and how the conditions can be greatly improved without involving anything in the least degree truly experimental.

The problem really involved in equipping roads of this sort is as follows: given standard motors and generators as the basis of operations, so to utilize them as to give the greatest economy in construction and operation with the fewest possible variations from every-day practice.

Fig. 55 shows in skeleton form Fig. 46, ready for laying out the interurban part of the system. With the main urban system we need not concern ourselves, since the feeding system would be developed in accordance with principles already laid down. The distance, A B, being ten miles we have already seen that to deliver an assumed maximum of 500 amperes at B would require at 150 volts total drop, about 2,000,000 c. m. of copper, costing about $45,000. This we will assume to be based on a dynamo giving at full load with its overcompounding 550 volts in accordance with ordinary practice. The voltage at the motors will then occasionally drop to 400 volts, certainly the extreme drop that could be tolerated. We have already seen that by boosting to 750 volts and doubling the loss in the line, the copper can be reduced by one-half. At the same time the minimum voltage is raised to about 450, which is much more satisfactory.

Now suppose that instead of doing either of these things we say to ourselves, "These standard motors of ours are intended to operate on 500 to 550 volts like the generators, let us make them do it." In fact these standard railway motors will operate beautifully at 550 volts. Gear them so as to get the full advantage of this voltage and keep down the current. Without any allowance for increased efficiency at the higher voltage the mere change of the running voltage at maximum load from 400 to 550, leaving other things the same, reduces the current to be transmitted for the same energy from 500 amperes to 364 amperes. Now install a boosting dynamo as before, automatically holding the voltage at B at or near 550 volts. Using a 200 volt booster as before, we can allow 200 volts drop, and figuring the copper on this basis it appears that 1,183,000 c. m. will do the work. As a matter of fact there would be an additional gain of nearly ten per cent owing to higher motor efficiency.

The net result is that the copper needed for the work at 500 volts is cut in half while the loss in voltage at full load is twenty-six per cent instead of forty as in the original booster system and the boosting dynamo itself is for seventy-five kilowatts instead of one hundred kilowatts.

As to the actual arrangement of the feeders, for a system likely to involve the use of large motor units and high speeds the author prefers a decidedly heavy trolley wire and would not hesitate in this case to employ No. 000 or No. 0000 trolley wire, putting the remainder of the copper in two cables of about 450,000 c. m. each.

These feeders may be well arranged as shown in the dotted lines of Fig. 55, one of them being carried right on to B the other being tapped into the trolley wire at a few points. The station A is capable of taking care at the increased voltage of a long stretch of the trolley wire without any taps from the feeder, since a No. 0000 wire has high carrying capacity. Transposing one of our stock formulæ

$$L = \frac{c.\,m.\,E}{13\,C}$$

and assuming one hundred volts drop, a No. 0000 wire can carry one hundred amperes a distance of over three miles unaided. The main precaution that has to be taken is to make sure that when a load at B is forcing the boosting system to its full voltage, a car may not be caught on a dangerously high voltage near the station. Perhaps the simplest way of avoiding this contingency is to cut the trolley wire at some point like C and feed the section next the station direct from the generator without the intervention of the booster. If the conductivity of the trolley wire is needed up to this point for the general transmission it is easy to reinforce the feeders between A and C by an equivalent amount. The exact treatment of such a case must be determined by the relative amounts of true interurban and terminal traffic.

If the problem we have been considering had not involved considerable local work at B, but only interurban work up to that point, it perhaps would have been better to operate the line at 1000 volts, using two motors in series. This procedure would have been feasible if there were, as often happens, an independent railway system at B. It probably would not be often desirable to continue a 1000 volt system through a city for general service, and in the absence of a substation or a local system there is no good way of obtaining the lower voltage desired. The three-wire system may often be used to advantage in doing the terminal work connected with a high voltage interurban

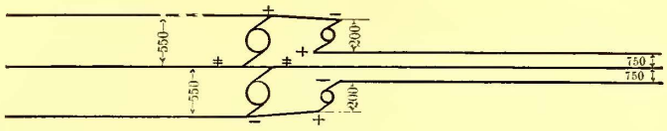


FIG. 56.

line. In conjunction with boosters it may also be decidedly useful in working a long and heavily loaded double track line. Fig. 56 shows this arrangement, which it will be readily seen is really a modified five-wire system. The main generators would then operate directly an ordinary three-wire railway system, while with the assistance of the boosting dynamos they would furnish current for working a heavy suburban or interurban line in the manner just described.

Such are the principal devices for operating extended railway lines from a single power station without any transformation of voltage. They are easy of application and fairly economical, although the voltages dealt with are not really high enough for the purposes to which they are sometimes applied. There is a steady growth of long lines

which cannot be economically operated by any of these simpler methods, which at best partake something of the nature of makeshifts. The time comes when a road becomes too long to be successfully worked from a single power station even with the assistance of auxiliary dynamos. A choice has then to be made between operating independent power stations at points along the line, and substations similarly located supplied with power from a single generating plant by the means usual to the long distance transmission of power. The principles involved in these important cases will be discussed latter.

Studies in Economic Practice.—Milwaukee.

By C. B. Fairchild.

The Milwaukee Electric Railway Bulletin is the name of a little paper published monthly by the management of the Milwaukee Electric Railway & Light Company. As it is a novel and interesting feature of street operation in Milwaukee, it is mentioned first in this article, which is designed as a summary of some of the practical features of railway work observed while on a visit to that city not long since. The publication mentioned is a six-page sheet, the pages of which are 7 ins. × 10 ins. The issue of May 1 was the first number of the second volume. The object of the paper as set forth in the prospectus of the first number is "to effect a closer relationship between the management and the employes, based upon more definite understanding on the part of the latter of the wishes and intentions of the former, that through it as an interpreter, may be known to all actively interested in the conduct of the affairs of the company, the changes already made or improvements contemplated, and the reasons therefor, to the end that a unity of purpose might exist among the army of workers and that all may seek the desired end by the same route." In other words it is intended to emphasize the principle of a community of interests between employer and employe.

Manager C. D. Wyman is to be congratulated not only that the paper has steadily grown during the year, and on its literary merit, but above all that the fruits of the paper have been manifest in an improved service and corresponding reduction in operating expenses, while it is highly appreciated by the men. The matter being advisory and suggestive, it is regarded by the management one of the best educational mediums ever tried. It gives the management an opportunity to explain what has led up to the adoption of certain rules or the reason why, and also gives advance information so that changes are not sprung on the men unawares, and it serves to interest the men in the future of the company.

Frequently complaints of patrons are published, and when these are in the nature of a criticism they serve to spur the men on to a more careful service. Copies are sent to city officials and frequently to complaining passengers, so that they can see that every effort is being made to instruct the men properly in their duties. New orders are usually first issued in the bulletin, then in the rule book or posted in the stations. A prominent feature is the illustration and explanation of such electrical apparatus as can be readily understood by the men.

The managers state that the time devoted to the preparation of the matter in the bulletin is no more than is usually required to instruct or communicate with the men as a whole by the ordinary methods, and it saves the necessity of repeating the same thing to different classes of employes. It also invites suggestions from the men and serves as a medium through which these suggestions are brought to the attention of all the others. When street railway managers generally realize that it is instruction and inspection rather than censure that employes require, to make them more careful and efficient, they will doubtless adopt some similar method of collecting and bringing the best fruits of general practice to the attention of their men, with suitable instruction as to how to absorb and use them.

WHEELS.

A reduction of fifty per cent in slid flat wheels was made during the past winter over the year before, and the life of all wheels increased. This was partially due to the condition of the weather, but chiefly to a more intelligent use of sand and a clearer understanding as to a proper application of the brakes, the result of special instruction by the inspectors. The use of sand was cut down two-thirds and more was used in starting than for stopping. The motormen are instructed to reverse the motors in emergency cases. A fuse is seldom blown and it is rare that a motor is damaged by this practice. A change has been made during the year in the make of wheels. A 350 lb., thirty-three inch wheel is employed, but it is proposed to increase the weight and cast the wheels with a solid web instead of spokes. Wheels are bought on a guarantee of 40,000 miles and a careful wheel record is kept. Solid brake shoes are employed, but it is proposed to use the Christy head and slipper.

RAILS AND TRACK.

The early track construction of the lines formerly controlled by the Milwaukee Street Railway Company, which consisted of 79 lb. girder rail spiked directly to ties with brace tie plates, is standing up reasonably well after a service of four years. On the lines more recently absorbed the flat and T rails are to be renewed. A short section of street, in which rails of the Lewis & Fowler girder type rested on chairs, was paved, two years since, with asphalt, by the city authorities against the protest of the company, which was not ready to relay the track with a suitable construction. This is now in bad shape, the rails being down at the joints, and the city is trying to compel the company to repave the street when the repairs are made. This experience shows the folly of paving without suitable track foundation. A new type of girder rail has been adopted by the company for the new construction. These new rails are to be rolled in sixty foot lengths. The height is seven inches and the base is five inches. The Falk cast joint is to be chiefly employed, but a portion of the track is to be united by thirty-six inch channel plates, with eight bolts staggered. The foundation will be gravel and ties. Some flat rails for bridge track were recently welded in the company's shop in eighty-seven foot lengths.

ROLLING STOCK.

The rolling stock consists of one hundred and seventy-seven closed cars and one hundred and forty-three open cars, the average number of cars operated daily is one hundred and fifty-three with ten extras regularly run and they are in use for nineteen hours a day or till after one o'clock. No owl cars are run.

A state law requires all cars to be vestibuled by Nov. 1 next. About half the equipment has already been provided with vestibules. The motormen generally like the vestibules, but the conductors do not, for it interferes with the adjustment of the trolley. Wagon collisions increase fifty per cent with vestibules. They also add to the weight of the car, and the frequent breaking of the glass in the vestibules is an item of expense. Vestibules furnish shelter for platform passengers in stormy weather, which, is about the only advantage that comes to the company from their adoption.

Twenty new cars of novel design have recently been bought from the J G. Brill Company. These are designed for all-the-year-round use, being adjustable for winter or summer service. The bodies of these cars are 25 ft. 6 ins. long and with the platforms 38 ft., the platforms being 5 ft. inside. The width at belt rail is 8 ft. 3 ins. and the height from floor to ceiling 8 ft. 3 ins. The window openings are deep, being below the belt rail and below the backs of the seats. The latter are of the Bushnell type with reversible backs, and arranged with center aisle. The removable vestibules with which the cars are fitted and the large window openings and large deck lights make the cars suitable for summer traffic. The cars are mounted on Brill maximum trucks and equipped with two G. E. 1000 motors

geared for a speed of from eleven to fifteen miles per hour. The type K controller is employed. All cars are fitted with Stanwood steps.

To train the motormen in the economical manipulation of the controller, an instructor is employed whose duty it is to go upon each car while in regular service and by means of an ammeter mounted on the dashboard in front of the motorman, show him by actual test the amount of power consumed in the operation of the cars. At the same time the instructor gives the motorman advice as to how and where a saving may be secured, and how to determine the sources of motor troubles. This method also gives the instructor an opportunity to test the equipment of each car and report as to the efficiency of its electrical apparatus.

The cost for maintaining cars at stations or car houses, including material and labor for light repairs to motors and trucks, is from fifty to fifty-six cents per day. Formerly it was seventy-two cents. A further reduction is contemplated by reducing the number of stations, there being seven at present. Each station is in charge of a day foreman and he has one regular repair man and one car cleaner who come on at 10 P. M. and work till 10 A.M. next day. In addition there is allowed at night one repair man and one cleaner to every ten cars. All heavy repairs are done at the shop. Repair cars before going out are tested in the shop for electrical defects, a system of wiring being installed with instruments located in the office of the assistant electrician, so that the motors may be coupled in any desired manner and records made from the testing instruments. Each car is also tested electrically by being run over a piece of unused track before returning to regular service. If a car comes in after a few days' service an inquiry is instituted by the superintendent as to why any existing defect was overlooked by the shop men or inspector.

The cars on this system have been run for nearly two years without headlights, effecting an estimated saving of about $3 per month per car. The light reflected from the brilliant interior has been deemed sufficient for forward illumination.

REPAIR SHOP PRACTICE.

In a run through the shop it was noted that the blacksmith forges were fitted with small smoke flues with exhaust draft. The flues were but little larger than ordinary stove pipe, and terminated only a little way above the fire leading there into a trunk flue, and thence into the stack. There were no hoods above the fire. The draft was apparently perfect, there being no smoke in the shop. A small motor furnishes power for operating the exhaust fan, and also drives the spindle in the buffing room. The tools in the wood and iron working department are also operated by motors. The shops are lighted at night by arc lamps from the trolley circuit, the lamps being connected nine in series.

The repair shop force is divided as follows: nine carpenters, four expert painters, ten apprentice painters, five blacksmiths, fourteen machinists in truck department, eight machinists in machine shop, and nine winders.

The foreman of wood work is pattern maker. Any of the carpenters operates the wood working tools for such pieces as he may require, the motor being started up to run the tools as required.

In the car washing department of the repair shop are wash racks, through the floor of each of which is led a flue through which warm air is delivered from the heating department, for quickly drying the cars after being washed.

In the armature winding department an old car register is placed near the field coil winder and so connected that it registers the number of turns the form makes. The armature dressing, which is compounded by the foreman, is mixed in a revolving barrel. In place of a locker for hats and coats in the winding room, poles ten or twelve feet long are used with hooks for the hats and coats. When the garments have been hung on these hooks the pole is raised and hooked over a pin in the wall above the floor, holding the garments out of the way of persons standing along the side of the room.

INSTRUCTIONS.

General rules and instructions, as noted above, are first generally printed in the bulletin. The men are also given a small book giving rates of fare, use of tickets, fares and transfers, names of transfer points and a list of the telephones along the line, one for every block as far as possible. At the different stations are posters in large type giving station rules and crossing rules. All posted orders are left on the board for ten days then removed and filled, the new men being required to come to the superintendent's office and read all the rules on file. Transfer tickets are punched for direction of use so the passenger can take any car going in that direction. This arrangement takes less of the conductor's time for punching. A light line punched indicates day-time, while the dark is for night. Different colors of transfers correspond to color of car on issuing line.

ENGAGING EMPLOYES.

A new form of employe's application blank has recently been adopted. The questions asked are as follows:

APPLICATION BLANK.

1. What is your full name and age?
2. Give your address in full?
3. Are you married or single?
4. Give your height and weight?
5. Are you suffering from consumption, weak kidneys, or any incurable diseases?
6. Do you use intoxicating liquors?
7. Did you ever attend bar, or conduct a saloon?
8. Have you a trade or profession, if so, state what?
9. Where were you last employed, and in what capacity?
10. When and why did you leave?
11. Were you ever employed by a street railway or steam road; if so, state when, where and in what capacity?
12. Why did you leave the service?
13. Fill out the following blanks, giving dates of your employment, and names of employers during the past three years:
14. Is it your intention to make street railway work your business, or are you only seeking temporary employment?
15. Fill out the following blanks, giving names, occupation and address of not less than three good, responsible persons, who are not related to you, and not former employers:

An applicant for a position as conductor or motorman must be between the ages of twenty-one and forty years, and must weigh not less than 140 nor over 200 lbs. After his record, as shown by the application blank given above, has been looked up and he is found to be a man of good reputation, he is notified by mail to appear at the superintendent's office. He is then sent to the physician of the company, who examines him as to his physical condition, a charge of $1 being made for the service. If found to be satisfactory the applicant is then turned over to the inspector for instructions in the duties of the position for which he has applied.

After a thorough drill of from two to three weeks' time, for which he secures no wages or pay, the final action is taken, and if his work shows him to be capable of performing the duties of the position, he is accepted as an employe, and assigned to duty on the extra list at one of the several stations of the company. He is then required to provide himself with a full uniform suit, etc. The entire expense is as follows:

Medical examination	$ 1.00
Uniform suit, $16 or $17	17.00
Uniform cap	1.75
Total	$19.75

In addition to the above, conductors are required to deposit $15 with the company as security for the money handled by them, and must also provide themselves with a working balance of $5 to be used in making change.

Badges and punches are supplied by the company, but when lost by a an employe are charged for at the rate of fifty cents for a badge and $2 for a punch.

The rate for the first three months is eighteen cents per hour. After this period of apprenticeship has ex-

pired nineteen cents per hour is paid, both being figured on basis of time card time.

Below is the surgeon's certificate used for both motormen and conductors.

MEDICAL EXAMINATION.

Give name, age, height and weight?

1. Have any of your relatives had consumption?

2. Have you ever had pneumonia, spitting of blood, shortness of breathing, palpitation, rheumatism, lumbago, varicose veins, piles, ulcer of leg, accidental injury, surgical operation, rupture?

For the Physician:

3. Are there any indications of disease of:

a Lungs . . Chest Measurement { Forced Inspiration . . in. { " Expiration . . in.

b Heart or blood vessels . . . . .

c Urinary Organs including Examination of Urine. . . . . .

d Digestive Organs . . . .

4. Has applicant varicose veins, varicocele, hernia, evidence of successful vaccination?

5. Eyesight . . . . . { Color Perception . . . . . { Distance . . . . . .

6. Hearing . . . . .

7. Do you recommend applicant? . . Motorman. Conductor.

The questions which the persons recommending any applicant are requested to answer are as follows:

1. Do you know this man?
2. How long have you known him?
3. Is he married or single?
4. Can you vouch for his honesty and truthfulness?
5. Does he gamble or associate with loose women?
6. Is he loud mouthed or profane?
7. Does he use intoxicants?
8. Has he to your knowledge ever attended bar or kept saloon?
9. Have you any knowledge of his being discharged from any former position, if so, give full particulars?
10. Is he to your knowledge afflicted with any physical disability, or incurable disease?
11. Can you consistently recommend him as a man worthy of the confidence of this company, and one to whose care the welfare of their patrons may be safely entrusted?

All replies, are considered strictly confidential.

A record book is kept in which the names of conductors and motormen are entered in order of seniority. Besides this there is a record case in which are pigeon holes or boxes in which all the papers and cards and reports relating to any employe are kept, also his trip slip account, reports and any paper that will help to make up his record. Great care is exercised in the selection of car men for the reason that it costs a good deal to properly train and educate a man as to his duties, so that it is of advantage to have good material to start with.

EMPLOYE'S BLANKS.

Conductors are given a holder of stiff covers 9 ins. × 4 ins., the inside pages of which contain a sample of trip slip front and back properly made out, and brief instructions as to what to do in case of accidents. This was illustrated in the March issue of the STREET RAILWAY JOURNAL. In addition to his trip slip each conductor has an accident report blank of stiff cardboard that is of proper size to fit the holder, also a defect card. There are also conductors' short cards and cards showing average receipts per car per month, also average receipts on all the cars on that line, then the amount taken by each car, then a note wherein the particular card shows whether the man's receipts are above or below the average. These are filed in the conductor's box together with a card showing amount turned in each month as compared with average. The box also contains reports from counters who may have found him short on registers.

The motorman's record contains application, medical examination, record of accidents or collisions and such complaints as have been turned in against him, also a record of broken glass or trolley cord.

At each station is a pad of blank forms, 20 ins. × 14 ins., on which the motorman places the number of the car and a report of the condition of the car when it is run in from a trip. When a reported defect is repaired the same is noted on the right of this blank. If the night foreman should find any defect in the car that is not reported by the motorman the latter must explain why he did not discover it. When a car is sent to the shop a blank is sent by the foreman to the shop station, stating what repairs are necessary. On this blank is a record of what has been done in the shop. This card is sent in turn to the manager and then to the superintendent, so that each department will know all that is done to a certain car. The badges of the men at the different stations run by hundreds; thus all between 400 and 500 are at one station, between 500 and 600 at another, etc. A careful record is kept as to time report for duty either late or off duty.

A telephone record book is kept at the superintendent's office showing calls for wreck wagon, time of delay on any line and cause. There is also a large book in which the inspectors' reports are entered, as they are obliged to report every hour, either in person or by telephone. If by telephone, the book shows the point at which they can be found. The same book contains blanks for the number and type of cars operated, and blanks to show all delays on line whether wire down, disabled cars, miscellaneous accidents, condition of weather, etc., and in winter location of sweepers.

The operating department of this system is under the supervision of Geo. M. Kuermmerlein and T. E. Mitten with the title of superintendents, and the repair shop under the supervision of L. W. Lynn. The claim department is supervised by G. E. Manhart.

ACCIDENTS.

The following records from the claim department show the number and class of accidents for the months named.

COMPARATIVE STATEMENT OF ACCIDENTS REPORTED.

	January.		February.	
	1895	1896	1895	1896
Boarding moving cars	0	2	1	3
Cars startiug, alightiug or boarding	1	0	0	0
Fell off car on curve	0	1	1	2
Fell, alighting or boarding	3	2	0	0
Fell in, on, or off cars	0	9	0	6
Ejectment from cars	2	6	1	1
Left moving car	2	15	1	12
Trouble, account fare	0	2	0	3
Trouble, account transfers	0	2	0	2
Disturbance on car	1	2	0	1
Disorderly conduct	0	6	0	0
Collision on cars	7	0	3	1
Collision of cars with persons	8	6	3	1
Collision of cars with vehicles	20	25	32	24
Collision of cars with animals	2	2	2	3
Frightened horses	0	1	0	1
Trolley wire injury	0	2	0	0
Electric shock to persons	0	0	0	0
Electric shock to animals	0	0	2	0
Center pole injury	1	0	0	0
Side pole injury	0	0	0	0
Track injury	0	0	0	1
Employes injured while on duty	1	3	3	5
Injury to company's property	7	7	10	4
Miscellaneous	1	3	16	3
Total accidents	56	96	75	73
Cars operated	147	154	147	154

THE power of the Kern River, the third largest stream in California, is now about to be utilized, the work undertaken by the Power Development Company being nearly completed. The fall from the end of the flume to the power house is 201.9 ft., and the capacity of the water is estimated at 7500 h. p. The electrical equipment will consist at first of two 450 k. w. General Electric three phase generators running at 257 r. p. m. The voltage at the dynamo terminals will be 550 volts. This will be raised in step up-transformers to 11,000 volts and will be carried on six No. 4 bare copper wires to the substation at Bakersfield, where it will be transformed down to 2000 volts for distribution.

The current will be utilized at first to operate an extensive system of electric railroads connecting Bakersfield with Kern and other districts. It will also be applied at once to street and house lighting, as well as to the operation of pumps for irrigation purposes. The mines in the mountains to the east will also probably take current for their mills, hoists, pumps, etc.

The work is being pushed to completion as rapidly as ossible and it is expected that by Nov. 1 the current will be turned into the transmission wires.

LETTERS AND HINTS FROM PRACTICAL MEN.

Resistance of Cast Welded Rail Joints.

CASS AVENUE & FAIR GROUNDS RAILWAY COMPANY.
ST. LOUIS, Aug. 21, 1896.

EDITORS STREET RAILWAY JOURNAL:

There has been much discussion lately concerning the conductivity of the cast welded joint, and some have claimed that the conductivity decreases after the rail has been buried in the ground a short while. In your last month's issue, one of your correspondents alleged that a cast welded joint which had shown the conductivity of a No. 0000 wire before use, had after a year's burial diminished in conductivity to a No. 00 wire. However as the length of the wire to which the joint is compared is not stated, the charge is rather indefinite.

The Citizens' Railway Company, of St. Louis, has about thirteen miles of cast welded track. Most of this was laid about a year ago, and tests have recently been made to determine the resistance of some of these joints. The method of making these tests was as follows: a large current was passed through the joint and the drop in voltage across the joint measured by a delicate voltmeter, the smallest division of which was one-thousandth part of a volt. The current having passed through an ammeter, the resistance was easily calculated from these readings.

A number of cast joints on eighty-five pound, seven inch Johnson girder rail were procured which had been in in the ground in actual service a year. They had been in special work and had been taken up when the special work had been removed. These were taken into the shop and the drop in voltage across them measured with different amounts of current. The resistance for the different joints calculated from this ran very uniformly, averaging 0.0000172 ohm, the highest being 0.000020 ohm and the lowest 0.000014 ohm.

In order to compare this with the resistance of an equal length of the rail itself, nine rails, varying in length from thirty feet to sixty-two feet, were brought into the shop and tested in the same manner. Five of these were eighty-five pound, seven inch rails and the others were of a smaller section. The results checked up very closely, and averaged for the seven inch rail, 0.0000102 ohm per foot of rail, on 86.61 ohms per mil foot.

The resistance of fourteen inches of rail calculated from this is 0.0000119 ohm, and comparing this with 0.0000172 ohm, which is the resistance of a fourteen inch cast joint, it is evident that the resistance of a cast joint is forty-four per cent greater than the same length of rail. Taking these results, the resistance of a track laid with the cast joint will be only slightly greater than the resistance of the rails themselves, because if the track is laid with thirty foot rails, the length of the joints will be four per cent, and if it is laid with sixty foot rails, only two per cent of the length of the rails.

In order to compare the cast joint with bonded joints, a number of rail ends were bonded with some of the ordinary bonds in use and their resistance measured in the same way. As these bonds were of several different lengths and sections, the only way to make a fair comparison between them was to deduct from their resistances the resistance of the copper wire, leaving only the resistance of the contacts. The lowest contact resistance obtained in this way was 0.00004 ohm, which alone is two and one-half times the total resistance of the cast joint. All of the bonds tested were new, the contacts bright, and the bonding carefully done in the machine shop.

An endeavor was made to measure the resistance of 1500 ft. of track in the ground. An opening was sawed in each rail, a measured current passed into the rails and the drop in voltage measured by means of a copper potential wire strung on the poles. The complete calculation of the results has not yet been finished, but the resistance of this length of track, each rail containing eighty-five cast welded joints, will be fully as low as the resistance of the rails themselves. This track has been laid a year and is subjected to heavy service.

The casting of the joints on this road was very carefully done and all the rail ends were thoroughly cleaned and brightened before the iron was poured. The conductivity in a great measure depends upon this, as a film of oxide between the casting and the rail may greatly increase the resistance of the joint. This company has never bonded its cast joints.

RICHARD MCCULLOCH, Engr.

Wheel Practice in Evansville.

EVANSVILLE, IND., Aug. 13, 1896.

EDITORS STREET RAILWAY JOURNAL:

I have been much interested in the articles concerning wheels and wheel mileages that have appeared in the Journal from time to time. I notice several have had trouble with sharp flanges and several remedies have been tried which have seemed to relieve the trouble in part. Sharp flanges mean not only a waste of power, but shorter life for the wheel, and the cause should be investigated and removed if possible. A good example of the loss of power occasioned in producing sharp flanges is found on some of our steam roads on the Western prairies. Trainmen often find it impossible to make time with a train if a strong wind is blowing against the side of the train, as the wheel flanges are continually being crowded against the rails on the side opposite the wind.

Quite frequently sharp flanges are caused by improper mating of the wheels. The mating of wheels should be done only by persons thoroughly understanding the business. The wheels should be measured and not calipered. A pair of calipers large enough to caliper a thirty-three inch wheel will spring so readily that a machinist could easily make an error of $\frac{1}{16}$ in. in diameter. The result would be that the larger wheel would crowd ahead all that the truck would allow. The flange on the small wheel would then be pressed continuously against the rail and slipped $\frac{3}{16}$ in. during each revolution. This is bound to make the smaller wheel wear off faster than its mate, thus making matters worse all the time instead of better.

In mating wheels the wheel should be laid on its hub, the face of the wheel cleaned of any dirt that may be on it and then the *circumference* of the wheel measured with a steel tape. Wheels can easily be mated this way so that their circumference will not vary more than $\frac{1}{32}$ in., a result which cannot be secured by calipering.

We were annoyed a great deal with sharp flanges till we took the matter up, and we have come to the conclusion that our sharp flanges were caused by improper mating, as we have never had a sharp flange where the wheels were mated in this way,

The following is the mileage made by the last fifteen pairs of wheels we have taken out.

74,136	79,734	60,087.8
64,208.5	54,588	53,191.6
63,166.3	55,250.3	84,764.2
94,647.5	72,050.6	75,615.6
48,884.2	73,244.9	81,193.3

The average of this record is 68,984.8 miles.

The smallest mileage made by any pair of wheels we have taken out within a year, except those that have been taken out because they had been slid, was 38,634 miles and the largest mileage made was 100,287.7 miles. Our road is quite level, only having one grade of importance,

but it was 235 ft. to the mile. It has, however, many curves of small radius. Two styles of truck were used, one with a six foot six inch wheel base and the other with a seven foot wheel base. Sand boxes were employed on about one-half the cars. No sand cars were used. We have had very little trouble with wheels being made flat by being slid.

The mileage on the above wheels is the actual mileage made by the cars while on regular trips. The mileage each car makes each day is figured from the trip sheets and a record kept of it, and the above mileage is taken from that record.

The following are the headings used in our Wheel Record Book.

Maker.
Number of Wheel.
Put Under.
Taken Out.
Mileage.
Why Taken Out.
Car Number.

W. L. Stockton,
Electrical Engineer.

Conductorless Cars and Brakes in Oakland.

Highland Park & Fruitvale Railroad.
Oakland, Cal., Aug. 10, 1896.

Editors Street Railway Journal:

In equipping this line with electricity we tried the experiment of using some of our old horse cars as motor cars and operating them without conductors. These cars were successful in demonstrating that cars can be safely run with one man, but after eighteen months' service were abandoned on account of "structural weakness." Ancient horse cars cannot stand the strain of fast electric service. We would have built new cars on the same plan, but familiarity with the "one man" proposition caused us to experiment with our double deckers, with the result that, excepting on Sundays, we now run all cars with but one man who acts as motorman and conductor. No fare boxes are used, but instead the motorman carries a portable register. Following our example, several other roads are now running branch lines with one man.

Our cars are single-enders, so have to be turned around at each end of the line. We use Ys instead of turntables. In backing cars around the Y we do not reverse the trolley. By a slight adjustment of the trolley pole, the wheel takes the right wire at the overhead switch, and if the motorman keeps his eye on the rope there is no danger of damaging either the line or the trolley pole. Of course, I know that most managers frown upon this practice, but we know that it meets our needs, saves time and enables the motorman to remain at his post.

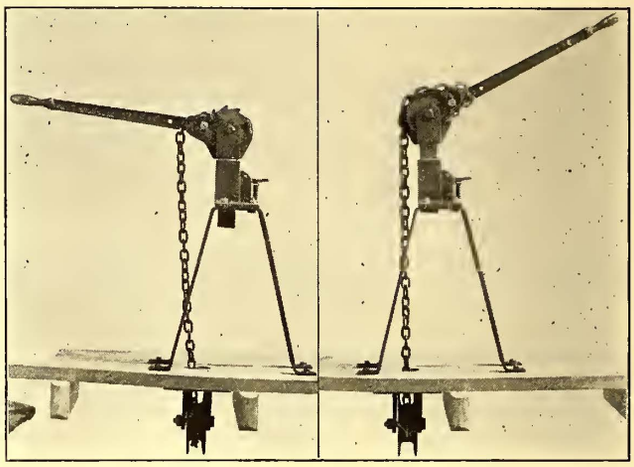
I enclose a photograph of a patent brake lever with which all of our cars are equipped. We have been using this device for over eighteen months with entire satisfaction. The cost is considerably less than the ordinary lever, with absolutely no repairs.

The photographs represent the brake in place on the platform with the dash removed. When at rest the brake lever is about level with the top of the dash, close to the motorman's right hand. The controlling stand is placed on the left hand side of the platform as usual.

To the standard or pedestal is attached, by bolts, a casting with an interior channel. In this channel a vertically movable post is fitted. In the upper part of this post, upwardly projecting sides are formed, which serve as fulcrums for a pin upon which the lever and cam turn. These levers can be of any length sufficient to give the requisite power for the operator. Usually it is twenty-two inches long. The cam is also made large or small in accordance with the length of the handle and amount of chain required to be taken up in order to properly set the brake.

The chain fits in a groove around the periphery of the elongated cam. The lower end of the chain goes through a two inch hole in the floor, thence around a direction pulley in the brake rod. The leverage increases as you pull back the handle. At the start considerable chain is taken up with a leverage of about 5 to 1. When the shoes are set to the wheels, but little chain is required, but a higher leverage is necessary. Thus we have about 16 to 1 (no "free silver" ratio, though), so it requires no effort on the part of the motorman to apply the greatest power.

While there is a pawl on the side of the handle, which engages with a ratchet, this is not used when operating the brake. It is there simply to hold the brake set when leaving the car or when applying "reverse" in an emergency; thus there is no danger of sliding the wheels as the motorman can "feel" them through the lever.



BRAKE OFF. BRAKE ON.

In order to compensate for variation in length of the chain, caused by changes in load, wear of shoes and connecting parts, and to maintain the proper relation between the cam and these movable parts, the vertically moving post which fits into the channeled casting attached to the pedestal, is fitted with a ratchet and pawl. It is easily raised or lowered to suit all conditions. When the slack chain becomes too great, a link or so must be taken up in the chain under the platform.

The brake is operated either parallel with or at right angles to the dash. The men are furnished with stools to sit on, as the brake can be operated as easily sitting down as standing up.

J. E. Morris, Supt.

The Steam Truss.

Chicago, July 3, 1896.

Editors Street Railway Journal:

The idea that the steam truss should take the place of the ordinary street car construction when eight wheels are substituted for four, is a mistaken one. It will be very desirable on our suburban roads to use straight sided cars, yet within city limits, they are practically out of the question, except where they come in on the tall trucks which are now usually considered necessary for rapid transit in the suburbs. In the first place, the steam truss is not built with sufficient care to stand the racket of street car work. Even on double trucks the street car is not as well handled as cars on the steam road. Its loading is decidedly unequal and it runs over shorter curves and has more crossings than any steam car.

The steam car truss is made of a number of small pieces, every one of which needs to be carefully fitted, have a sound, fair bearing and the toe or window rods must all be taken up equally. If neglected, as street cars usually are, such a combination of individual trusses is likely to give worse wear than the coach side now employed. In the building, unless great pains is taken and unless truss rods are used, the expected strength is not likely to be found.

If, on the other hand, a truss is to be built into the side of the car as it has been practiced by many steam car

constructors, the arch plank or truss being halved on to the posts, we are confronted with two dangers. One is that the work, in the first place, will not be done with care so as to give all of the plank and the posts perfect bearing on each other, and the second one is that the shrinkage of the wood which takes place in time no matter how thoroughly it be dried will leave the bearings more or less open and the cars will drop out of shape. These trusses being built up and not adjusted, the car will have a hog-back appearance after a short service. When once such a car changes shape nothing can be done to bring it back to its normal camber.

Again, the double truck street car is by no means on the same basis as the steam car. Theoretically, it is carried on two bolsters which are supported at points and, consequently, the trucks are free to rise and fall independently and the body is not twisted and wrenched as in ordinary street car work. Practically, this is not the case. The eight wheel car is carried on four points. As side bearings are generally used on street railway double trucks, when one side of the truck rises the body twists on account of the side bearings and is wrenched and strained to almost as great a degree as on the four wheel truck. The chief gain, I think, of the eight wheel over the four wheel car, is that the eight wheel car does not gallop, but the strains of the body in other respects are very similar, if not identical, with those of the four wheel car, and we are by no means ready to abandon the street car side for that of the steam car truss.

W. C. T. F.

Four Post Cars.

CHICAGO, Aug. 15, 1896.

EDITORS STREET RAILWAY JOURNAL:

I have had very little experience with four post cars, but on a recent journey I saw several cars constructed in this way and made observations upon them, which may be of interest. If a car is to be built with only four posts, these should certainly be of much larger size than is usually considered necessary. For electric service, I think it would be preferable to make them flat and put them upon the floor frame with their long side parallel to the side of the car. The head piece, having a broad bearing upon them, will give sufficient strength from side to side to resist swaying. By means of their great fore and aft depth they will be better able to resist the momentum of the roof in stopping, starting or pitching.

The roof itself, when supported at the four corners only, ought to be framed very differently from the ordinary car roof. The side of the raised deck should be a truss much deeper than usual, and of sufficient strength to carry the trolley stand and pole. Really, the roof should be framed with the idea of carrying the whole load from the ends, consequently the carlins become unimportant members, while the lower and upper plates of the raised roof have to be depended upon as upper and lower chords of the truss supporting the roof. What is ordinarily the plate resting on the posts ought to become a much lighter member than usual, since its function is reduced to that of holding the ends of the carlins. I do not think much of the idea of intermediate posts in the framing of a so-called four post car. When they are of iron they have too little stiffness to amount to anything more than supports for the hand rail. When of wood they are so slender and insignificant as not to give any strength worth mentioning.

I do not see why an open car, with seats back to back in the center, and two aisles upon the outside, should not be built upon an entirely different plan from any that has been proposed. Why not place posts and braces between the backs of the seats? Light posts at this point, with diagonal rods, would give a strength to the whole superstructure of the car, equal, if not superior, to that of any box car. An entirely new form of roof would then be possible, and a strong and altogether novel car would result.

The ordinary violations of the fundamental principles of mechanics are inexcusable, and, like other sins, have punishments from which there is no escape. For myself, I would rather be excused from purchasing or using cars of this description. Not long ago I had occasion to inspect some old cars, built, I judge, "in the year one." Their roofs were covered with canvas, without roof boards. A lighter roof, I think, I have never seen, and although it was carried on posts of very moderate dimensions, and had been run for many years over one of the roughest tracks that has ever been seen, yet the car was in good condition, and the roof had done what roofs should do, it had kept water away from the woodwork of the car. I argued from this example that if cars must be built with only four posts for carrying the roof, it would be better to use bent carlins, and cover them with canvas, than to attempt the present style of raised deck, with hinged sash, ventilating windows and all the accompanying features which increase weight.

C. S. C.

Conductorless Cars.

BIRMINGHAM RAILWAY & ELECTRIC COMPANY,
BIRMINGHAM, ALA., July 6, 1896.

EDITORS STREET RAILWAY JOURNAL:

Referring to letters in your May and July issues in regard to "Conductorless Cars," I beg to state that on one division upon which we operate seventeen motor cars, we use fare boxes and have had better results than when we used conductors. We also find that we have fewer accidents than when conductors were on the cars. We believe that one man on a car in full charge is more particular than when two are on and the responsibility divided. We have another division upon which we run six motor cars with trailers, running to a lake resort, where conductors are a necessity.

J. B. MCCLARY, Supt.

Practice in Lebanon, Pa.

LEBANON & ANNVILLE STREET RAILWAY COMPANY.
LEBANON, PA., July 31, 1896.

EDITORS STREET RAILWAY JOURNAL:

A few words from this section may, no doubt, be of interest to some of the readers of your valuable journal. We have twenty miles of track, seventeen cars, of which thirteen are closed and four open, two Westinghouse equipments, two G. E. 800 and thirteen Edison. The number of our cars in daily service is seven. We do not furnish our power. We do our own repair work however, mechanical and electrical.

Three men are employed in our car house, one day foreman and assistant and one night man.

The expense of operating seven cars during 1895 was $65.52 per day or $9.36 for each car. This includes wages, power, material, overhead and track repairs, but does not include taxes and interest.

Our line runs through the finest part of our beautiful Lebanon Valley, a distance of thirteen miles, Myerstown being the eastern terminus and Annville the western, with Lebanon midway. This valley is not, as quite a number of our Eastern friends suppose, a coal center, but instead, a great farming region. It certainly is at this time a perfect "panorama."

CHAS. H. SMITH, Supt.

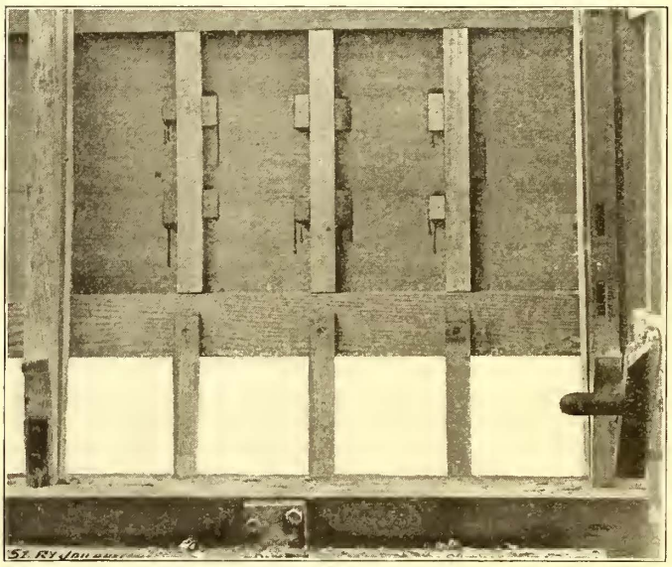
A Large Trolley Party.

An extensive trolley party was given July 15, by the Knights of Pythias over the lines of the Calumet Electric Street Railway Company, of Chicago. Fifty-four cars, making a procession one mile in length were required. 25,000 guests were carried, together with six bands of music and two drum corps. The cars ran over a circuit of about forty miles.

Car Construction Details.

The engraving herewith shows the inside of a panel near the end of one of the long cars recently built at a prominent car company's shops for the West End Railway Company, of Boston. The lower ribs are mortised into the sill and screwed to the middle, or belt rail. The other ribs are mortised into both rails, and are secured to the panels by a series of glue blocks put on with hot glue. Over these blocks the canvas is placed. The careful attachment of these blocks adds materially to the security of the panels which, in this case, are rather wider than usual. The care with which they are rubbed in place is evident to the practised eye by the appearance of the glue, etc.

An error appears to have been made by the designer, which has escaped the scrutiny of the various processes through which the plans have passed. The cross sill comes under the side sill, with a deep shoulder against it, but is not mortised into it. The right angle malleable casting, shown in the bottom of the engraving, is used instead. Two bolts go down through it and through the cross sill, and two horizontal bolts hold it against the side sill, going



AN ERROR IN CAR BUILDING.

through the latter in its upper half. Three bolts go down through the side sill at the same point into the tongue of the cross sill. This makes five bolts passing through the sill within a distance of, perhaps, three inches. What makes this the more destructive is that the heads of all these bolts are boxed in flush, either on the top or side of the sill. A safer method, and one which would have really detracted little from the strength of the timber, would have been the use of a piece of malleable or strap iron coming over the top of the sill and down upon the cross joist. Two vertical bolts would have been sufficient to hold it in place and would have answered every purpose. As these cars are the first of this particular design which have been built, the construction will undoubtedly be changed.

An alternative construction, which would have the advantage of spacing the bolts further apart, might have been obtained by using a twisted stirrup.

The suggestion has been made that veneer panels would be very suitable for use on car bodies. No one seems to find any fault with the idea. The only objection brought up has been the neglect with which cars are treated and the length of time which passes between the paintings. It is supposed that if allowed to go for even a short time without paint the veneer would be ruined. This would not be a bad thing if it compelled more frequent painting of cars. It would at least be an economy for the railroads.

The "Ghost Chill."

Car wheel makers are familiar with a form of iron which when used in wheels produces what they term a "ghost chill." By this they mean a chill which while having the appearance of great depth and hardness is weak, crumbly and soft. Such a chill is quite unfit for use, and yet to the unskilled eye presents no marks by which it may be detected.

In speaking of the "ghost chill," one of the leading wheel manufacturers recently said:

"There is nothing surprising about the ability to detect what is called a 'ghost chill' in fact now-a-days I should think it would be a good deal more difficult to find one of the opposite kind, considering the work of a great many car wheel makers. The character of chill mentioned is produced by the use of manganese, which makes quite a coarse crystal in the chill surface of a peculiar shape so far as its angles are concerned. The fractured surface is brilliant and might be supposed to be extra hard on that account; but as a matter of fact the iron is in many cases possessed of less resisting power to wear than might be obtained from special manufactures of iron that were not chilled at all.

"The methods of some wheel makers, are so crude when considered by one familiar with the subject as to make one wonder whether the actual knowledge of the material and quality of wheels is something so far beyond the information that should be possessed by railway officials, who are generally posted on similar lines.

"The use of manganese in car wheel mixtures is perhaps responsible for more trouble experienced with wheels of late years than any other one thing, as with it wheel makers are able to use cheap non-chilling irons in scrap and to convey a quality of strength and appearance of chill that would seem to indicate a good wheel. Manganese is, however, an unreliable as well as an unsatisfactory constituent. The varying temperature of the furnace in which the mixtures are melted causes the manganese to take on different conditions in the metal when cast; its presence is excessive in some wheels and almost entirely lacking in others; and generally speaking the result is about the same as might be expected in the case of a man who being in poor health and condition tried to keep up his strength by the use of artificial stimulants. The result at best can only be temporary, and the breakdown must come sooner or later. Of course, the wheel makers have not been entirely responsible for many of the conditions of operations on electric railways, which would have caused more or less failures in any case; but to the extent that certain wheel makers have promoted unsatisfactory conditions by continually offering wheels at lower prices, they are responsible for the poor results that have done so much to injure the reputation of the chilled wheel."

We may add that a wheel with a ghost chill can without difficulty be drilled through what should be the hardest part of the chill, where the metal should be hard enough to cut glass.

As to wearing, such a wheel will not wear at all. The soft metal grinds away at once and the wheel is flattened and thrown out of service in a very short time.

Some companies are giving up the use of Babbitt linings in their car wheel boxes and casting the boxes entirely of Babbitt metal. When the bearings wear out, the entire box is returned to the Babbitt dealers who allow, it is said, the original price, less about six cents a pound, making the total cost comparatively little.

The towns of Norwalk and Stamford in Connecticut are united by electric railway now, the tracks of the Stamford Street Railway Company and of the Norwalk Tramway Company uniting at Noroton Hill. Through cars are being run between the two cities.

LEGAL NOTES AND COMMENTS.*

EDITED BY J. ASPINWALL HODGE, JR., AND GEORGE L. SHEARER,
OF THE NEW YORK BAR.

Exclusive Franchises to Operate Street Railways.

It can be asserted, on the authority of one of our leading text books on the law of street railways, that no question is more perplexing, and none has so severely taxed the ingenuity of legislators and the learning of judges as those which have arisen out of the conflicting rights of different street car companies who have sought to occupy the same street. None of the most vital of these questions can be yet said to be settled by any general consensus of authority. We have not the temerity to attempt a solution of them, but a brief statement of a few of the contending basal principles of the law on either side of some of them may be interesting to our readers.

Where an exclusive franchise is claimed, four or five documents have to be examined in each case before the question to be considered can be discussed. The constitutional legislative enactments of the state where the road is located; the charter of the road; the charter of the city or community granting the franchise; and the franchise itself, besides the common law, including some very elastic portions of it.

It is quite manifest from this statement that no general rule can be applied which will surely solve the problems of a particular case.

The constitutional and legislative enactments vary with every state.

The charter of the company, restricted as it often is by the general law under which the company is incorporated, is rarely of such a character as to, of itself, prevent the acceptance of a franchise granting the most exclusive rights. Even where the charter limits the term of the existence of the company it has been held that the franchise, being assignable, it may be valid in perpetuity, notwithstanding that the company making it passes or is to pass out of existence by the very document which created it.

The charter of the city or community granting the franchise may so limit the powers conferred that no franchise for the exclusive use of streets can be granted; and the courts hold that municipalities cannot grant exclusive franchises unless authorized by explicit legislative enactment. (*New Orleans C. & L. R. R.* v. *City of Orleans, 11 So. Rep. 78.*)

The franchise itself is a privilege, conferred by the state, which could not be exercised, except in the pursuance of such a grant; yet if granted upon valuable consideration, as is ordinarily the case, it is within the constitutional provisions against the impairment of the obligation of contracts. For most intents and purposes it is a contract, although there are cases by its terms where it is merely a license, which may be withdrawn. The wording of the franchise, the questions as to whether the company has fulfilled all conditions precedent, and has paid a valuable consideration, either in money or by undertaking to fulfill obligations on its part, are all to be considered in determining whether in any particular case the company has acquired a valid exclusive right, which cannot be taken away.

On the one hand we have the argument ably set forth in the decision of a United States Circuit Court to the effect that an exclusive franchise having been granted to an Indianapolis company, the company having entered upon certain obligations and fulfilled the same, a contract has been made and no act of the legislature or of the city can impair its obligations without the consent of both parties to it. (*Citizens' Street R. R.* v. *City R. R., 56 Fed. Rep. 746; s. c. 64 Fed. Rep. 647.*) In that case it was held that an attempt on the part of the city to grant rights to a competing road was void by virtue of the constitutional prohibition against any law impairing the obligations of a contract.

On the other hand, it is argued that, since the street is dedicated to the public for the use of all vehicles, unless there be some restriction of the use at the time of the dedication, no limitation imposed can be held to be valid which in any way prevents such use, either by ordinary street vehicles or by the cars of a competing road.

Mr. Booth in his work on Street Railways puts the case in the form of a dilemma. He says, "It would be inconsistent to declare, on the one hand, that a railway, constructed at street grade to accommodate local travel, is a public highway to such an extent, at least, that abutting owners cannot prevent its operation, and, on the other hand, that it is so far private and exclusive as to prevent a similar use of the same street by others."

But perhaps this dilemma may be avoided by the suggestion that it is within the discretion of the city authorities to grant an exclusive right to one company on the ground that a multiplication of cars or tracks would impede public travel. In a Michigan case it is held that a municipality cannot so multiply tracks as to interfere with the rights of the general public in the street. (*St. R. R. of Grand Rapids* v. *West Side St. R. R., 48 Mich., 433.*)

Closely connected with the questions under consideration is the right, which is often regulated by statute, as in New York, of a new company to use the tracks of an established street railway.

In a case decided by Judge Pryor within a month with reference to these statutory enactments he cites cases wherein it has been construed and where it has been held to be constitutional. (*Central Crosstown R. R.* v. *Met. St. R. R., N. Y. Law Journal, Aug. 6, 1896.*) He says, "By the section of the railroad law above cited it is provided that 'no street surface railroad corporation shall construct, extend or operate its road or tracks in that portion of any street, avenue, road or highway in which a street surface railroad is or shall be lawfully constructed * * * without first obtaining the consent of the corporation owning and maintaining the same. '*42nd Street R. R.* v. *34th Street R. R. 52 Super. Ct. 257; Matter of 34th Street R. R. 102 N. Y., 343.*)'"

Thus in New York the right being once granted to a road upon a given street and exercised, there is, what appears to be, an exclusive grant (subject however to certain provisions contained in section 102 of the Railroad Law.) But it is interesting to note that, in the last case cited by Justice Pryor, the Court of Appeals says, that the legislature "may hereafter in its discretion remove the restriction (the consent of the existing company) and abrogate the condition," but we take it that this would not apply to a case where the original grant to the company was an exclusive one in the nature of a contract.

In the solution of the problems which we have suggested, rather than discussed, in the brief space which is at our disposal, the courts show a growing tendency to consider the general public good in each particular case rather than technical rules of law. Manifestly, therefore, the whole course of judicial decisions in any given state may be determined by the case which is first presented, and rules laid down, for subserving of the public good in that particular case, may bind the court in subsequent cases, which, if they had been presented first to the court,

*Communications relating to this department may be addressed to the editors, No. 32 Nassau Street, New York.

might have led to the enunciation of different principles. It can hardly be expected, therefore, that we shall have a homogeneous law upon the subject throughout the country, even where the decisions in the several states are not determined or modified by statute.

On the one hand, the courts will frown upon the granting of an exclusive franchise to the use of any street dedicated to public travel, and on the other hand, they will protect capital invested upon the faith of a valid obligation existing between the company and the city, for which a valuable consideration has passed. H.

ORDINANCES, FRANCHISES, ETC.

IOWA.—Where a city has by ordinance established a new grade for a street, but has done nothing towards raising the street surface to conform to it, a street railway company, which is granted the right to construct a track through the street, is liable to abutting property owners for damages resulting from laying the track at the later grade, in the absence of an express provision authorizing the act.—(Stritesky v. City of Cedar Rapids, 67 N. W. Rep. 271.)

OHIO.—Rev. St. §§ 2501–2505, 3437–3443, provided for the manner in which street railroad grants might be renewed, which was in effect by the concurrent action of the board of public works and the city council; and, where only one of the boards has acted in the matter, there can be no implied renewal from a grant authorizing the substitution of electricity for horses as a motive power, and under which the company has expended a large sum in making the substitution.

Where a street railroad company was granted a right to occupy streets for a term of years on payment of a stated license fee for each car, and after the expiration of the term, without a renewal of its grant, or subsequent provision by the city for license fees, it continued the occupation, the company was a mere trespasser on the streets, and not liable for the payment of license fees after the expiration of its contract.—(Cincinnati Inclined Plane Ry. v. City of Cincinnati, 44 N. E. Rep. 327.)

NEW JERSEY.—The special Act of Mar. 11, 1872 (P. L. 1872, p. 512), which authorizes the Camden Horse Railroad Company to build a railroad or railroads on "any public road or highway extending from the city of Camden into the county of Camden," does not empower the company to build a railroad upon a public highway no part of which touches the city of Camden, but does empower it to build more railroads than one upon the highways mentioned in the Act.

A municipal consent to the laying of "a street railroad" in and along the streets of the municipality is not a consent to the laying of two distinct street railroads.

If a company has legislative power to build a railroad on a designated street, provided the municipal authorities consent thereto, and it commences to build such railroad without municipal consent, the municipal authorities cannot grant to another company the exclusive right to build a railroad in that street, without giving to the first company notice and an opportunity to be heard.—(West Jersey Traction Co. v. Camden Horse R. R. Co., 35 At. Rep. 49.)

COLORADO.—An ordinance granting a franchise to a cable company provided by sections 8 and 9, that the company should "construct culverts in such manner and at such points on its lines as the city council shall require and designate," and reserved the right to pass ordinances in reference to the operation of the railway, and also reserved the police and legislative powers with respect to the streets used. A later ordinance required the company to "furnish, construct, put in place, and maintain * * * all necessary conduits and syphons for carrying surface water across or under" the streets used, at all points where the track crossed any street. A further ordinance made any defective or filthy drain a nuisance. The railway company constructed culverts under the streets, terminating at either end in syphons whose bottoms were considerably below the bed of the culverts, as required by the city authorities. *Held*, that the ordinance requiring the construction of syphons imposed a burden on the company not within the intendment of the reservation of the franchise ordinance, and was therefore invalid.

2. The word "maintain" as applied to the syphons, means to keep in repair; and, since a failure to keep them clean and in a sanitary condition in no way impeded the flow of water through the culverts, the company was not responsible for their unsanitary condition.—(City of Denver v. Denver City Ry. Co., 45 Pac. Rep. 439.

NEW JERSEY.—Act 1893 (P. L. 1893, p. 241), §§ 1, 2, empowered city authorities, by ordinance, to authorize street railroad companies to substitute electric motors in the place of horses, as the propelling power of their cars, and to authorize the use of poles in the streets, with wires thereon to supply the motors with electricity, and to prescribe the places in which such poles should be located. The Act did not confer on the companies any rights beyond those vested in them by their charters. *Held*, that such ordinance did not per se create an additional easement.

The Act did not confer on the companies the right to acquire private property by the exercise of the right of eminent domain, but only the right to erect poles and use the trolley system, so far as the public easement is concerned, with a view to the public convenience in the use of the streets; and, when poles were erected at points designated by the ordinance, there was not a taking of private property without compensation, within the constitutional interdiction.

Where the privileges granted by the Act are made the occasion of unlawfully injuring the owners of abutting property, by using cars of great size or weight, or by running cars at an unusually high speed, such acts of the company are ultra vires, and redressible by action at the suit of the injured party.—(Stater v. Trenton Pass. R. Co., 34 At. Rep. 1090.

MARYLAND.—The "park tax" provided for by Acts 1882, c. 229, and Acts 1894, c. 550, is a tax on the gross receipts of "street railway companies" in the city of Baltimore, imposed in consideration of the franchise accorded such companies to locate and operate their tracks on the public streets, and has no reference to an electric railroad originally constructed outside the city, on a private right of way, purchased, by legislative authority, from a turnpike company, though a portion of such line is subsequently brought within the city by an extension of the territorial limits.—(Mayor, etc., of Baltimore v. Balt., C. & E. M. Pass. R. Co., 35 At. Rep. 17.)

PENNSYLVANIA.—Act May 14, 1889 (P. L. 211), does not limit corporations chartered under it to the right to build passenger railways on "streets" properly so called, but authorizes the building of such railways through boroughs, and over township or country roads.

The charter of a street passenger railway company, granted under Acts May 14, 1889 (P. L. 211), covered the route on which the road was built, and it had the consent of the local authorities, of all the owners of property along the roads occupied, and of those through whose property its line passed. *Held*, that a railroad company whose tracks were crossed by such street railway, and which owned no land abutting on the streets or roads occupied by such passenger railway, could not dispute the passenger railway company's rights to construct and operate its road over such streets and roads.

But where such passenger railway passed over an overhead bridge which was not built originally for use by a street passenger railway, and which passed over such railroad company's tracks, the railroad company was entitled to be protected from the danger to it and its passengers arising from the use of the bridge by the street railroad company.—(Penn. R. Co. v. Greensburgh, J. & P. St. Ry. Co., 35 At. Rep. 122.)

CONNECTICUT.—2. Act 1893 (Pub. Acts 1893, p. 308) provides that when a street railroad company is given the right to construct a railway or lay additional tracks in a city it shall, before proceeding to do so, present to the mayor and common council a plan, showing the streets in which it proposes to lay its tracks, the location of the same as to grade and the center of the street, etc.; and that no company shall construct or lay additional tracks except in accordance with a plan so approved. Act 1893 requires the company to keep the street in repair between its tracks and two feet on each side of them. *Held*, in case of a street railway company which had tracks in certain streets of a city, and which, on being granted power by the legislature to lay additional tracks in other streets thereof, presented a plan showing the particulars required by Act 1893, that, as cities have all powers necessary to the attainment and maintenance of their declared objects and purposes, and as one of the objects and purposes of the city in question, declared by its charter, was the maintenance of highways within its limits in safe and proper condition, and the provision of means for payment of expenses thus occasioned, the city could make its approval, subject to the condition that the company annually pay the city a sum which should be just compensation for the new expenses to which the city would be annually subjected in the maintenance and reparation of the streets on which the additional tracks were to be laid, though it could not require compensation for such expenses as were occasioned by tracks already in use. Torrance, J., dissenting.

5. For a city to condition its approval of the plan of a street railway company for additional tracks on the company's annually paying a certain amount towards the new expenses in maintaining the streets occasioned by the presence of tracks, is neither the laying of a tax nor the charging of a license fee. Torrance, J., dissenting.

3. A revised city charter (Sp. Acts 1895, p. 359, § 23) gave the common council power to make such orders as it deemed fit to provide for the placing and maintenance of fenders on electric cars. After such Act went into effect, a public Act, which went into effect immediately, was passed, giving the railroad commissioners exclusive jurisdiction with respect to ordering such fenders on street cars, and repealing all inconsistent acts, resolutions and by-laws. *Held*, that the city could not thereafter make it a condition for approval of a plan for a street railway that the company keep its cars at all times equipped with such fenders as should be satisfactory to its street committee.

4. The city could make its approval of the plan of the street car company for additional tracks conditional on there being no abandonment of the tracks already laid, and on there being trips thereon as often as every twenty minutes; especially as Act 1893 gave the mayor and common council exclusive direction over the relocation or removal of tracks permanently located on a street, and authorized them to order resumption of operation of any line which the company should cease to operate. Torrance, J., dissenting.—(Appeal of Central Ry. & El. Co., 35 At. Rep. 32.)

NEW JERSEY.—In a contest, raised in a certiorari proceeding, between two street railways each claiming the exclusive right to lay its track in a certain street, the prosecutor failed altogether to show

its own interest in such controversy. *Held*, that the prosecutor had no standing in court to question the right of its adversary.—(State—West Jersey Traction Co.—Proseeutor v. Board of Public Works of City of Camden, 33 At. Rep. 966.)

OHIO.—Where a street railway company was authorized by ordinance to construct single or double tracks, side tracks and turnouts on certain streets, an injunction will not lie to enjoin it from eonstructing a side track or turnout in front of plaintiff's premises, though it had previously operated with but one track. If plaintiff sustained any special damages, his remedy was at law.—(Oviatt v. Arkon St. R. Co. 2 Ohio N. P. 84.)

LIABILITY FOR NEGLIGENCE.

COLORADO.—The conductor of an electric railway car assumes, as a matter of law, the risk of injuries received in falling from the car, due to the failure of the company to construct the car with a guard extending outside of the wheels, so as to prevent a person's foot from passing under the wheels of the car.—(Denver Tramway Co. v. Nesbit, 45 Pac. Rep. 405.)

PENNSYLVANIA.—A person riding on the bumper on the rear of a street car, without the knowledge of the conductor, is, as a matter of law, guilty of contributory negligence, so as to prevent a recovery for injuries occasioned by the car upon which he was riding being struck from the rear by another car.—(Bard v. Penn. Tr. Co., 34 At. Rep. 953.)

U. S. COURT.—A street railway company which, in removing snow from its tracks, piles it up in the part of the street outside such tracks, and suffers it to remain there in masses which constitute an obstruction to travel, in violation both of its general duty and of a local ordinance requiring it, in removing snow, to distribute it evenly over the street, so as not to interfere with the free use of the same by the public, is responsible for the injuries suffered by a traveler on the street, whose horses take fright, though not in consequenee of any fault of the railway company, and whose carriage is upset by coming in contact with such mass of snow before he is able to regain control of the horses.—(McDonald v. Toledo Con. St. Ry., 74 Fed. Rep. 104.)

INDIANA.—Where the evidence is absolutely silent as to the acts of decedent from the time he left a street car at a street crossing till he was struck by a street car moving in the opposite direction on a parallel track, and such interval was long enough to have permitted him to cross the street in safety, it will not be presumed that he was free from contributory negligence, though the car was run over the crossing in a reckless and negligent manner.—(Evansville St. R. Co. v. Gentry, 44 N. E. Rep. 311.)

LOUISIANA.—The lineman of the defendant company, in the discharge of his duty, was ordered to take down a guy wire from an electric pole and guy tree. The pole had not been securely planted. It fell on the lineman, inflicting injuries of which he died. The vice of construction was latent and concealed. The officers of a preceding board of management had been notified of the defect. The company is not relieved under the plea of want of notice, although the present general manager had not been notified, but the preceding manager or superintendent.

The lineman did not voluntarily place himself in a dangerous position.

The employe is not bound to know latent, but only patent, defects.—(Bland v. Shreveport Belt Ry., 20 South Rep. 284.)

RHODE ISLAND.—Where a street car company, authorized by charter to build a street railroad, lets a contract for constructing the road to an independent contractor, without any agreement as to the particular manner in which the work shall be done, it is not liable for injuries caused by a wire stretched across the road by such contractor or in the course of the work.

The rule that a railroad company cannot delegate to a contractor its charter right to construct the road, so as to exempt it from liability, does not extend to the use of the ordinary means employed for its construction, but to the use of such ordinary powers as the corporation itself could not exercise without first having complied with the conditions of its charter.

A charter of a street railroad company, which provided that it should be liable for the negligence or misconduct of its agents and servants in constructing the road, does not apply to the negligence of an independent contractor.—(Sanford v. Pawtucket St. Ry. Co., 35 At. Rep. 67.)

ALABAMA.—It is not, as a matter of law, contributory negligence under all circumstances, to attempt to board a moving train. In an action against a street railway company for killing plantiff's intestate, all the witnesses fixed the place of the accident midway between two streets. Two witnesses for plaintiff testified that the train stopped at said place, when said witnesses and deceased, with his arms full of bundles, boarded the cars, and that the train started up with a jerk, which caused one of said witnesses to be thrown backwards, striking deceased, who was then on the bottom step, and throwing him to the ground. Two witnesses for defendant and the train employes testified that the train was moving at from four to seven miles an hour when deceased attempted to board it, and that the train did not stop between said streets: and one of said witnesses testified that no one was with deceased at the time he attempted to board the train. A city ordinance prohibited trains from stopping between said streets.—Judgment for plaintiff reversed and new trial ordered.—(Birmingham Ry. & El. Co. v. Clay, 19 South, Rep. 309.)

IOWA.—Evidence that plaintiff on getting into his wagon, which had an inclosed top, making it necessary for him to lean out to see back of him, looked and saw no car coming; that a block further on, he looked back and saw no car; that a block further, he was struck by a car coming from the rear; that he was driving between the street car track and the curbing, the distance between which was nine feet four inches, into which the car projected eighteen inches; that his horse was walking, and that he, though attentive, heard no sound indicating the approach of the car; that the car was running down grade at a high rate of speed, and no signal of the approach of the car was given—justifies the verdict for plaintiff—(Wilkens v. Omaha & C. B. Ry. & Bridge Co., 65 N. W. Rep. 987.)

NEW YORK.—A driver of a wagon, in attempting to cross a cable track while a car was 150 ft. distant, is not, in law, guilty of contributory negligence because a collision results through failure of the gripman to make any effort to moderate the speed of the car.—(McDonald v. 3d. Ave. R. Co., 37 N. Y. Supp. 639.)

INDIANA.—A person injured by another's negligence cannot recover for any aggravation of the injury, caused by his failure to use ordinary care in securing medical treatment and in continuing the same so long as his injuries appear reasonably to require it.

The burden of proving that plaintiff's injury was aggravated by his failure to use ordinary care in procuring medical attention is on defendant.—(Citizens' St. R. Co.v. Hobbs, 43 N. E. Rep. 479.)

GEORGIA.—There being no error of law, and the evidence for the plaintiff, though decidedly in conflict with that introduced for the defendant, being sufficient to warrant a finding that the defendant was guilty of negligence, and that the plaintiff could not, by the exercise of ordinary care, have avoided the injuries he sustained in consequence thereof, there was no abuse of discretion in denying a new trial.—(El. Ry. Co. of Savannah v. O'Connor, 24 S. E. Rep. 405.)

EXCESSIVE DAMAGES.

NEBRASKA.—A farmer, twenty-four years of age, was thrown under a car from which he was alighting, and received injuries, consisting of a cut in the fleshy part of his heel, and the laceration and bruising of the muscles of his ankle, which, however, would not result in permanent disablement. He was in bed some eleven weeks, during which time he suffered more or less pain, and was compelled to use crutches after getting up for some time, and lost, as the result of the accident, about a year's time. *Held*, that a verdict for $6300 should be reduced by $1300.—(Fremont, E. & M. V. R. Co. v. French, 67 W. Rep. 472.)

IOWA.—A verdict for $4000 in favor of a single woman, twenty-one years old, earning about $75 a month as a stenographer, for a personal injury, was not excessive, where plaintiff was confined in bed for five weeks, during which time she had difficulty in breathing, and suffered intense pain in her leg from inflammation of the bone; that such pain continued up to the time of the trial, a period of seventeen months, and was likely to be permanent; that plaintiff walked with a limp, and still suffered pain in her chest when she leaned forward; that she had been able to do no regnlar work since the injury, and had paid some $200 for medical treatment and nursing.—(Bryant v. Omaha, & C., B. Ry. & B. Co., 67 N. W. Rep. 392.)

EMPLOYER'S LIABILITY ACT.

TEXAS.—Act May 4, 1893, defining who are fellow servants, does not, in referring to "any railway corporation," include street railway companies, so that a street railway company is not liable for injuries to one of its servants which were caused by the negligence of a fellow servant.—(Riley v. Galveston City R. Co., 35 S. W. Rep. 826).

EQUITY—SPECIFIC PERFORMANCE.

ALABAMA.—Where a contract for an unexpired term of years imposes on complainant the rendition of continuous mechanical services demanding the highest degree of skill, and on defendant the duty of maintaining costly machinery, and the daily use of cars moved by electricity on the line of its railway, a court of equity will not decree a specific performance of the contract.

The complainant has an adequate remedy at law by terminating the contract for defaults of defendant.—(El. Lighting Co. of Mobile, v. Mobile S. H. Ry. Co., 19 South Rep. 721).

EJECTION OF PASSENGER.

NEW YORK.—In an action for wrongfully ejecting plaintiff from defendant's car, a request to charge without qualification that defendant was not liable if the conductor's conduct was willful or malicious, or if his acts were done with a purpose of his own, was properly refused, because a master is liable for the acts of his servant within the general scope of his employment while engaged in the master's business, and done with a view to the furtherance of his business, whether the act is done negligently, wrongfully, or even willfully.—(Burns v. Glenn Falls & St. R. Co., 38 N. Y. Supp. 856.)

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Street railway news and all information regarding changes of officers, new equipment, extensions, financial changes, etc., will be greatly appreciated for use in our Directory, our Financial Supplement, or our news columns.

All matters intended for publication in the current issues must be received at our office not later than the twenty-second of each month.

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OUR October issue will be a special and exceedingly beautiful Souvenir Number prepared in honor of the American Street Railway Association, whose annual meeting is held next month. For some time past we have been collecting material and arranging for the writing of a number of special articles which will be of great interest to those connected with the street railway industry. It is probable that the unusual labor involved in bringing out this elaborate Souvenir Number will make it difficult to deliver it to our subscribers on the regular date of publication, but we believe that their patience will be rewarded with an issue which in beauty and value of contents will have few equals in the history of technical journalism.

THE work of the American Street Railway Association has been promptly and energetically taken in hand and carried out this year by the officers and Executive Committee, and there is every promise of a remarkably interesting and successful meeting at St. Louis next month, with an attendance which will largely exceed that of any recent convention. The year's work was well started by the publication of the Annual Report within ninety days from the date of the Montreal convention—a record which has never been equalled in the history of the association. An early meeting of the Executive Committee was held at St. Louis, at which the papers were determined upon, the headquarters selected, the general plan of the year's work laid out, and the local organization for arranging the details of the 1896 convention effected. The local committees immediately went to work under Captain McCulloch's energetic direction, and everything has been carefully thought out and plans made for the comfort and pleasure of the visitors. The hotel selected as headquarters has long been famous both East and West for hospitality and good cheer. The association is fortunate in having the use for its meetings and exhibits of a building of ample size and at reasonably convenient distance from the hotel headquarters. Nearly all of the minor drawbacks which have been found at several of the recent conventions, will be absent at St. Louis, and such as may be inevitable will be borne with cheerfulness by the visitors in the large overcompensation of the enjoyable features. The local committee has given time and money most liberally to the work of proving to another great association how well justified is the reputation of St. Louis for the cordial entertainment of conventions of this character. The ladies attending the convention will, in particular, be treated with special consideration, and entertainments, lunches, receptions and "functions" of various kinds will make their stay in St. Louis a thing long to be remembered. The papers to be read by Messrs. Bowen, Akarman, Wyman, McCulloch, Willard and Kelly deal with problems of much importance to managers, and have been prepared with great care and after extended correspondence, in order to condense the widest possible experience into the conclusions drawn. It is surprising that in times so dull as these, applications for space should be so large and should cover so wide a range of industries. Already between sixty and seventy manufacturers have applied for space, aggregating nearly 20,000 sq. ft., out of a total of 32,500 sq. ft., including aisles and waste space, at the disposal of the committee on exhibits—the largest space, by the way, ever given over to this purpose at any convention so far as we are aware. More applications will doubtless be sent in during the next fifteen days and will be heartily welcomed by the committee, which will award space to the best interests of the applicants so far as may be possible. Special trains will be run from New York, Boston, Philadelphia, Pittsburgh and Chicago, while others from Western points will probably be arranged for.

* * * *

Member companies of the Association should not forget that their representatives will be called upon at St. Louis to vote upon the amendments to the constitution recommended for passage last year by the Executive Committee, and the delegates should be empowered by their companies to vote upon the financial questions involved, so that it may not be found at St. Louis, as was the case at Montreal, that many delegates felt themselves unauthorized to commit their companies to any proposition involving larger dues. There is chance for much difference of opinion regarding these propositions. Considerable doubt has been expressed by street railway managers as to whether any large amount of information can be obtained by the secre-

tary for the use of members which will be "worth the candle." Many hold that the fact that street railways are governed by state and not national laws would make the legal precedents of one state valueless in the other, and would so remove from the secretary's enlarged field of action a branch of study which might otherwise be thought to be an important part of his duties. The belief has also been expressed that the science of street railroading under the new conditions of mechanical and electrical motive power is not sufficiently settled down to make the collection of operating or other data at present generally useful. In order to advise intelligently with street railway companies upon questions of infringements of patents, the secretary must needs employ, and at considerable expense, patent experts of the highest grade, and even their opinions are by no means infallible. All these arguments are made, and beneath them all is, undoubtedly, the feeling that larger dues cannot be afforded in these times of great business depression. It seems to us that the real problem in the matter is the one of finding the right man to undertake a work of this character. It is possible to so handle the work that the effort would be wasted and results would be absolutely worthless and worse than worthless, because delusive. It is possible, on the other hand, to collect data that would be of extreme value to every member of the Association. It all depends upon the man—his training, his skill, his powers of analysis and his grasp of street railway problems. If the right man is found, the secretary's office may be easily worth to the Association ten times its cost; with the wrong man, the smallest sum paid may be utterly wasted. With regard to the other questions at issue, it seems to us that the changes recommended are in the right line.

THE experiments with compressed air motors on two New York City lines have been undertaken in the hope of finding some method of propelling cars by mechanical power, without going to the large expense of installing the cable or the underground electric systems. On many of the lines in New York City, no material increase of traffic caused by the introduction of improved motive power can be hoped for for the reason that the horse railway service is already so frequent and so rapid as to make any improvement in these two most important elements of traffic practically impossible. The Twenty-third Street horse cars, for example, now get all the traffic probably to be obtained from those who would use the line even with improved motive power, and this is the case with most of the other crosstown lines with which there is little competition. Now to equip these lines with the cable or the underground electric system, costing from $50,000 to $100,000 per mile, means that the interest on this large additional investment must be made out of the saving in operating expenses alone, and this to probably would be impossible to accomplish. The companies would therefore gladly welcome the advent of a thoroughly sucessful mechanical, air, gas or storage battery motor which could be proven as economical in operation as horse cars, for there are many important collateral reasons for doing away with horses wherever it is possible to do so, even without the prospect of any large saving. Whether or not there has been sufficient advance made in compressed air motor work to warrant the hope that the motors now being tried in New York will be more successful than those used abroad, is yet a matter of doubt, as the exact workings of the new apparatus are for the present withheld by the inventors. There is no doubt that good work has been done by the Government and private investigators during the last few years in the line of more economical use of compressed air, but when all is said and done there must be many solid advantages proven by the advocates of compressed air in order to outweigh the tremendous disadvantages of reciprocating parts, sometimes imperfect traction, valve difficulties and general complication of the apparatus. In any event no one need expect, we believe, that compressed air will be as economical in operation as the overhead electric system, or that it will have anything like its flexibility and reliability in service.

THREE cent fares have proved a failure. After a fair trial of a year under the most favorable conditions they have been found insufficient to pay the necessary expenses of operation, care for current renewals and provide a fund for the replacement of those portions of the equipment which are constantly wearing out or becoming antiquated, but which have a longer life than one or two years. This is the verdict, according to President Pack of the Detroit Railway Company, of the widely heralded experiment in that city, and is exactly in line with the prediction published in the STREET RAILWAY JOURNAL at about the time that the road was inaugurated, of what must necessarily take place. Two and two cannot be made to make more than four by any system of arithmetic, and those who hope by some combination of the figures to produce a result which will look something like five, will find that as time goes on the product will assume such a growing resemblance to four that at last its identity with that number will be unmistakable. So a new road, by charging little or nothing to depreciation, can earn large profits or carry passengers at lower fare, so long as its equipment remains new. But renewals, like death, taxes and some other disagreeable things which we would all like to avoid if we could, will come, and then the question of what the true operating expenses are is determined. The franchise of the Detroit Railway Company relieved it from almost all taxation and all paving, the lines as laid out by the company were extremely short, and with no old track and rolling stock as "assets" it was in a better condition to make the three cent fare a success, if it were possible, than most roads. These grants were subsidies in another form; and if a road were subsidized sufficiently, it could carry passengers for nothing at a profit. The fact that the Detroit Railway could not make money even under these favorable conditions shows upon what a narrow margin of profit street railway companies really operate. A loss of twenty per cent of their gross receipts following a reduction of fares from five to four cents, would send half of our best paying roads into bankruptcy, and would so cripple the others as to make improvements in service practically impossible. A further reduction of twenty per cent would make them all shut down. The actual fare in Detroit, owing to the fact that the three cent fare meant eight tickets for a quarter and cash fares were five cents, averaged about three and a half cents, but even then they could not be made to show a profit. The much mooted question as to whether or not the public will ride enough more frequently at a three cent fare to make the gross receipts equal to those under a five cent fare has been settled most decidedly in the negative so far as Detroit experience is concerned. The company will therefore make some arrangement with the old company by

which it can reduce the number of its cars except on the best paying lines, as its franchise does not permit higher fares.

The Effect of Free Silver on Street Railway Employes.

How would the great working force of our street railway systems—a force numbering, perhaps, 250,000 men—be affected by free silver in the United States? Would it be benefited or injured?

In thinking over such a question as this, a man naturally looks upon it from two points of view—first, "How would such a policy affect my personal interests?" second, "How would such a policy affect my country at large?"

Street railway employes who have heard the silver question discussed know that the one great argument made for free silver is that it will raise the prices of farm products, all manufactured goods, and wages. When the free silver orator talks to the farmers he lays great stress upon the increase in the price of *farming products;* when he is talking to laboring men he says nothing about increased prices for the necessaries and luxuries of life, but only talks about how *wages* will be increased; and finally, when he is fortunate enough to secure an audience of business men and manufacturers, he discourses glibly upon the terribly low prices ruling at present on all *manufactured articles*, and promises an improvement.

Now it does not take an exceptionally clear head to see that if the prices of everything, including wages, are all raised in the same proportion, the average man will be no better off than was the case before. In other words, if an increase in wages, *measured in dollars*, does not increase the purchasing power of a man's daily work, measured in food, clothing and toys for the children, he is no better off than before.

Let us see what the sound money men say about these claims of the silver men. In the first place they freely admit that prices of farm and manufactured products will go up. In fact they claim that this is one of the strongest arguments *against* the free coinage of silver as regards the laboring man, for it compels him to pay largely increased prices for everything which he has to purchase.

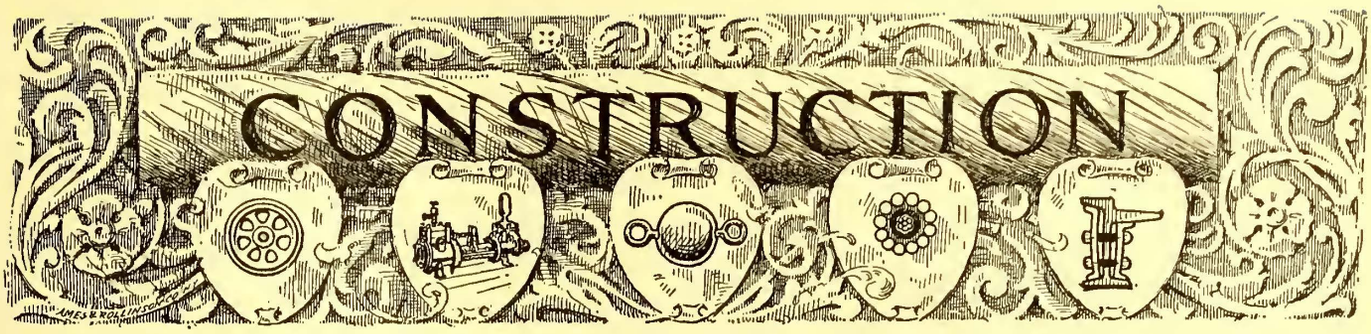
The sound money advocate refuses to believe, however, that the wages of the laborer will rise, or at least will rise in any proportion such as to make the purchasing power of a day's work under free silver anywhere near as great as it is to-day. Wages will surely lag far behind prices of commodities in any rise which may take place and Ex-President Harrison's statement that "the first dirty errand of a dirty dollar is to cheat the workingman" will be verified.

The reasons for this sluggish movement of wages may be looked for in several directions. In the first place, there is little question in the minds of employers and business men all over the country that a widespread financial panic would follow the election of a free silver candidate. Even now, when there is only the remote fear that his election is possible, business is at a standstill and failures are becoming more frequent with the difficulty of borrowing money and making collections. Even the free silver advocates admit that there is likely to be a serious panic in the general rearrangement of values that will follow the adoption of free coinage, but say that after this panic the country will go on freely and joyously to higher prices and great prosperity. Now this prosperity may come to the silver mine owners and some of the debtors of the country, but the question we are considering now is how is the laboring man to be benefitted. If his employers are poor or have just passed through insolvency, are his demands for increased wages likely to be met with favor? If his employers have got to spend more for supplies and wages than they have ever done before, how are their extra profits, promised by the free silver people, going to be realized, and must they not go out of business rather than put wages up to such a point that the working man can live as comfortably as he does at present.

If these sound money arguments are true in regard to labor in general, how much more will they apply to street railway labor. A street railway company cannot possibly raise the price of its one saleable product—passenger transportation. It is fixed by law or by the charters of the different companies, usually at a five cent rate. Moreover, the companies are obliged to pay their interest in most cases in gold and would undoubtedly have to pay a considerable premium on the money that they receive, to get this gold. Their prices for supplies are going up, according to the free silver programme, and with all these burdens upon them, can they afford to also increase the wages to their men? On the contrary it is far more likely that many of our street railway companies will fail outright, unable to carry on business and pay operating expenses and interest. How much chance of increased wages would the street railway employes of an insolvent road have?

Finally, there is the second question referred to above—the general influence of the free silver policy upon the prosperity of the country in general. Every true American loves his country, is proud of it, wishes it to stand high among the nations of the world, with untarnished honor and credit. Every American is proud of the wonderful way in which this country has paid back, since the civil war, $3,000,000,000 of debt. Are we at this time, when less than $1,000,000,000 remains to be paid, willing to repudiate a part of this obligation by saying to the world that we will pay in silver what we originally received in gold? Are we to permit the disease of repudiation to spread among our people? Shall the insurance companies, savings banks and national banks be allowed to pay in silver to their policy holders and depositors that which they have received in gold? Are we to deliberately take rank as a nation with Mexico, India and South American Republics (which are on a silver basis) instead of with England, Germany, France, Russia, Austria—the great and powerful nations of the world? A thousand times "No!" Every consideration of patriotism, honor and self interest makes it the urgent duty of each right thinking American citizen to work with all his voice and influence against the terrible incubus of repudiation and disaster to employer and employed alike, which is sought to be put upon this country by the free silver heresy.

An exceptionally violent thunderstorm occurred in Chicago on Aug. 21, and burned out several of the outside connections in the station of the Chicago City Railway, but as duplicate cables are used on all the outside connections, the operation of the road was not disturbed. The arrester saved the machinery in the power house.



Some Lessons in Car Construction Taught by Old Cars.

By W. E. Partridge.

The three old cars represented in the accompanying engravings were built at a period so far antedating the present that it cannot be exactly determined, so far as can be ascertained. One gentleman upon the examination of them stated that he thought they came into existence about the year 1866; they were certainly not built later than 1869. They were originally horse cars, and ran over a track which for irregularity, unevenness, looseness of joints and general badness cannot at the present time be equalled anywhere within the United States. Mornings and evenings they were crowded; in the middle of the day they jogged along with one or two passengers, and on Sundays they were full all day long and the people hung on to the dashboards. After fifteen or twenty years of this kind of service, during which time they probably never received a coat of paint or varnish, and only such repairs as were absolutely necessary, electricity was introduced as a motive power. The road being in the neighborhood of a great city, and having a large population to serve, adopted the new motive power, and the old horse cars were fitted up with motor trucks, and trolleys were put upon their roofs.

The first of these, shown in Fig. 1, was the No. 1 car of the road. It was well built so far as its framework was concerned, although the panels were not continuous, and there were many features of construction that would not be used at the present day. The only strengthening which it had was a 2 in. × 4 in. piece of oak extending along the bottom of the sill from one end of the truck to the other. The other cars were fitted up in about the same manner. They had been built, however, by other manufacturers, and did not stand the racket quite as well. Had it not been for a decided outcry on the part of the public and a threatened unfavorable legislation, it is not improbable that these same cars might have been running to the present day, instead of having terminated their usefulness after four or five years of electric service.

Fig. 2 was an open car with a canvas roof. Fig. 3 was an ordinary box car. While none of these cars can be said to be of absolutely poor construction, yet some were superior to others. In Fig. 1 the camber of the roof is apparently little changed and the lines of the belts and of the sills are straight. The roof covering, which is apparently the same put on when the car was built, is in fair condition. The panels have held their own remarkably well, though in the center a hole has been knocked through the side and repaired by the insertion of another piece. Their good condition on both this car and that shown in Fig. 3 is very largely due to the fact that the road was a suburban one and did not meet with as much heavy teaming as a city line.

Fig. 2 teaches a number of very important lessons. The posts here were unfortunately rather light and their attachment to the letter board was not made as secure as it should have been. In fact, the letter board appears to have been a panel secured only by screws and not gained or halved on the posts as it should have been. The result of this is the longitudinal crack going clean through the board and the cutting off of the screws which has taken place at nearly every post. Although this roof is of canvas unsupported by boards, yet it appears to be tight all over the car. The natural tendency of painted canvas to swell has caused it to bag between the carlins and to become very unsightly. This roof has held its shape however somewhat better than could have been expected. The trolley truss, which gave the trolley pole very little support, has come down, but it must be remembered that there were no iron carlins in this roof, and that the trolley truss was not in every case supported from carlins which rested on the top of a post.

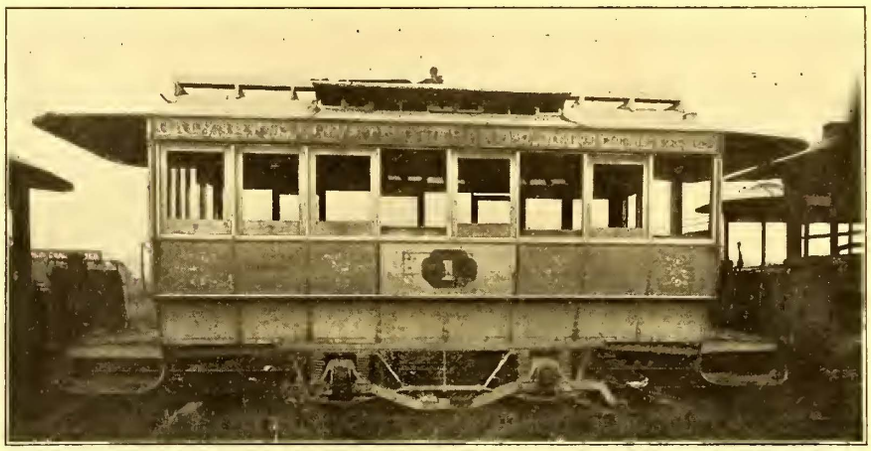


FIG. 1.—HORSE CAR CHANGED TO ELECTRIC CAR, NOW DISCARDED.

One of the greatest sins in the construction is the method by which the running board was supported. The step irons or brackets were cut into the sill from ½ in. to ⅝ in., so that they were flush with the outside face. This, in one way, was equivalent to taking off that much thickness from the sill, but as these notches were square across the timber they acted like breaks already begun, and as a consequence the sill cracked through nearly the whole thickness, starting from one of these notches just over the axle box. Another piece of bad management in putting the motor truck in place was cutting out an inch from the under side of the sill, so as to make the iron top plate of the truck flush with the bottom. A crack started from the end of this notch. It is probable from the position in which the cars were standing at the time the photograph was taken that the smashed hood was not the result of actual wear and tear, but came from the careless way in which the cars were run upon the side track where they are at present dropping to pieces from decay. The ruin of the car shown in Fig. 2 may be said to be due to bad design partly coupled with bad workmanship, but when the atrocious treatment which it received is considered the wonder is not so much that the car went to pieces, but that

it stood so many years of severe usage. It must be premised however that it is a considerably younger car than Fig. 1. The panels at the posts were rather poorly constructed. The seat ends have split away from them in some places, and in others have cracked and gone to pieces in a way that is not at all complimentary to the manufacturer. Their weakness had something to do with the racking of the roof.

FIG. 2.—OLD OPEN CAR.

Fig. 3 is a box car from another manufacturer. The body has held its shape fairly well, although the posts have sprung outward at the top, giving it the appearance of having more than its proper camber. The roof has gone down, even the trussed trolley board being unable to save it. Here we come to one of the peculiar features of monitor roof building. There was no lack of strength in the timbers or carlins to hold up the trolley. It was simply impossible in the old fashioned method of construction to make the joints at the angles in the carlins strong enough to stand the strain. To-day we put in iron carlins sometimes at every post. Most builders forget the true use of the iron, and act as though they depended on the iron to support the roof. The roof is amply strong to support itself under much greater loads than ever come upon it, provided the four angles could be made stiff; that is, the angles at the top and bottom of the monitor sides. Many builders bear this in mind, and so dispose their iron in relation to the woodwork as to strengthen these points to the utmost. This strength gained, there need be no further anxiety in regard to the ability of the roof to stand up to its work.

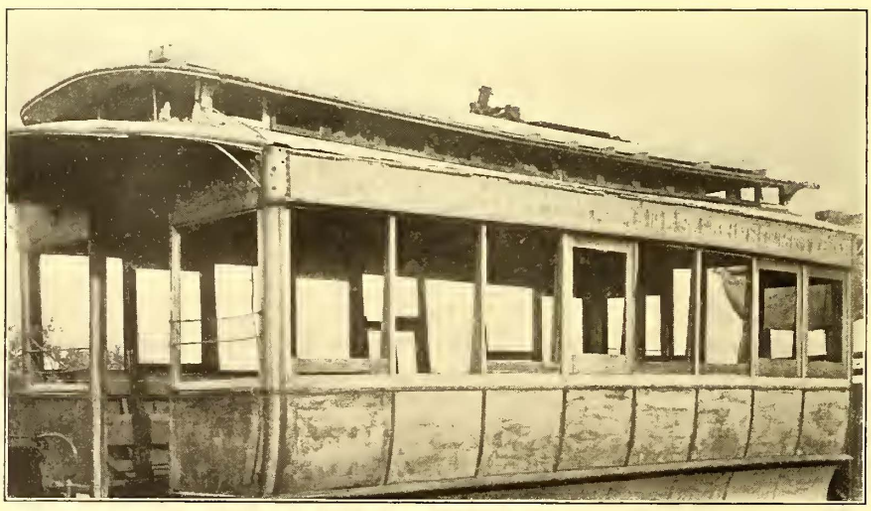


FIG. 3.—OLD MONITOR ROOF BOX CAR.

The covering of this car was perhaps as bad as could well be imagined. It may be taken for granted that from the time it left the shop until the day it went on to the side track the only attention the canvas received was at uncertain intervals a coat of paint. The letter board parted from the post and was reinforced at a later date by a piece of iron nailed around the corner. As this iron went outside of the upper moulding, it probably answered not only the purpose intended, but the other more destructive one of conducting the drip down along the post to the inside of the car.

How severe the service was may be judged from the fact that the paint has gone almost all over the panels down to the bare wood. In this car there were many decayed posts, and the plate was broken in several places. Several errors were committed in the design of this car which helped to the destruction, the roof especially being weak and the arrangement of the ventilators such as to give a fewer number of posts on the side of the raised room than was desirable.

The cars in Figs. 2 and 3 are a most marked contrast in their condition to that of Fig. 1, which is in a remarkably good state of preservation and at the time it was condemned could without much difficulty have been repaired and made to do good service for many years longer.

Changes in Station and Track Construction in New York.

The cable winding drums in both of the main power stations of the Third Avenue Railway Company, New York, which were originally cast solid and pressed on their shafts, have had to be renewed recently, owing to the breaking of rims and spokes from shrinkage strains. Split drums with the hubs bolted to the shafts have been substituted and these so far stand up to the work with no signs of failure. These renewals have been necessary after a little more than two years and a half of service. It is thought that the cause of the failure of the drums was as noted, for the reason that the maximum horse power transmitted was not excessive, being in the Sixty-fifth Street station about 1000 h. p. and in the Bayard Street station about 500 h. p. A change has also been made in the tension apparatus of the Sixty-fifth Street station. Formerly the tension weights were suspended in wells, now steel towers have been substituted. These are thirty-seven feet high and are placed in pairs on each side of the building. The tail ropes of the tension carriages are led out at right angles to the rims and pass over sheaves at the top of the towers and under traveling sheaves attached to the weights. This arrangement gives a long and free travel for the weights and the latter are always accessible for inspection and the changing of plates.

RAIL JOINTS.

Light has also been thrown on the rail joint question by the operation of the lines controlled by the Third Avenue Company.

In the construction of the Tenth Avenue and 125th Street lines, the former of which was put in operation in 1885, and the latter in 1886, a seventy-eight pound, 5½ in., center bearing girder rail was employed, and the joints were supported on the yokes. It was observed however after a time that there was considerable wear between the base of the rail and the yokes, causing low joints; hence,

when the line on Third Avenue was designed it was decided to suspend the joints, and the line was so constructed and the opposite rails laid with broken joints. The rail employed was an eighty pound, seven inch, grooved girder, and the joints were united by heavy six-bolt fishplates and nut lock washers. Now, after a service of 2½ years, the joints have gone down to an alarming extent, while opposite each joint, or rather a few inches in advance, the rails are brightened and dented by the reaction of the opposite wheel, thus inducing a hammer blow in the middle of each rail as well as at the ends. The cost for repairs in this case is augmented by the construction of the paving, which between the rails consists of granite blocks grouted with Portland cement, while that outside the rails is grouted with gravel and asphalt. Repairs can be made by renewing or tightening up the fishplates, while in the case of suspended joints, shims can be employed to help sustain the load. The company contemplates the employment of the Falk cast weld joint in future repairs.

Some idea of the service imposed on the rail joints of this line can be formed when it is remembered that during the greater portion of the day cars are run on forty seconds headway, every other run being a two car train, so that ten wheels pass, or ten blows are dealt to a joint every forty seconds, or fifteen per minute.

The Growth of Electric Railways in Southern New England.

In certain respects the states of Massachusetts, Rhode Island and Connecticut have been most favorably situated for the installation and rapid extension of electric railways. In the early days of electric railroading they were close to the homes of the two principal railway equipment companies and where capital could easily be secured for electrical enterprises; moreover, the territory is for the most part populous and prosperous. On the other hand, there were certain conditions which militated against a rapid growth of electric roads. The steam railroads were strong financially, the fares charged on them were low, being almost universally two cents a mile on the trunk lines, and at first sight it seemed that comparatively little new territory remained to be developed. Again, in Connecticut, the work of equipment by electricity was delayed for several years, owing to political causes which produced a deadlock between the Legislature and Governor and prevented the passage of the necessary ordinances.

The accompanying tables, showing statistics of steam and street railways in the three states for the year ending June 30, 1895, were compiled from official sources, and present very interesting information upon the relative extent and amount of traffic carried by the different systems in the three states. As will be seen, the number of passengers on the electric roads was from two to six times that carried on the steam roads. The gross receipts given for

STATISTICS OF STEAM ROADS IN MASSACHUSETTS, RHODE ISLAND AND CONNECTICUT.

	MASS.	R. I.	CONN.
Number of miles operated*.....	7,980	480	1,719
No. of passenger cars operated.....	1,839	192	801
Passengers carried.....	55,387,525	5,254,287	18,621,732
Passengers carried, per capita.....	25	15	24
Gross receipts, freight and passenger.	$34,858,035	$3,982,261	$14,519,259

*Measured as single track.

the steam railways include those derived from both passenger and freight traffic, as the two could not be separated in all cases. As given in their reports, the number of cars operated, passengers carried and gross receipts of the steam railways located in two or more states are given *in toto* and are not separated according to the different states. The figures given in the table represent these totals divided for each state in proportion to the number of miles of track operated in each. All the street railways in Connecticut and Rhode Island, and all but sixty-two miles in Massachusetts, are operated by electric power.

The construction of electric roads in the three states has been on the whole on most conservative lines. In Connecticut, the statutes covering the construction of new electric railways are particularly stringent. No street railway can be built between one town and another on public highways so as to parallel any other street railway or steam railroad, until it shall have proved in a hearing before a

STATISTICS OF STREET RAILWAYS IN MASSACHUSETTS, RHODE ISLAND AND CONNECTICUT.

	MASS.	R. I.	CONN.
Number of miles operated.....	1,087	143	317
Number of cars operated.....	4,426	636	896
Passengers carried.....	259,794,308	32,618,473	38,037,474
Passengers carried, per capita..	112	94	50
Gross receipts.....	$13,246,372	$1,624,281	$2,232,051

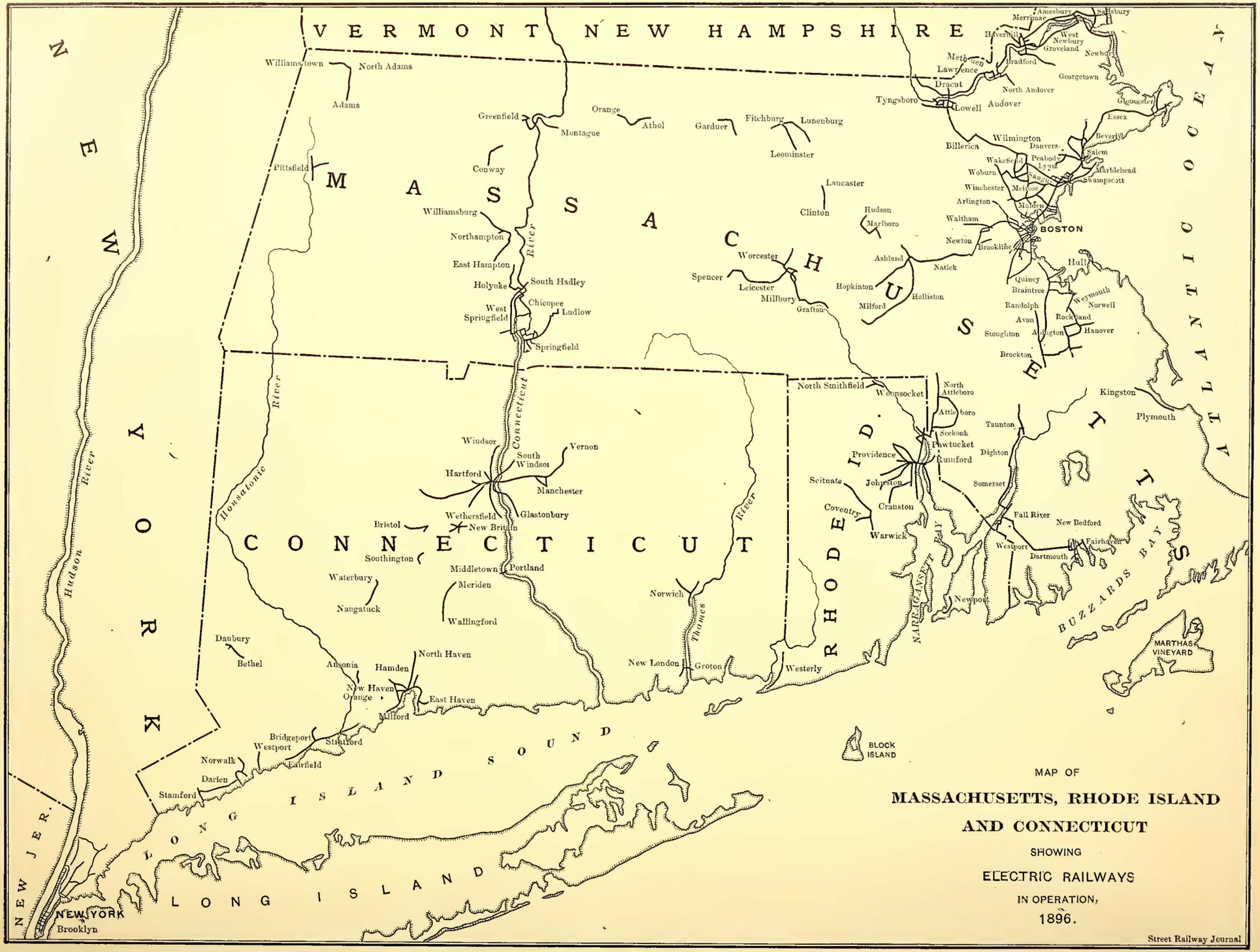
judge of the Superior Court that public convenience and necessity require its construction. This is intended to prevent a paralleling of an existing road which would prove disastrous for both old and new enterprise. Freight transportation is prohibited except under special permission and under such regulations as may be prescribed from time to time by the Superior Court. The issue of bonds in excess of fifty per cent of the actual cost of construction and equipment of such a line is also prohibited. The actual cost must be certified to under oath by the president and treasurer of the company and a civil engineer approved by the comptroller of the state.

In Massachusetts any proposed issue of bonds by a street railway company must first be submitted for the approval of the Railroad Commissioners of the state with an explicit declaration of the purposes of the issue, and unless the commissioners consider it for the best interests of the road and according to statute, permission is refused.

The construction of electric roads has necessarily had a marked effect on the business of the large steam railroad companies. The short distance travel on the latter has shown a marked falling off during the past year and two years, and that this has not been due to the general business depression is evinced by the fact that the long distance travel was larger during the past year than in 1894; that is, with a total decrease in number of passengers carried, there has been a total increase in passenger mileage. In the steam railroad traffic in and out of Boston alone, this decrease in number of passengers amounted to 750,000 and the falling off in this travel in and out of Boston, as compared with 1893, the high-water year in traffic and revenue, was more than 4,565,000. For the ten years ending with 1893 there had been, on the other hand, an average annual increase of nearly 2,500,000 in the number of passengers by railroads to and from Boston.

The question for the steam railroads of whether it is possible to recover some of the short distance travel, and if so, the best way of accomplishing this result, is an important one. Would the electric equipment of its lines for passenger transportation, or in any event for local passenger traffic, help to secure this?

The following are the principal considerations which induce a selection between routes of travel between different places: comfort of cars, speed, frequency of service, rate of fare and length of time required to reach the starting point at one end and to go from the stopping point at the other end of the journey to the point desired. So far as the first two considerations are concerned the advantages are now with the steam railroad company. In rate of fare it is possible that with considerable traffic it would be as cheap to operate with steam as with electricity. In the fifth and last consideration the railroad company operating over its own right of way cannot expect to compete with the street railway which occupies the highway. The question of frequency of service then alone remains, and this is one largely of amount of traffic. If the latter is in such


VERMONT
NEW HAMPSHIRE
NEW YORK
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
ATLANTIC OCEAN
LONG ISLAND SOUND
LONG ISLAND
NEW JER.
Williamstown
North Adams
Adams
Greenfield
Montague
Orange
Athol
Garduer
Fitchburg
Lunenburg
Leominster
Pittsfield
Conway
Williamsburg
Northampton
East Hampton
Holyoke
South Hadley
Chicopee
Ludlow
West Springfield
Springfield
Laucaster
Clinton
Hudson
Marlboro
Worcester
Spencer
Leicester
Millbury
Grafton
Ashland
Natick
Hopkinton
Holliston
Milford
Waltham
Newton
Brookline
BOSTON
Arlington
Winchester
Woburn
Wakefield
Billerica
Tyngsboro
Lowell
Dracut
Andover
North Andover
Lawrence
Methuen
Haverhill
Amesbury
Merrimac
Salisbury
West Newbury
Groveland
Bradford
Georgetown
Newbury
Gloucester
Essex
Beverly
Danvers
Salem
Peabody
Lynn
Marblehead
Swampscott
Malden
Melrose
Saugus
Hull
Quincy
Braintree
Weymouth
Norwell
Randolph
Avon
Rockland
Stoughton
Abington
Hanover
Brockton
Plymouth
Kingston
Taunton
North Attleboro
Attleboro
Seekonk
Pawtucket
Central Falls
Providence
Rumford
Dighton
Somerset
Fall River
New Bedford
Fairhaven
Westport
Dartmouth
Johnston
Scituate
Cranston
Coventry
Warwick
North Smithfield
Woonsocket
Narragansett Bay
Buzzards Bay
Newport
Westerly
Block Island
Martha's Vineyard
Windsor
South Windsor
Vernon
Hartford
Manchester
Wethersfield
Glastonbury
Bristol
New Britain
Southington
Middletown
Portland
Waterbury
Meriden
Naugatuck
Wallingford
Norwich
New London
Groton
Thames River
Connecticut River
Housatonic River
Hudson River
Daubury
Bethel
Ansonia
Hamden
North Haven
New Haven
Orange
East Haven
Milford
Bridgeport
Westport
Stratford
Fairfield
Norwalk
Darien
Stamford
NEW YORK
Brooklyn
MAP OF
MASSACHUSETTS, RHODE ISLAND
AND CONNECTICUT
SHOWING
ELECTRIC RAILWAYS
IN OPERATION,
1896.
Street Railway Journal

amount as to warrant the frequent running of steam trains at short intervals, little will be gained by the application of electricity. That is, if there are enough passengers to fill three or four-car trains running on a headway of from ten to fifteen minutes or oftener, but little more suburban travel would probably be gained by single electric cars at more frequent intervals. If however the traffic will only warrant the operation of trains at long intervals, say, once an hour, there would be a distinct traffic advantage in operating single electrical cars at more frequent intervals.

This seems to have been the line of reasoning followed by the managers of the New York, New Haven & Hartford Railroad Company, whose engineers are now looking very carefully into the subject of the third rail system of transmitting the current to the cars. The experiments on the Nantasket Beach line are familiar to the readers of the STREET RAILWAY JOURNAL, and after a test of certain improvements which are proposed on this line, the New Canaan line, extending from Stamford to New Canaan, a distance of some seven miles, will probably be also equipped with the system.

The land transportation between Boston and New York is now, and has been for a long time a monopoly of the New York, New Haven & Hartford Railroad Company, and during the early history of electric railway construction the possibility of the completion of a parallel line between these two large cities was the subject of a great deal of thought and discussion. All plans for such a parallel line have been strenuously fought by the steam railroad system, which to make its position stronger finally secured control of the electric railway systems in Stamford and Meriden, Conn. As will be seen from the accompanying map, any parallel electric line designed to operate between the cities of Boston and New York and secure any considerable amount of local traffic must almost of necessity pass through these two cities, so that in the ownership of these lines the steam railroad company has materially strengthened its position. It is also rumored that the company controls one or two other properties between New York and Boston.

That portion of the map showing the electric lines in Massachusetts is a reproduction on a small scale of a large map drawn to the scale of 2.9 miles to the inch, by R. H. Derrah, assistant to the president of the West End Street Railway of Boston. Mr. Derrah, who kindly consented to the reproduction of his map on the scale given spent a great deal of time in the preparation of his large map, and all the different lines are drawn upon it with great detail and care. The map given shows the lines as built the first part of this year.

As yet the traffic of the electric roads has been confined almost entirely to short distance travel The two cities furthest separated which are connected by electric railway are Hopedale, Mass., southwest of Milford, and Newburyport, Mass. A person traveling from one place to the other would have to make a circuitous route through Boston, Lowell and Lawence. The method of making such a trip, time required and lines used are shown in the accompanying table, for the data in which we are also indebted to Mr. Derrah.

Towns.	Name of Street Railway Company.	Miles.	Fare.	Time. h.	Time. m.
Hopedale to Natick	South Middlesex St. Ry. Co.	18	$0.25	1	40
Natick to Wellesley Hills	Wellesley & Boston St. Ry. Co.	4	.15	.....	26
Wellesley Hills to West Newton	Natick & Cochituate St. Ry. Co.	3½	.10	.....	20
West Newton to Newton	Newton St. Ry. Co.	3	.05	.....	21
Newton to Boston	West End St. Ry. Co.	7½	.10	.....	53
Boston to Malden	West End St. Ry. Co.	6½	.05	.....	49
Malden to Melrose	Lynn & Boston R. R. Co.	3	.05	.....	12
Melrose to Reading	Wakefield & Stoneham St. Ry. Co.	6	.05	.....	30
Reading to Billerica Centre	Reading & Lowell St. Ry. Co.	13½	.15	1	07
Billerica Centre to Lowell	Lowell & Suburban St. Ry. Co.	6	.10	.....	45
Lowell to Haverhill	Lowell, Lawrence & Haverhill St. Ry. Co.	20	.25	2	.....
Haverhill to Salisbury Beach	Haverhill & Amesbury St. Ry. Co.	17	.35	2	.....
Total		108	$1.65	11	03

Running Notches of Series Parallel Controllers Compared.

BY S. L. FOSTER.

At the present time when so much engineering skill is being devoted to the problems of making the evaporation per pound of coal in boilers a maximum, the consumption of steam per horse power in engines a minimum, the efficiency of generators at all loads the greatest possible, and the sum of the interest on the copper feeders plus the cost of the power wasted in transmission the least possible, it is well not to overlook the economies in the cause of producing this carefully tended power. The cars whose propulsion requires the production of this power are often so situated with relation to the power house that one horse power wasted or one horse power saved on them means two horse power more or two horse power less to be produced at the power house. This being the case, it is important to make the amount of power used by each car a minimum.

In the course of improvement, the General Electric Company has recently brought out the G. E. 1000 motor of slightly larger capacity than the G. E. 800. With the production of this new motor, which is likely to become that company's standard street railway motor, a new controller has been furnished in which the use of the shunted field for running points is abandoned. This controller can be safely taken as the latest improvement in controllers and a few data on the superseded K type may not be amiss, as showing how out of several ways of using this controller there is often one most economical way for a given speed.

When the old controller came out first, the directions accompanying it specified four of the notches as "running" notches as distinct from the other three which were to be used only as starting or transmission notches. The running notches were notch 3—motors in series, full field—notch 4—motors in series, shunted field—notch 6—motors in multiple, full field—notch 7—motors in multiple, shunted field. Nothing was said about the relative expenditure of power or the economy at these four notches, and the matter has been discussed considerably by car house men and motormen with very little satisfactory result. "Instructions for motormen" have been published from time to time by various street railway companies, and almost invariably notch 4 has been recommended as an "economical" or "efficient" notch for long continuous running.

The current diverted from the field windings by the shunt around them seemed to necessarily involve a positive loss of energy, and logically it seemed unreasonable that it was equally "economical" or "efficient" to run with shunted field as with full field. The following data were collected in San Francisco for the purpose of clearing this matter up and at the same time rendering the relative condition of affairs at the different notches intelligible to the average motorman. The results seem to conclusively prove that the shunted field with motors in series is suitable only as a transition notch, and for continuous running is the least economical of all so-called "running" notches.

These data render clear the relative absorption of power and relative speeds at different notches and combinations, and show, as could be anticipated from theory, that the motors in multiple with full field is the best method of running the car. They show the motorman that he can run his car more economically by avoiding as much as possible the use of the shunted field for continuous running, especially when the motors are in series, but they still leave the excuse open for him, that he can not "make his time" except by using the shunted field notches. In this case time tables may require some changes.

These figures are not based on theory, nor are they claimed to cover all cases. They show the state of affairs that existed with an 8½ ton, single truck car equipped with two G. E. 800 motors and propelled over a dead level roadway built of seventy pound, center bearing rail, entirely free of low joints and dirt of all kinds.

The speed to be used usually depends on local condi-

tions. The headway is governed by the traffic met with. The point sought to be brought out in this article is that, in the case of ordinary speeds that can be obtained by either of several combinations of notches on the K controller, there is a great difference in the amounts of power required—or what is the same, the coal burned—between these various combinations for the same speed.

All street railways differ in such features as cars, motors, line voltages, rails, cost of labor, cost of power, etc., and it behooves each one to investigate for itself as to whether the cost per car mile can be reduced or not.

Only three instruments are required—an ammeter, a voltmeter, and a stop watch—and the possible saving in power per car mile is from two to ten per cent as a return for the intelligent use of the information gained. Two per cent may seem trifling, but it assumes a very respectable figure when 200 cars are considered, each making 50,000 car miles annually.

For the purpose of this test a stretch of electric track along the sea wall in San Francisco, that was absolutely level and comparatively free of wagon traffic, was selected. The poles were numbered and the distance between poles carefully measured. The readings taken were amperes, volts and feet per second for the four running notches—3, 4, 6 and 7. The same crew, readers, car, weather load and acceleration were used throughout the tests. In all cases the car was brought up to the speed that the notch under test would produce and kept there for 200 ft. before any readings were taken. The length of the course was 200 ft. and all readings subject to the slightest suspicion were rejected. The voltage varied during the tests, as all street railway voltage does, but not excessively, the maximum being 520, the minimum 475 and the average of all readings 500 exactly. Weston instruments and a split second stop watch were used.

After collecting the data on the four running notches mentioned and deducting from them the results to be explained later, various simple combinations of these notches were considered. The table following shows the variation in speed and in power absorbed.

I.	II.	III.	IV.	V.	VI.
3 all the way	.61	1.	1.		
4 " " "	.814	1.334	1.131	2.34	5.06
3 half the way / 6 " " "	.8865	1.45	1.229	1.801	3.48
3 " " " / 7 " " "	1.	1.639	1.288	1.95	3.86
4 " " " / 6 " " "	.9885	1.620	1.294	1.87	3.66
4 " " " / 7 " " "	1.102	1.806	1,354	1.95	3.86
6 all the way	1.163	1.9	1.46	1.69	3.23
7 " " "	1.39	2.27	1.58	1.79	3.46

In column I are given the notches used, as for example, "notch 3 all the way," " 3 half the way and 6 half the way," etc.

In column II are given the kilowatt hours per mile of continuous run.

In column III are given the comparative kilowatt hours per mile run, using that required at notch 3 as unity.

In column IV the comparative speeds attained are given, using that at notch 3 as unity.

In column V are given those powers of the speed, the kilowatt hours per mile run are, as for instance, at notch 4 the kilowatt hours per mile run—or the power—increase as the 2.34ths power of the speed, etc.

In column VI, to render clearer by exaggeration the meaning of the figures in column V, are given those multiples of the kilowatt hours per mile used at notch 3 that would be expected at the notch or combination of notches indicated, if the speed were to continue to increase at the same rate that it now does until the notch 3 speed is doubled, as for instance, in order, by using notch 4 all the way, to double the speed prevailing at notch 3, 5.06 times as many kilowatt hours per mile would be required, etc. Of course, theoretical considerations of oversaturated fields, etc., are omitted in getting the figures of column VI.

This table shows that in order to get the greatest acceleration per kilowatt hour expended, the car should be run at notch 6 all the way. Next in point of economy comes the use of notch 7 all the way; then notch 3 half the way and notch 6 half the way, and notch 4 half the way and notch 6 half the way. The combinations of notch 3 and notch 7 and notch 4 and notch 7, showing no difference in the first two decimal places, come next with the use of notch 4 all the way as the least economical method of all.

The gist of these data and deductions is—*for work on the level:*

If slow speed is allowable, run on notch 3, as the slower the speed the less the power absorbed. But see later on "coasting."

If high speed is required, use notch 6 or 7—preferably 6—continuously, as they are the most efficient notches.

If intermediate speeds are necessary, use notch 4 as little as possible, as it is the least efficient of the running notches.

Attention should be called to the difference between the terms "car mile" and "mile of continuous run." In ordinary city work during not over half of the running time is the car running under a "running" notch. The other half of the trip is occupied by starting and coasting. The figures just given are for "mile of continuous run." What the figures per "car mile" would be would depend largely on the motorman and the frequency of stopping.

A single truck car in city service usually runs 130 miles a day, and costs, depending on the price of fuel, from $1 to $3.50 per day for power to propel it. Now if it can be shown that by using notch 3 and notch 6 instead of notch 4 and notch 6 a saving of 11½ per cent in power can be effected with a loss of but five per cent in speed, the average superintendent should consider the subject worth investigating, especially as fuel constitutes from sixty to eighty per cent of the power house expense. If the running time is so fast now or the lay-over at the termini so short that it is impossible to allow of a reduction of five per cent in the speed, a saving may still be possible, for, as a general rule, it is found that if the running time is made now by a combination of notches containing a shunted field notch and, by changing timing points, can be made by a combination not containing such a notch, it will be accomplished for less power.

A consideration of the following three sample cases bears out the above statement. The number of these cases might be increased, but these three seemed to sufficiently point out the idea aimed at. It may be well to state here that the object of the motorman should be to just make schedule time and no more. That rushing over the route on notch 6 or 7 and then laying over a long time at the terminus is wasteful can be seen by inspecting the preceding table where it is seen that, in going a mile at notch 6, ninety per cent more power is required than when traversing the same course at notch 3.

These figures mean that the same time as is made on the level by using notch 4 for the whole distance run can be made by using notch 3 for seventy per cent of the distance and notch 6 for thirty per cent of the distance with nearly 6 per cent less power.

The use of notch 4 for half the distance and notch 6 for half the distance is a very usual combination. The same average speed can be made in three other ways. By one a saving of 2¼ per cent is made and by the others, involving the use of shunted field, a loss is incurred. The use of notch 4 and notch 7 is not frequent, but it serves as a good example. It is interesting to see how the more the shunted field is avoided the greater the improvement is.

We thus see that the use of the shunted field with the motors in series, while useful as a transition notch, and convenient for short runs is not as economical a notch for long continuous runs as combinations of other notches. It is similar to the case of the "loop" on roads having heavy grades. The "loop" was an ingenious, effective and safe way to increase the speed on the level. It was abused by many motormen however by being used on grades, and when it was found impossible to prevent this abuse, the "loop" connection was cut off the rheostat altogether. So with the shunted field method for accelera-

tion; it is an excellent device when used with judgment, but is liable to abuse in the hands of ignorant or careless men, and in the absence of a sure means of preventing this abuse, it has been abandoned.

The comparative value of full field and shunted field notches was obtained by another means—that of the portable recording wattmeter, as a check on the preceding figures. This test was made on three different lines and was conducted as follows: for a continuous week embracing about 1000 car miles of run, the motorman was instructed to use notch 3 and notch 6 only, avoiding notches 4 and 7 for continuous running. During the following week the method of handling the car was reversed. The results all pointed the same way. In one the exclusive use of notches 3 and 6 showed a saving of 1½ per cent, in another a saving of 2¾ per cent and in the third a saving of 9.3 per cent over the more or less exclusive use of notches 4 and 7.

DIFFERENT METHODS COMPARED FOR SAME SPEED ON THE LEVEL.

Notch.	Proportion of distance used. %	K. W. hours per mile.	Feet per second.	Saving. %	Loss. %
4	100	.814	17.	. . . . .	. . . . .
3 6	71.4 28.6	.768	17.	5.65	. . . . .
4 6	50 50	.988	19.47	. . . . .	. . . . .
3 6	35.5 64.5	.966	19.47	2.23	. . . . .
3 7	48.9 51.1	1.008	19.47	. . . . .	2.02
4 7	63.3 36.7	1.025	19.47	. . . . .	3.74
4 7	50 50	1.102	20.36	. . . . .	. . . .
3 7	38.6 61.4	1.089	20.36	1.18	. . . . .
4 6	31.8 68.2	1.052	20.36	4.53	. . . . .
3 6	22.7 77.3	1.037	20.36	5.89	. . . . .

A simple and interesting experiment is to take two stop watches and ride over a line with a motorman who usually confines himself to notch 4 and notch 6. Note the proportion of the current-taking time each notch occupies and figure from this and the data in the first table given, or a similar one, the average speed. Then, using the same table, calculate how the same speed could be produced by using notch 3 and notch 6 and the saving in power realized. Several trips on practically level lines furnished the following results:

PRESENT METHOD.		POSSIBLE METHOD.		Saving. %
Notch.	Proportion used. %	Notch.	Proportion used. %	
6 4	64.5 35.5	6 3	74.7 25.3	1.6
6 4	19.5 80.5	6 3	42.5 57.5	4.21
6 4	45. 55.	6 3	60.7 39.3	2.62
6 4	63.6 36.4	6 3	74. 26.	1.7

The figures in the table were based on work done on the level, whereas most "level" railroad lines contain some slight grades. The saving calculated would thus fail of being exact. It can easily be seen however that the results will be fairly accurate, and in case they all point the same way should encourage further investigation by means of the portable wattmeter.

During these tests the question was asked, Which is the more economical method of handling a car on a long level line with slight grades—using slow speed notches continuously where timing points seem to require them, or working the speed up to notch 6 and then throwing the current off, letting the car coast until the speed has dropped to about notch 3 speed, working up again, coasting and so on? The latter method was decided the better as notch 6 is the most economical notch, and a method whereby all the acceleration of the car was gained under notch 6 must be the best. To settle it more definitely three trips were taken on each car and the "coaster" was found to make the same time, over the same course, for respectively 19, 12.5 and 14 per cent less power than the man using notches 3 and 4 for long stretches. These results are certainly surprising and combined with the results set forth in the article published in the June, 1896, number of the Journal on "Ascending Grades by Electric Force," where notch 6 was shown to be the most economical of power on grades, they show the importance of laying out timing points or running times so as to allow of the use of notch 6 as much as possible.

Electric Heaters of To-day.

The present season being the one in which the thoughts of street railway managers naturally turn to the question of the heating of their cars, some particulars upon the present status of electric heaters may not be without interest. While more expensive as producers of heat than stoves, the advantages in the line of compactness, greater ease of operation and reduced liability of fire, more than counterbalance, in the opinion of many street railway managers, the greater expense. As a result the number of railways operating electric heaters has increased during the past two years, as has the number of manufacturers, so that now there are many types of heaters on the market.

Most of these are familiar to readers of the STREET RAILWAY JOURNAL, but as certain changes have been made during the year in a number of types, some of the improved forms are illustrated herewith.

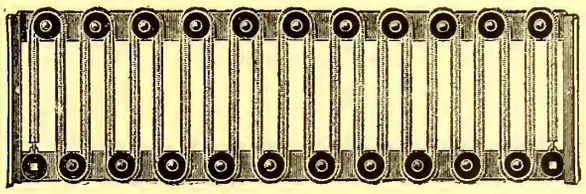


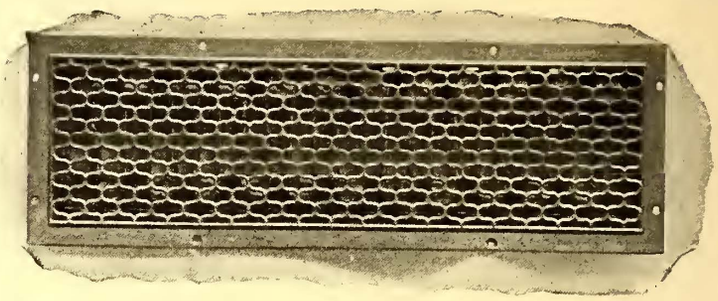
FIG. 1.—SECTION OF AMERICAN HEATER.

A view with the case removed, of the heater of the American Electric Heating Corporation is shown in Fig. 1. The coils are fastened to a terminal insulator at either end and are supported throughout their entire length by an asbestos cord placed inside, drawn taut and fastened on the terminal insulators, permitting of adjacent turns of the coil being placed quite close to each other without fear of accidental contact. In the event of a possible break from any cause the coil is held firmly in place, and no short circuit or similar trouble can develop. The frame is made of light steel, and steel studs support the porcelain insulators which carry the coils. The metal from which the wire is drawn is a special grade of steel which does not change its resistance with use.

The heaters can either be fastened to the floor under the seats, as shown in Fig. 2, or in side seat cars, placed with their fronts flush with the riser under the seat, as in Fig. 3. The advantages claimed for this latter are briefly as follows: it has a small radiating surface at the back underneath the seats, where whatever heat is dissipated is practically lost. It is twelve pounds lighter per heater than any other of this class made; making a difference of from

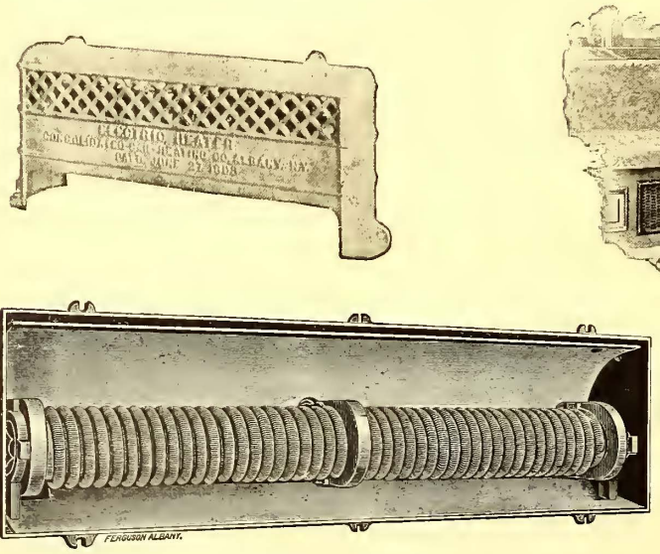
fifty to one hundred pounds per car according to the number of heaters placed in the car. It is capable of three gradations of heat. The coils are disposed of behind the grid or lattice work of the heater, in such a manner as to get the maximum effect of radiant heat.

A new detail of construction enables all heaters to be in service at the same time, with three different adjustments of heat, distributing the heat uniformly throughout the entire length of each heater case regardless of the total amount being supplied. The heaters are usually made to use three, five or eight amperes as may be required by the weather. The arrangement of the heating coils is such that the principal radiation is from the front surface, i. e., towards the center of the car when placed along the sides, a more efficient method than when both sides of the case may be come equally heated. When three divisions of heat only are required they can be secured with a pair of single switches or a combination switch.



FIGS. 2 AND 3.—AMERICAN HEATERS.

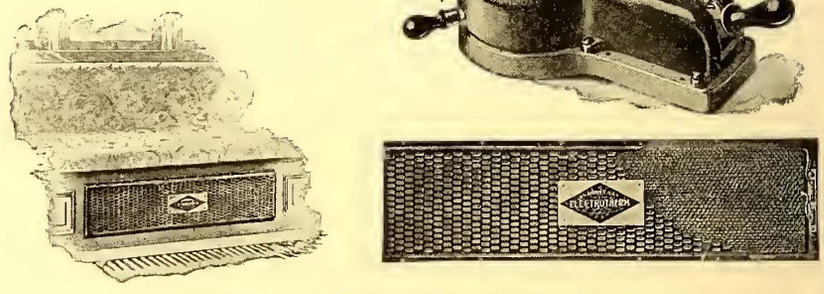
The heaters of the Consolidated Car Heating Company are illustrated in Figs. 4 and 5. A coiled wire is used as a resistance as in each of the other types of heater mentioned, but the heater differs radically from those described, in the method of supporting the wire. This is accomplished by first winding the wire in the form of a coil, and then winding the coil so formed in a spiral path around a porcelain rod, where it rests in grooves made especially for it. In this way, the coils being separated for their entire length, there is no danger of a possible short circuiting, while the form presents about as compact a method of construction as could well be devised. Another advantage claimed for this form of heater is that the wire coil cannot vibrate with the jarring of the heater, and the danger of crystallization of the wire from the heat and jarring is thus removed. Another evident advantage of this construction lies in the fact that the coil of wire can be easily removed from its supports and replaced, without interfering with the other parts of the heater.



FIGS. 4 AND 5.—FORMS OF CONSOLIDATED HEATER.

The form shown in Fig. 5 is that which is used when the heater is placed behind the riser. This heater is provided with a circulating air space between the insulated lining and the back casing, preventing the loss of heat under the car seat. There are over 50,000 of these coils in use, some of which have been in service for four years, and the Consolidated Car Heating Company claims that none of them has ever burned out in regular use.

Figs. 6, 7 and 8 show a different type of heater manufactured by the H. W. Johns Manufacturing Company. The construction of these heaters is radically different from that just described. The resistance wires are completely covered with asbestos thread, and are then woven into a mat or cloth, the warp of which consists of asbestos cords. The mat, or "Electrotherm," thus formed is then thoroughly impregnated with a special insulating varnish baked in at high temperature, and is attached to a backing of asbestos millboard, similarly prepared, the completed heater being enclosed in an ornamental perforated steel casing, japanned or otherwise decorated, as illustrated in the sectional view. Hardened asbestos washers, or knobs, which will not crack or split under pressure, or a blow, are utilized to separate the heater from the panel below the seat to which it is attached. Two binding posts, mounted on heatproof insulation, are provided at each end of the heater for the electrical connections. The usual lengths of the heaters are thirty-three inches and thirty-seven inches, the width in each case being nine inches. The heaters are very thin and unobtrusive, being only 7/8 in. thick; they are light in weight and have no projections which may injure clothing, and occupy no valuable space.



FIGS. 6, 7 AND 8.—JOHNS HEATER AND SWITCH.

The protection from direct contact with the atmosphere afforded the resistance wire by the airtight envelope is claimed to be a valuable feature, in that oxidation, either in the form of rust from condensation, dampness or scaling from overheating, is practically impossible. Vibration, and consequent crystallization from this cause, is also prevented by the weaving of the wires in a compact mat; and short circuits and the cutting out of resistance by reason of the wires coming in contact with each other, are obviated. Another advantage gained by the mat form of heater, is the ability to create a high resistance, if required, with a great length of comparatively fine iron wire, and to provide an extraordinarily large radiating surface for the heat generated. As the heaters are screwed to the faces of the panels, no cutting or mutilation of the car is necessary.

The operation of the heaters is controlled by the

"H. W. J." patented knife switch, which is positive in action, and substantially constructed, with ample space for breaking the arc in a 500 volt circuit, as shown in the illustration. To meet the changing conditions of the weather, the switch provides for three degrees of regulation. With the standard equipment of twelve heaters to an eighteen foot car, the intensities of the current are about three, five and eight amperes when the switch is at the positions 1, 2 and 3 respectively.

In the design of the Gold electric heater, the principal object sought has been to utilize the electrical energy consumed to the best advantage, by having the resistance coils so placed that all of the cold air entering the heater at the bottom is thoroughly cut up and divided into the minutest particles by the hot resistance wires. This is based upon the theory that to most thoroughly heat cold air, it must first be separated into small portions, and this principle in the Gold heater has been carried to its fullest extent. The Gold Company has several different styles of heaters, all of which however are constructed on the same principle as outlined above, different patterns of heaters having been gotten up to suit the various kinds of cars which have been equipped. Considerable attention has also been given to securing handsome designs for the heater casings.

The resistance coils of the Gold heater are usually of 1¼ ins. diameter and generally three coils high, one placed

FIG. 9.—VIEW SHOWING SECTION—GOLD HEATER.

directly above the other in a horizontal position, as shown in the engraving (Fig. 9). These coils are held securely in position by slight grooves in the solid and specially prepared enamel plates, so that in the improbable event of a wire breaking, it would be impossible for it to leave its original position, thereby avoiding any short circuit or burning of wires or fuses. It is self-evident however that

FIG. 10.—CASING—GOLD HEATER.

there can be no strain or tension put upon the wires of the resistance coils when they are placed in position. The resistance wire is of special composition to provide against oxidation.

With the Gold electric heater three gradations of heat are obtainable by means of an especially constructed switch, the different degrees being shown by points on a dial below the handle. The regulation takes place in each individual heater, no heaters being cut out; for instance, the heaters are wired and so connected that when the switch is turned to point No. 1, the electrical current is passing through the upper one of the three horizontal coils in each heater; when the switch is turned to point No. 2, the current is passing through the lower two coils in each heater, and when the switch is turned to point No. 3, the current passes through all three coils of the heaters. The advantages claimed for this form of construction are that it supplies a uniform heat through the entire length of the car body on both sides, each heater furnishing its equal share.

Fig. 11 shows the new upright electric heater of the Dorner & Dutton Manufacturing Company. The company also manufactures a heater which can be fastened to the side of the car or seats without cutting or defacing them. This heater differs radically from any heretofore described in that there are no wires in it. The resistance is a powdered compound incased in tough earthenware tubes which present a large heating surface to the air. The company claims that this resistance will not burn out, and will outlast the lifetime of a car.

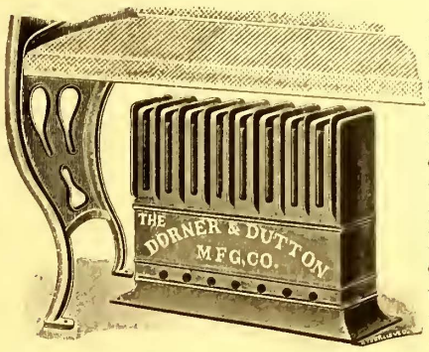


FIG. 11.—DORNER & DUTTON HEATER.

Another type of heater is that manufactured by the National Electrical Manufacturing Company. The chief feature of this heater is that the wires carrying the current are concealed in a white enameled plate casing. The latter is corrugated and provided with openings between the corrugations to admit of a circulation of air through the heater. One advantage claimed for this form is that as the wires are concealed they are therefore not subject to atmospheric changes, cannot become corroded, are impervious to water, and cannot break and ground the heater. The wires are also not subjected to mechanical strain either from expansion or contraction or from tension in winding. As it takes the heater over thirty minutes to cool after the current is turned off, the wire is practically under a process of annealing during that period and is therefore not apt to become brittle.

The Ohio Brass Company, manufacturer of the Warner electric heater, is contemplating some changes in the design and detail construction of the heater. These have not yet been settled upon, so that the form of the heater which will be put on the market by this company cannot be illustrated in this issue.

The Whittingham Electric Car Heating Company has made no change in the construction of its heating apparatus since last year. The form employed last year gave entire satisfaction to the companies who used it.

THE Norwalk Street Railway Company has adopted the commendable plan of keeping in reserve about as many motors and cars as are required in the daily operation of the line. In this way, except on special occasions, only half, or less than half, of the cars are in use at one time, allowing plenty of time for the inspection of those in the car house. All necessary repairs can be made in the day time, and, as a result, the general manager states that the line has been very free from accidents to its equipment. The method involves a considerably greater first outlay, but, it is claimed, is much more economical in the long run.

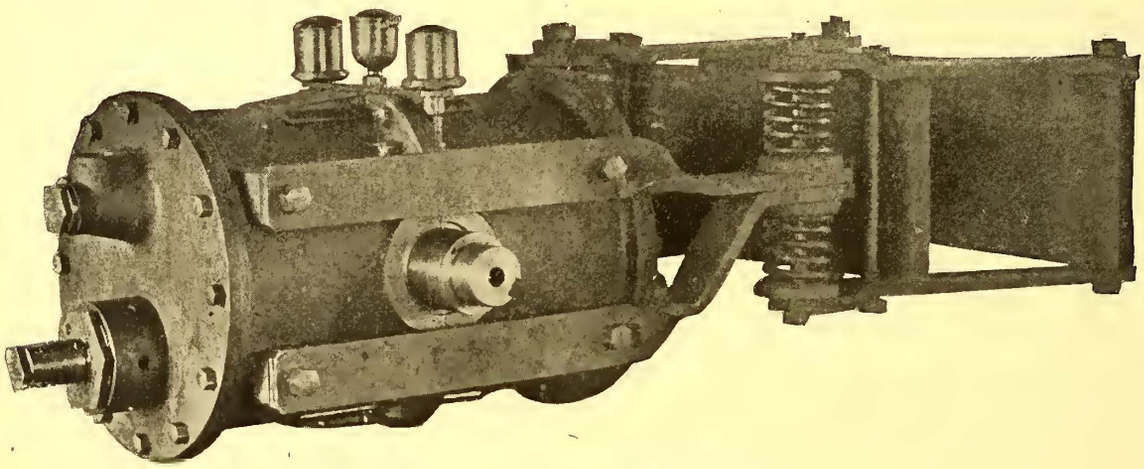
THE Bridgeport Traction Company is obtaining excellent results with the Reagen water tube grate. With an increasing number of cars the number of boilers in regular use has been cut down from eight to four, showing a doubled capacity. With from fifty to eighty-five cars in operation, the power station, which is a condensing one, burns from 290 to 300 tons a month of coal.

THE Norwalk Tramway Company is installing a 270 k. w. General Electric generator, direct connected to a McIntosh & Seymour tandem compound engine. The company is also laying a considerable amount of sixty foot T rail.

SCIENCE · ENGINEERING · INVENTION

New Vacuum Pump for Elevated Railway Service.

A unique piece of apparatus in air brake practice is the twin-cylinder vacuum pump designed and built by the Standard Air-Brake Company for the electric locomotive equipped by the Electric Storage Battery Company, of Philadelphia, for the Manhattan Elevated Railroad Company, New York. The pump is built on the general lines of the well known Standard double acting type. A vacuum pump having been specified, the Standard Company could not follow its usual practice, but had to furnish entirely new designs. Its success was shown in the preliminary shop trials, during which the pump was cut in and out automatically on one-quarter pound variation of pressure, giving at the same time 28½ ins. of vacuum.



VACUUM PUMP FOR THE ELEVATED RAILWAY, NEW YORK.

This, on trial runs, equalled the results obtained by the best condensing pumps on the market.

The cut shows the general design of the pump and method of suspension. The pump is swung on the inside axle of a bogie truck, suspended by balance springs and is supported on the main bolster frame of the truck. From the suction pipe lengths of hose connect the automatic cut-outs on the ends of the cylinder, these cut-outs being an integral part of the pump design. The pump is built in halves, one cylinder being attached to each half. The halves are bolted together around the axle which carries the eccentric. The eccentric casing is cut away so as to leave an aperture. This is covered by removable brass shields. The top shield carries a base for necessary oil cups for the eccentric and side bearings. Ample lubricating facilities are provided thereby.

On the turned locomotive axle a cast steel eccentric is securely bolted. This is of ample face and bears directly upon the phosphor bronze thrust-plates provided for each steel piston. The pistons are held together by steel distance-rods shouldered at thrust-plate and secured to pistons by bronze countersunk nuts, fitted with lock screws. Suction and discharge valves seating on hard composition are turned out from single pieces of mild steel. These valves and fittings are amply protected from grit and against the possibility of getting jammed by the piston, in the event of breakage of minor parts. The suction valve is fitted with a diaphragm arrangement, which is operated by the relief valve being lifted from its seat, which holds the valve open or neutral when the vacuum reaches the point at which trip is set.

The engineer's special valve is operated by the short handle used in locomotive practice. The vacuum on entering the valve first meets a soft composition-seated plunger. On raising this, by throwing handle to one side, vacuum is admitted to chamber cast in valve and travels from thence to brake diaphragm. The reverse movement of hand lever closes valve and a duplicate spring valve (directly over the other) is forced from its seat and admits the atmosphere to chamber, thus killing the vacuum. The whole valve is surmounted by vacuum gauge with double pressure vanes.

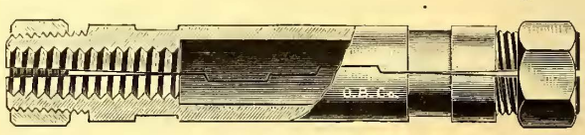
In the construction of this twin-cylinder vacuum pump particular attention was paid to the interior workmanship so that the outfit might be long-lived, built of the best known materials, and that it would work under the most adverse conditions. The cut shows the pump after inspection and before mounting. This type of apparatus admits of ample vacuum for braking a train of several cars and locomotive. The pipes and diaphragm of another company (which depended entirely upon a steam ejector for vacuum) were not discarded, but are used with the Standard outfit.

The Standard Air Brake Company, as has been seen, does not depend upon steam for furnishing the vacuum, nor does it require any outside plant. Its system provides for using the locomotive axle for the small amount of power required for braking. By means of this new departure the company is able to furnish vacuum brakes for any steam road changing to electric. Credit must certainly be given to the Standard Air-Brake Company for its untiring efforts in the air brake field.

Splicer for Soft Drawn Copper Wire.

The feeder wire splicer illustrated herewith has been designed by the Ohio Brass Company to afford a practical means of making a quick, cheap and effective splice in feeder wires. The splicer is in two pieces, each a duplicate of the other, except that one is slotted to allow solder to be poured through it. These pieces dovetail together when in position, being held by two nuts threaded externally on their ends. The inside diameter of the central portion of the splicer is somewhat larger than the wire, which permits of a sufficient quantity of solder being placed there to make a perfect electrical and mechanical connection. The extremities of the splicer are tapered and slightly corrugated on the inside, and when clamped on to the abutting ends of the wire by threading the nuts into place securely hold them in position. It can be used as a permanent or temporary connector equally well with solid and stranded conductors.

The splicer used with hard drawn wire differs but slightly in construction from that used with soft drawn wire. The greater tensile strength of the former requires a stronger method of splicing it, and to accomplish this the wires are headed on their ends before being placed in the splicer. For this purpose a riveting tool is employed, which, in connection with an ordinary hammer makes the operation a quick and easy one. The inside of the splicer is so made that the heads seat themselves against a shoulder in it, which arrangement, together with the solder used, makes a joint the full tensile strength of the wire itself.



SPLICER FOR COPPER WIRE.

THE City Council has granted a franchise to the Glen Oaks & Prospect Heights Railway Company (Peoria, Ill.) to build and operate its lines on certain streets of Peoria. Work is to be begun within sixty days and the road completed within one year from time of beginning. Among those interested are Monroe Sieberling and Fred. Patee, of Peoria, and William E. Avery, of Detroit, Mich.

Combined Feedwater Heater, Purifier, Filter and Oil Separator.

The Cookson feedwater heater illustrated herewith is of the open type and is put on the market by the Bates Machine Company. The general construction of the heater may be seen from the section (Fig. 2). The exhaust steam may be connected at either exhaust opening and the oil in the exhaust steam is separated immediately from it on entering the heater. As two separators are provided, one at either exhaust opening, it matters not through which opening the exhaust is admitted; except that the oil outlet pipe should be placed on the side opposite the exhaust inlet, an opening being made for that purpose.

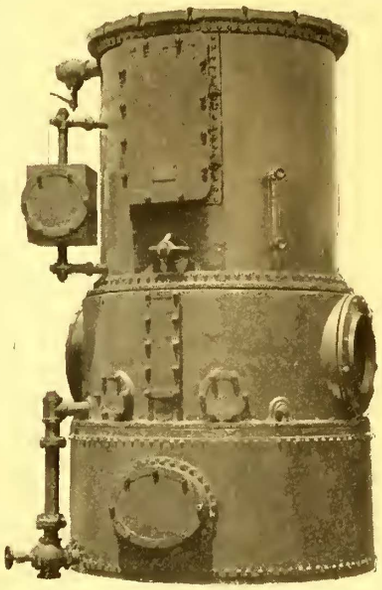


FIG. 1.—IMPROVED HEATER.

The steam, after being relieved of the oil, passes around either side of the oil separating plate where it is expanded and then passes up through one large tube and discharges in the direction of the other tube; passes down same into another expansion chamber; it then passes around either side of the oil separating plate where all moisture in the exhaust steam is separated on the same principle that the oil is separated on entering the heater and then discharges to the atmosphere or heating system. On the top of the tubes is placed a pan which prevents the spray of water from passing down them.

The water is admitted at the top of the heater from the side through the inlet valve and discharges into a receiver or spray box. The water overflowing this spray box falls through the steam and is thoroughly heated. It will be noticed that the force of the exhaust steam is not brought in direct contact with spray of water; therefore it is impossible to carry water out with it. The water spraying from the top of the heater condenses the steam, forming a vacuum which draws the required amount to heat the water, the air having been driven out by the exhaust at the time of starting. The water, after having been thoroughly heated in direct contact with the steam, passes into the hollow partition that divides the two exhaust chambers, where it is further heated by having steam constantly on both sides of it, entering same at the back of the partition and discharging at the front end into the filter.

The filter is of large proportion and is preferably filled with Excelsior shavings. The supply of water to the heater is regulated automatically by a float, which at all times maintains a uniform water level. An overflow pipe is placed on the inside of the upper chamber; and in the event of an overflow, discharges into the exhaust chamber and is drained out through the oil outlet.

All chambers are provided with manholes or handholes, making the heater very accessible for cleaning. The suction flange is placed at the back of the heater. All flanges are removable.

The exhaust chamber, or the center section of the heater, is always of cast iron made in one piece, in which the oil separating plates and hollow partition are formed. As this chamber is made in one piece and of cast iron, it cannot leak, is not affected by expansion or contraction, and there is no breaking off of oil plates secured by bolts; in fact, it is so constructed that it will last one hundred years, and the balance of the heater, with ordinary care, a lifetime.

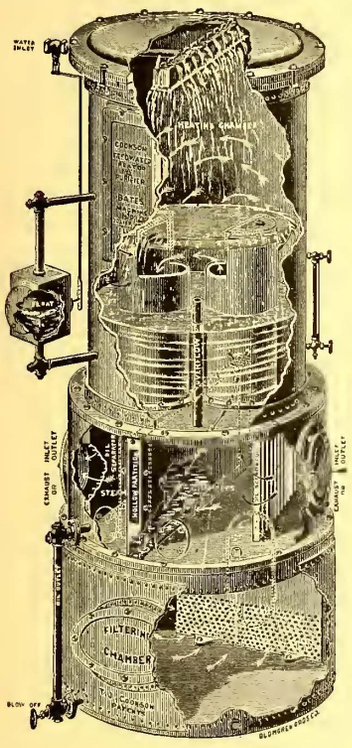


FIG. 2.—SECTION OF HEATER.

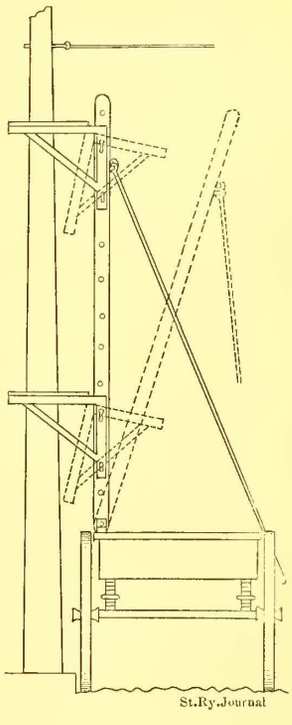
Trolley Appliances for Figure 8 Wire.

The figure 8 trolley wire, though of recent origin, has already found favor with many of the leading electrical engineers engaged in railway construction, as its adoption by some of the largest systems recently installed conclusively proves. Its selection made new requirements in the design of the construction material necessary to suspend it in position, as its peculiar and novel shape would not permit employing those devices which had been used heretofore without making radical changes in their form and detailed construction. Two of the principal factors which had to be considered in this connection, were the increased weight of the trolley wire, and the application of the various devices, so that the contacting surface of the wire would present a free and uninterrupted passage for the trolley wheel.

To fill these conditions the Ohio Brass Company, of Mansfield, O., has placed on the market a full line of improved designs of trolley wire devices for use with this style of wire, and has already equipped a number of roads which use figure 8 trolley wire for their overhead construction.

Painting Trolley Poles.

A new method of painting trolley poles is employed by the Union Traction & Electric Company, of Providence, R. I. The apparatus, which was invented by H. A. French, foreman painter of the company, has been used to paint over one thousand poles on the line. It is said to reduce the time for painting a pole one-half, and the obstruction of the highway is lessened to a corresponding extent.



FIGS. 1 AND 2.—SECTION OF POLE PAINTING WAGON AND METHOD OF USING.

A platform is mounted on wheels, and on the platform at one side is a ladder supported on removable pins at the lower ends, which are held between brackets. The ladder is made double by putting a stick in the middle to support the rounds which are long enough to reach both sides of a post at the same time. Each outside bar of the ladder has a brace rod near its upper end, and the rods are held at

their lower ends between brackets on the other side of the platform, the bars being flattened at the lower ends to allow holes for removable pins that pass through the brackets and the bars.

The supports for the painters consist of four knee brackets, which are held, two on each side of the ladder, at the proper height from the ground and each other to so divide the space to be painted that a person standing on the ground can paint to the first bracket, and the man on that bracket can paint to the upper bracket and one on the last can paint nearly to the top of the pole with his brush. These knee brackets are on removable pins passing through the end just below the angle and the side bar of the ladder, and the lower leg of each bracket is secured to the bar with a similar pin to hold the upper leg of the bracket out horizontally, and a narrow platform is secured to it for the painter to stand on.

When in use the apparatus with the ladder erect and the knee brackets in position, is drawn with the wheels just outside the curbstone in front of a pole. Then the brackets are raised and the pins inserted. Two of three men go up the ladder to the top platform, one on each side of the pole, and paint above that platform; then they descend to the lower platform and paint the space between the two platforms, and during this time the third man will have the post painted from the ground up to the first platform. After removing the pins to allow the bracket to drop down to avoid hitting the post the apparatus is driven to the next pole. If tree limbs should obstruct the way the ladder can be let down to any angle required, and raised after passing the obstruction,

The large box in front is used as a receptacle for paints, brushes, etc.

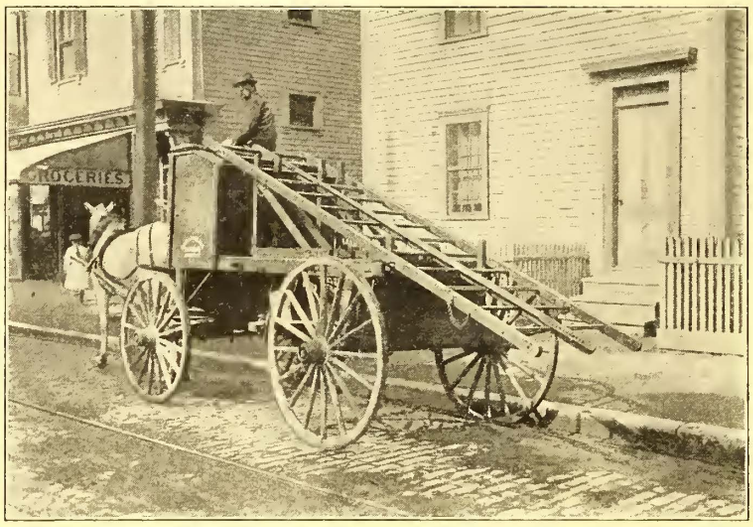


FIG. 3.—PAINTING TOWER LOWERED.

New Protected Rail Bond.

The accompanying engravings show a new type of rail bond brought out by the Forest City Electric Company, and designed to be placed under the channel plate. It can also be used under the base of the rail, if preferred. It is of flattened copper wires, with the ends cast welded into copper terminals and drop forged to size and finish. The terminals are large in area to give plenty of contact with the rail, and the construction of the bond allows it to be flexible to vibrations and yielding to contraction or expansion.

The bond can be either secured to the rails by hand riveting or pressed by use of the clamp shown in Fig. 2. The bond is first forced through the hole. A small point on the end of the clamp screw is then placed into a depression in the base of the terminal and the screw is turned up tightly again, making a connection similar, it is claimed, to a weld.

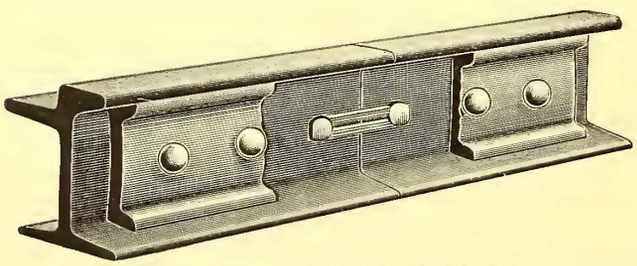


FIG. 1.—PROTECTED BOND.

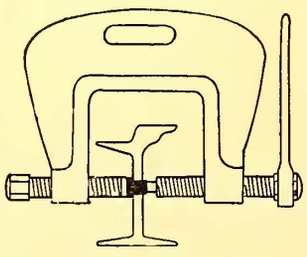
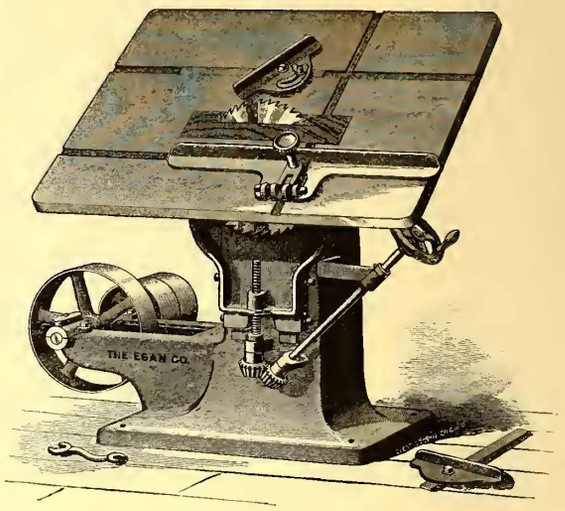


FIG. 2.—CLAMP.

The new Bristol Tramways electric line of Bristol, England, is growing in popularity and the increased traffic has compelled an increase in the equipment.

Improved Variety Saw.

The variety saw with table manufactured by the Egan Company for ripping, cross cutting, grooving, etc., is illustrated herewith. The machine being all iron and steel, the great variety of work it can be adapted to, and the precision and accuracy with which it can be handled, the convenience for adjustment, and the strength and durability of all its parts, stamp it as a standard machine for ripping, cross cutting beveling, cropping, grooving, mitering, etc. The machine is self contained, the frame being a cored pedestal supporting the table and carrying the countershaft.



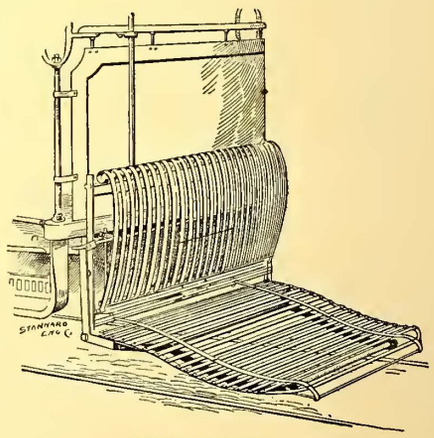
VARIETY SAW.

The table is of cast iron, well ribbed and braced, and can be set plumb, at right angles with the saw, or adjusted to any bevel up to 45 degs. The table is raised and lowered in planed, gibbed ways, with adjustment for wear. The mandrel is of best cast steel, and runs in self oiling boxes. The fences can be used on either side of saw, giving the operator every advantage and convenience, especially when using the table on a bevel. This point will be appreciated by a practical sawyer.

A fourteen inch saw is generally used and runs at 3000 r. p. m.

New Fender.

The Shields patent automatic fender is clearly shown in the accompanying cut. Both the lower and upright platforms are made of spring steel. Ordinarily the lower platform runs about 2½ ins. to 3 ins. above the rails. It is arranged to work automatically by a chain inside of a rubber tube which is attached to each end of the lower platform, and runs through two push rods connected with this platform. Any object striking the cord pushes the rods, and these release two triggers which causes the platform to drop upon the rails and to thus scoop up the object. The car bumper and coupling are covered by the upper platform, thus protecting the person from injury from this source, should he fall upon the fender. This fender is the invention of D. P. Shields.



NEW FENDER.

It is reported that the Nunnery Hill Inclined Plane Railway, Pittsburgh, Pa., which has not been used for some time, will be rebuilt and operated in connection with the lines of the Federal Street & Pleasant Valley Railway Company. The estimated cost of rebuilding is about $30,000.

Manufacture of Armature Coils at Schenectady.

One of the most important economical questions confronting street railway managers is the ease with which repairs may be made to damaged motor armatures. Up to quite recently any repair to the winding of an armature has been a task involving more than considerable trouble, as well as the enforced idleness of the armature a disproportionate length of time. The advantages therefore of having motor armatures so wound that damaged coils can easily be removed and perfect coils substituted were so patent that the General Electric Company early adopted the Eickemeyer system of winding for the armatures on all its different types of street railway motors.

At its works at Schenectady an entire department is given over to the manufacture of these coils, and some idea of the size of this department may be gathered from the fact that its daily capacity is about 7000 completed coils and it is worked full time. The illustrations show some of the different sections of the department, and

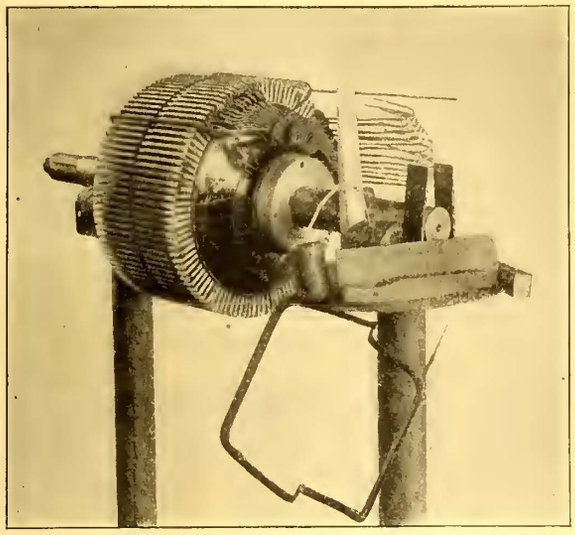


FIG. 1.—ARMATURE AND COIL.

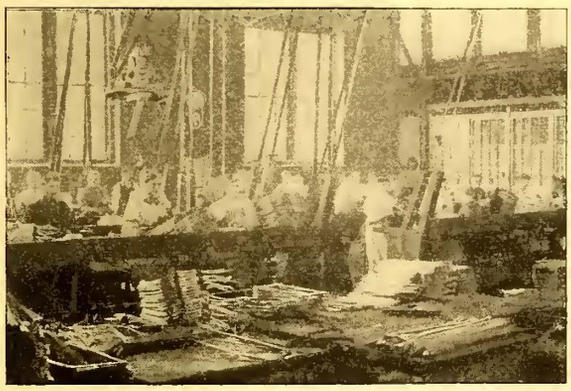


FIG. 3.—TAPING MACHINE.

the progress in the manufacture of the coil from the plain wire through the insulating, taping, dipping and drying sections from the last of which the finished coil goes to the armature winder.

The winding of the Eickemeyer armature consists of a series of exactly similar insulated coils, each with a long and a short side lying upon the armature face, and with the portions on the ends of the core so formed that when the adjacent coils cross each other a space intervenes between the underlying portion of one coil and the overlying portion of the other. In addition to the facility of repair afforded by this winding, a uniform resistance in the several circuits, great economy in space and a more perfect insulation are possible. And these qualities have become recognized as essential in a successful railway motor armature. So much is this the case that over 2,250,000 of these armature coils are now in use on General Electric motors.

Compressed Air Motors in New York.

During the last month the three compressed air motor cars manufactured by the Rome Locomotive Works have been received by the Third Avenue Railroad Company and have been put in operation on the 125th Street line of that company. The car bodies were built by the Brooklyn & New York Railway Supply Company. The cars have not been in operation long enough yet to determine the question of economy.

The compressed air cars for the Lenox Avenue line of the Metropolitan Street Railway Company have not yet been received from the works at Worcester, Mass.

Increased Use of Electric Power Transmission.

The increase in the use of electricity is none the less rapid because carried on quietly. To gauge the progress attention should not so much be directed to the fields of electric lighting and electric railways, as to that of electric power, a field which is now steadily repaying the arduous culture bestowed upon it during the past four years.

We have secured from the General Electric Company's Power and Mining Department some figures which illustrate not only the growth in the use of electric power, but also its economy and efficiency. These figures are represented in the unfluctuating horse power instead of in dollars. The former on account of the fluctuation in prices, offers a standard gauge. The figures take cognizance of electric power apparatus only.

	1892	1893	1894	1895
H.P.	13,719	18,762	42,379	46,727

In 1896 the missionary work of the past four years began to come to rapid fruition. From Jan. 1 to July 31, the total horse power of the apparatus amounted to over 48,000 h.p. During the same period, in 1895, the aggregate orders amounted to 25,737 h.p. From Aug 1 to Aug. 18, the total amount of power apparatus ordered during 1896, was increased to the respectable figure of 62,164 h.p.

FIG. 2.—WINDING THE COILS.

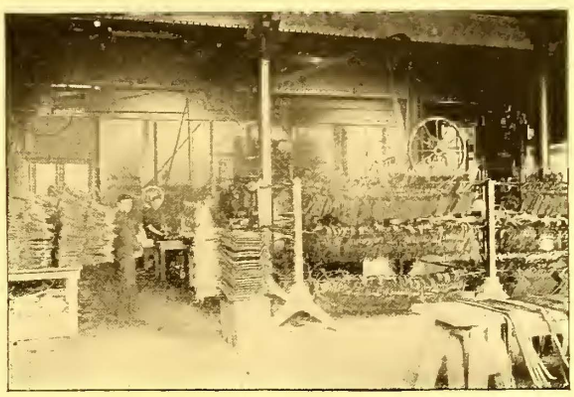


FIG. 4.—DRYING ROOM.

Such a showing in face of the universal dullness in business everywhere is remarkable, and perhaps emphasizes the fact that during hard times the truest economy is the use of apparatus which costs least to operate.

Rails Wanted in Australia.

J. H. Young, minister of Public Works for the Colony of New South Wales, Australia, has requested bids for the manufacture of 150,000 tons of steel rails and other permanent way materials for use on the lines in that colony. These supplies are to be manufactured in New South Wales, and from iron ore, coke, coal, or other fuel raised in the colony. The delivery of rails is to be extended over a period of ten years and is to be at the rate of 15,000 tons per annum. Full specifications of the rails desired are supplied by the Board of Public Works, at Sydney, or can be seen at the office of the STREET RAILWAY JOURNAL. The rails are to be of the T type, of about sixty and eighty pounds to the yard, from thirty to forty feet in length, as required, and of special composition.

THE officers of the Consolidated Street Railway Company, of Grand Rapids, Mich., in connection with certain religious societies, have been devoting considerable attention recently to the comforts of their employes, particularly in the line of establishing reading rooms in the different car houses. A number of periodicals have been subscribed for to be sent to each of the car houses, and the employes' quarters have been made as comfortable and attractive as possible.

STREET RAILWAY NEWS

The St. Louis Convention.

In order that those intending to be present at the Street Railway Convention, in St. Louis, next month may be fully informed as to all the details of the Convention so far arranged, the following review is made of the announcements which have been given out from time to time by the different committees together with the latest reports obtained by the STREET RAILWAY JOURNAL'S special representatives at St. Louis and this month's official announcements by the Secretary and Committee on Exhibits.

The date for the Convention is October 20 to 23. Special trains will be run from Chicago, New York, Philadelphia and Boston. The only detailed announcement so far made by the railroad companies is that a special train will leave Boston at 10:30 A.M. and New York at 1:50 P.M., on Sunday, October 18, and will run over the Boston & Albany, New York Central, Lake Shore & Michigan Southern and "Big Four" systems to St. Louis, at rates of one and one-third fare for the round trip. This train will arrive at St. Louis at 6:56 Monday evening.

The Convention headquarters will be the Southern Hotel. A large number of applications for rooms have already been made and delegates should make sure that hotel accommodation is secured several weeks in advance of the Convention as they might otherwise find it difficult to get comfortable rooms at any of the first-class hotels, since the city's various hostelries are sure to be heavily taxed.

The Association meetings will be held in one section of the great Convention Hall, at which the Republican and Populist National Conventions have been held, while another large section will be devoted to the exhibits. This hall is within several blocks of the Southern Hotel and is reached by a number of street railway lines.

The delegates will be afforded the courtesies of the street cars all over the city during the Convention.

The following announcement is made of the names of the manufacturers who have already applied for space.

NAME.	AMOUNT SPACE.
General Electric Co., Motors, etc.	2000 Sq. Ft.
Walker Co., Motors, etc.	500 "
Johnson Co., Rails, Frogs and Switches	1200 "
Wm. Wharton, Jr., & Co., Rails, Frogs and Switches	
Paige Iron Works, Rails, Frogs and Switches	400 "
Mark Ry. Equipment Co., Track Fastenings	240 "
Dilworth-Porter & Co., Track Fastenings	100 "
W. W. Doty & Co., Track Fastenings	200 "
George Stever, Track Fastenings	150 "
Heine Safety Boiler Co., Boilers	500 "
Stirling Co., Boilers	
Consolidated Electric Purifier Co., Removing Scale	100 "
J. G. Brill Co., Cars, etc	1100 "
American Car Co., Cars, etc.	1200 "
Brooklyn & New York Ry. Sup. Co., Ry. Supplies, etc.	1600 "
Peckham Motor Truck & Wheel Co., Trucks, etc	750 "
Taylor Electric Truck Co., Trucks, etc	
Graham Equipment Co., Trucks, etc	
Diamond Truck & Car Gear Co., Trucks, etc	500 "
D. C. Sweet, Trucks, etc	200 "
Consolidated Car Fender Co., Fenders, etc	300 "
Devlin Street Car Brake Co., Brakes	100 "
Standard Air-Brake Co., Brakes	200 "
Dr. Given Campbell, Brakes	100 "
Fitzgerald-Van Dorn Co., Automatic Drawbar	144 "
The Trojan Button Fastener Co., Sand Boxes	100 "
Scarritt Furniture Co., Car Seats	800 "
Woven Wire Mattress Co., Car Seats	100 "
Brussells Tapestry Co., Car Shades	200 "
E. T. Burrowes Co., Car Shades	150 "
St. Louis Register Co., Registers	200 "
International Register Co., Registers	100 "
Bundy Manufacturing Co., Registers	100 "
Meaker Manufacturing Co., Registers	200 "
American Electric Heating Corpor., Electric Heaters	200 "
Gold Street Car Heating Co., Electric Heaters	100 "
Consolidated Car Heating Co., Electric Heaters	320 "
The Safety Car Heating & Lighting Co., Elec. Heaters	200 "
Adams & Westlake Co., Lamps, etc.	100 "
Chas. G. Smith, Lamps, etc	100 "
Clarence Whitman & Co., Lamps, etc.	100 "
Central Electric Co., Electrical Supplies	150 "
Central Union Brass Co., Electrical Supplies	
Western Electric Supply Co., Electrical Supplies	150 "
Partridge Carbon Co., Electrical Supplies	100 "
A. W. Morrell, Electrical Supplies	100 "
Commercial Electric Supply Co., Electrical Supplies.	400 "
Mica Insulator Co., Electrical Supplies	100 "
H. W. Johns Mfg. Co., Elec. Sup. and Overhead Material.	250 "
R. D. Nuttall & Co., Elec. Sup. and Overhead material.	
Leschen-MacComber-Whyte Co., Overhead Material	100 "
Theodore Fletcher, Overhead Material	100 "
Creaghead Engineering Co., Oveahead Material	200 "
Munson Electric Conduit Co., Electric Conduits	750 "
The Sargent Co., Brake Shoes	100 "
Missouri Car & Foundry Co., Brake Shoes	100 "
Missouri Malleable Iron Co., Castings	100 "
Shickle-Harrison & Howard Iron Co., Castings	200 "
National Lead Co., Paints	100 "
Elliot Frog & Switch Co., Frogs, Switches, etc.	200 "
Shultz Belting Co., Belts	200 "
Ready Rock Asphalt Roofing Co., Roofs	100 "
STREET RAILWAY JOURNAL, Publications	100 "
Street Railway Review, Publications	300 "

The Committee on Exhibits and the secretary wish it announced that there is still considerable space available for exhibition purposes, and that applications will be received up to October 1st, or even later if the space be not at that time fully assigned. The price per square foot has been fixed at a very low figure and there is plenty of room in the great Convention Hall for all who care to use it. The papers to be read at the Convention have nearly all been finished and sent in to the Committee on Papers and are now as follows:

"Track and Track Joints: Construction, Maintenance and Bonding"— M. K. Bowen, superintendent Chicago City, Railway Company.

"Trucks"—Jno. N. Akarman, superintendent Worcester Consolidated Street Railway Company, Worcester Mass.

"How Can the Revenue of Street Railways be Increased, Taking into Consideration the Collection of Fares, Method of Registry, Transfers, Use of Tickets or Cash Fare and Attractions along the Line of Road"— C. Densmore Wyman, general manager Milwaukee Street Railway Company, Milwaukee, Wis.

"Modern Overhead Electric Construction"— B. Willard, general superintendent New Orleans City & Lake Railroad Company, New Orleans, La.

"The Modern Power House"— Richard McCulloch, engineer Citizens' Railway Company, St. Louis, Mo.

"Selection and Management of Employes" (to be discussed at an executive session)—W. F. Kelly, general manager Columbus Street Railway Company, Columbus, O.

The Local Committee has designed an exceedingly beautiful solid silver button, which will be given to delegates and others in attendance. Great pains will be taken this year to provide a wide variety af entertainment for the delegates, particularly for the ladies, and every effort will be made to make the visit to St. Louis, of so many street railway men, from all over the country, long to be remembered.

Convention of the New York State Street Railway Association.

The next annual convention of the Street Railway Association of the State of New York will be held at Hotel Bennett, Binghamton, Tuesday, Sept. 8, at ten o'clock A. M.

It is the intention of the association to make the meeting one of especial benefit and importance. A feature of the programme will be the reading of several papers upon subjects of every day importance to street railway men. All papers prepared and read before the convention will be brief and concise, twelve minutes being the limit of time allotted to each. It is also intended to make the ex-

hibit of supplies, small models, etc., a prominent feature of the Convention, and ample room will be provided (free of expense) for all who desire to make a display.

The following are the topics selected for discussion:

Points on financial organization.
Car mileage record; its advantages.
Improvements needed in electric motors.
Suggestions for special track construction.
How can we increase travel, especially in smaller cities?
General track construction and the most approved method.
Is selling tickets at reduced rates an advantage or disadvantage?
The maintenance of power station from an economical standpoint.
A description of the "Gorge Road" at Niagara Falls. (Allotted).
Street Railroads *vs.* State—Their relation to each other. (Allotted).
How to keep car bodies clean? A plan for daily inspection and care.
The use and abuse of transfers—Are they advantageous? (Allotted.)
Fenders—Are they practicable? Their advantages and disadvantages.
Construction and maintenance of trucks and care of motors. (Allotted.)
Overhead construction; maintenance of same, and suggestions for new work.
How can we prevent accidents and increase the general efficiency of employes?
The best method of and the advantages gained by rotating crews and distribution of runs.
How to prevent collusion on the part of motormen and conductors to defraud the company?
The relative advantages and disadvantages of single and double trucks for interurban service.
Interurban electric roads—possibilities and advantages from a financial standpoint. (Allotted.)
Can small electric roads be operated to advantage in conjunction with small electric light companies?
Report blanks, time sheets, etc., and their general usefulness to the superintendent. Suggestions for forms.
The proper form of liability insurance. Can a company insure itself to advantage by establishing a fund?
The daily inspection and care of car equipments. How to accomplish the best results with the least expense.
The Daily Record-Book of conductors' returns—its necessity and advantages. Suggestions for headings.
The best method of promoting personal interest on the part of the employes in the affairs of the company.
Signals and inter-communication with reference to maintenance of schedule on single-track street railroads.
What is the proper and most efficient method of protecting a street railroad company from dishonesty of employes?
Street Railway Legislation—How can it be met to best subserve the interests of street railroad companies and the public?
Street Car Wheels—Should they be made heavier, to avert possibilities of accident? Is it possible to establish a standard?
How shall we prevent pounding down of track joints? How shall we remedy the evil when it exists, without replacing entire track?
The comparative advantages and disadvantages of operating long or short cars. The extra expense and increased capacity considered.
Power from the trolley circuit. Is it practicable? Why do the fire insurance companies object? What should be done to overcome the objection?
Pleasure resorts and their advantages to street railroads. Are they profitable? How should they be conducted and maintained to attract the largest number of people and secure permanency?
Can cities of less than 15,000 inhabitants support a street railroad of moderate mileage, carefully and well built at present prices, without over-capitalization of costs, owned and handled by local parties? What measure of profit can be expected therefrom?

At the last annual Convention of the Association a resolution was introduced whereby supply men could be made associate members of the Association, paying membership fees and dues, to assist in defraying the expenses of the Association. After a thorough and lengthy discussion, participated in by the supply men themselves, it was considered wise and expedient not to adopt the resolution, but the privilege of all conventions was extended to supply men, and they were cordially invited to participate in the exercises and entertainment provided, and the only outlay asked was an assessment of $5 each to defray the expense of the banquet, which would entitle the contributor to a ticket.

Aside from the banquet, which will be held at 8:30 P. M. at the Hotel Bennett, the Binghamton Railroad Company has arranged an excellent programme of entertainment, including a trolley ride to the various points of local interest, and terminating with a ten-mile ride to Union, with luncheon at the Casino, provided by the Binghamton, Lestershire & Union Railroad Company. To these entertainments all visitors, including representatives of supply houses, are invited.

Convention of the Pennsylvania Street Railway Association.

Preparations for the fifth annual meeting of the Pennsylvania Street Railway Association, to be held in Altoona, on Sept. 2 and 3 next, are completed; and judging from the number of responses by members of the association and others interested in promoting the general welfare of local rapid transit, it will be the largest convention yet held by the association. The programme will be one of unusual interest to those gathering scientific and practical knowledge upon the construction and operation of street railways, (to which the first day will be devoted), while a series of entertainments has been provided for the second day, that will afford a pleasant variation to the members and visitors of the association.

The convention will be called on Wednesday, Sept. 2, at 11 A. M. sharp, in the "Casino," at Lakemont Park, Altoona, and continue during the day. There will be an address of welcome by Hon. Martin Bell, and response by the president, Hon. B. F. Myers, of the Wilkesbarre & Wyoming Valley Traction Company. The following papers will then be read: "Long Distance and Heavy Duty Electric Railways," by Mr. F. W. Darlington, electrical engineer. "Construction and Maintenance of Electric Railway Tracks," by Mr. Geo. H. Neilson. "Transfer Tickets," by Mr. J. H. Stedman. The following topics are for general discussion: "Street Railway Law"; "Liability Insurance." On the evening of Wednesday, the first day, a complimentary concert by the Altoona City Band will be given to members and visitors of the association, at Lakemont Park, by the Altoona & Logan Valley Electric Railway Company. The second day will be devoted to an excursion over the lines of the Altoona & Logan Valley Electric Railway Company, a trip to "Wopsononock," ending with a banquet at the Mountain House, "Cresson," in the evening.

All entertainments are free, except the banquet, for which a nominal charge of $5 per plate will be made, to which all persons in attendance upon the convention are most cordially invited, whether members of the association or not. The Logan House, Altoona, will be headquarters of the association.

Annual Convention of the Massachusetts Street Railway Association.

The annual meeting of the Massachusetts Street Railway Association was held Aug. 11, at Fall River, Mass. About one hundred members of the association were present. They were met at the railroad station by President Goff and other officers of the Globe Street Railway Company and the Dartmouth & Westport Street Railway Company. A trip was first taken in electric cars over the lines of the Globe Street Railway Company, terminating with a clambake at Lincoln Park. After a very enjoyable time the cars were again boarded at three o' clock and a trip was made to New Bedford where the guests found a welcome at the Wamsutta Club where they passed a very pleasant hour. A run to Fairhaven was then made.

Important Electric Railway Contracts.

The Walker Company reports the sale of a large number of its new trolleys and controllers to railway companies in all parts of the country, and it is believed that both have proven to be inventions of great importance and merit. It is, of course, well known to STREET RAILWAY JOURNAL readers that the controller is one in which no magnetic blowout is used, the circuit being broken instantaneously at thirty-two contact points on a special breaking cylinder contained in the coutroller box. It is said that this method of preventing destructive arcing in the controller is entirely efficacious and without disastrous influences on the motor field coils and armatures. The reports from the men using these controllers are entirely satisfactory.

The trolleys are also doing good work and are meeting with much favor from managers, owing to the fact that they are easily kept in order and do not require any overhead switches, turnouts, etc. It is claimed that the trolley does not infringe any patent whatever, while it is itself covered by strong patents which will be vigorously enforced should infringements be made.

The company has made a remarkable record during the last few months in generator and motor sales, which have aggregated over 25,000 horse power. This in a time of extreme dullness and stringency of money. Among these orders may be mentioned the following: Chicago City Railway Co., Chicago, Ill., six 800 k. w. generators; Englewood & Chicago Railroad Co., Chicago, Ill., four 200 k. w. generators and twenty-three 50 h. p. motors; Metropolitan Street Railway Co., Kansas City, Mo., one 1200 k. w. generator; New York & Brooklyn Bridge Railroad, New York, two 400 k. w generators; The Albany Railway, Albany, N. Y., one 800 k. w. generator; Syracuse Rapid Transit Co., Syracuse, N. Y., two 800 k. w. generators; Detroit Railway, Detroit, Mich. (extension order), two 750 k. w. generators; Los Angeles Street Railway Co., Los Angeles, Cal., one 800 k. w. generator; London Street Railway Co., London, Ont., one 400 k. w. generator; Newcastle Electric Co., New Castle, Pa., two 250 k. w. generators; Pacific Power Co., San Francisco, Cal., one 300 k. w. generator; Albion Construction Co., Chicago, Ill., two 150 k. w. generators; Bamburn, Germany, two 100 k. w. generators; Rapid Railway Co., Detroit, Mich. (exten-

sion), one 400 k. w. generator and twenty-two 50 h. p. motors; Brooklyn Heights Railroad Co.. Brooklyn, N. Y., eighty 35 h. p. motors; Union Railway Co., New York City, eight 25 h. p. motors; Albion Construction Co., Chicago, Ill., ten 50 h. p. motors; Hamburg, Germany, ten 35 h. p. and twenty-four 25 h. p. motors; Paris, France, eighteen 25 h. p. motors; Rahway Electric Light & Power Co., Rahway, N. J., ten 30 h. p. motors.

An Annual Clambake.

The annual clambake extended by that genial host Eugene F. Phillips, of the American Electrical Works, to the American electrical fraternity was celebrated Aug. 22. The day proved to be a fine one although there were a few clouds in the morning, and about 250 guests were present to enjoy the good things prepared for them. The visitors assembled at the Narragansett Hotel where they were welcomed by the two Messrs. Phillips, Messrs. Sawyer, Remington and Hathaway of the home office, and Messrs. Ackerman, Donohue and Carroll of the company's branch offices. The trip was made in trolley cars to the Pomham Club in East Providence where the feast occurred.

The usual festivities were indulged in before the event of the the day, after which the party was divided into the club dining room where they found an elaborate banquet ready. The speeches were unusually good, and the meeting broke up with a general opinion that the eighteenth annual clambake had, exceeded any of the preceding seventeen in success, if that were possible.

Silver Lesson in Kingston, N. Y.

Mr. Peckham, of the Peckham Motor Truck & Wheel Company, is a strong believer in sound money, and took occasion last month to give his employes in the Kingston factory an object lesson. Each man found in his pay envelope at the end of the week one bright, new Mexican dollar, together with a typewritten statement which read as follows:

"Enclosed you will find a specimen of Bryan's dollars, which are now only worth fifty-one cents, according to the price of bullion; but if Bryan is elected, these same dollars (worth fifty-one cents only) will cost you their full face—one hundred cents each."

The effect of this experiment has been to arouse an interest in the money question in Kingston, which will lead to a careful search for information, and it is to be hoped that a knowledge of the subject will be obtained which will bring out an intelligent vote in November.

News Items.

Allegheny, Pa.—The following street railway companies have been incorporated at Harrisburg: The Evergreen Hamlet Street Railway Company with a capital stock of $12,000: the South Avenue Street Railway Company with a capital stock of $6000, and the Bouquet Street Railway Company with a capital stock of $6000.

Atlanta, Ga.—An ordinance has been introduced in the City Council requiring street railway companies to equip their cars with fenders.

Baltimore, Md.—The Baltimore & Ohio Railroad Company has under contemplation the construction of an electric line on Fells Street to be equipped with large electric motors for hauling freight cars. J. T. Manning is chief engineer, and W. M. Green is general manager of the company.

Batavia, N. Y.—Surveys for the Batavia Electric Railway have been completed in the city, and the surveyors are now working on the line to Horseshoe Lake. W. Pratt is president, and H. A. Sage manager of construction of the company that will build the line.

Beaver, Pa.—Newspaper reports state that work on the lines of the South Side Railway Company, recently incorporated, will be begun on Aug. 31. The line will be run to Rock Spring, back from the river, and the company will spend $30,000 on the resort, erecting a summer hotel, a long chute to the river and making the park an ideal picnic ground. Among the incorporators are J. J. Hoffman and T. H. Javins, of Rochester, Pa.

Belleville, N. J.—At the next meeting of the Township Committee application will be made by the Union Traction Company for a franchise to extend its line through the town. H. G. Bell, of Rutherford, N. J., is vice-president of the company.

Benton Harbor, Mich.—Rights of way for the Benton Harbor & Eastern Electric Railway have been secured, surveys have been made and the grades for the line have been established. The residents of Paw Paw will grant a bonus of $2000 to the company, and the city of Decatur will also give sufficient aid to insure the construction of the line. It is the intention of the company to build the line as far as Paw Paw this season and extend it to Allegan in 1897.

Boston, Mass.—The West End Street Railway Company is having 150 closed cars built to be put in operation in October. The American Electric Heating Corporation is equipping the cars with electric heaters.

Braddock, Pa.—The Braddock Electric Passenger Railway Company will begin work at once on its extension over Bessemer Terrace to East Pittsburgh.

Brenham, Tex.—Abraham Harrison is the promoter of an electric railway in Brenham.

Bridgeport, Conn.—It is reported that N. H. Heft, Frank E. Clark, Frank Miller and George E. Somers, of the New York, New Haven & Hartford Railroad Company, are at the head of a company to be incorporated soon to build an electric railway in Bridgeport and vicinity.

Bristol, Pa.—G. S. W. Brubaker, of Lancaster, Pa., has been awarded the contract for the extension of the Bristol & Langhorne Electric Railway. Work will be commenced soon.

Brockton, Mass.—The Brockton Street Railway Company has awarded the contract for constructing the North Easton extension to Soule, Dillingham & Company, of Boston, Mass.

Brunswick, Me.—I. C. Libby, of Waterville, Me., and A. F. Gerald, of Fairfield, Me., are the promoters of an electric railway from Brunswick to Topsham. Work will be begun at once and the line is to be completed within a month.

Bucyrus, O.—The Toledo capitalists interested in the electric line between Bucyrus and Galion have applied to the County Commissioners for a franchise.

Burlington, Vt.—It is reported that the Winooski & Burlington Street Railway Company and the Military Post Street Railway Company have been consolidated and the two lines will be operated under one management in future.

Chester, N. H.—The Derry & Chester Electric Railway is nearly completed and will be in operation in a few weeks.

Chesterville, W. Va.—J. E. McDonald, of East Liverpool, O., is the promoter of an electric railway from Chesterville across the Ohio River to East Liverpool, O. A steel bridge 2000 ft. long will be built across the river.

Chicago, Ill.—The Englewood & Chicago Electric Street Railway is expected to be in operation by Oct. 1. The cars will be run by storage batteries.

IT is reported that the Chicago General Railway Company will test the Hardie compressed air motor. It has just erected an air compressing plant at a cost of $18,000.

Cincinnati, O.—The Cincinnati Street Railway Company is planning to build a belt line in the city as soon as franchises can be secured. The line will start at the Grand Central Depot and pass by the Custom House, Court House, Music Hall and the new City Hall.

Cleveland, O.—The Cleveland, Painesville & Eastern Railroad Company has filed a trust deed in favor of the Cleveland Trust Company, of Cleveland, and the State Trust Company, of New York. The deed was given as security for $500,000 of improvement bonds.

Connellsville, Pa.—The Connellsville Suburban Railway Company has been incorporated to build electric railways in Connellsville and suburbs. The officers are: president, S. R. Slaymaker; vice-president, Joseph Soisson; secretary and treasurer, Robt. W. Soisson; chief engineer and superintendent, William Henderson; directors, John D. Frisbie, John F. Soisson, Joseph Soisson, S. R. Slaymaker, P. S. Newmeyer, Robt. W. Soisson and John F. Barry. The City Council has granted rights of way and the engineers will begin work at once.

Conway, Mass.—The Conway Electric Street Railway Company has awarded the contract for constructing its extension to Hendrick, Taylor & Warner, of Northampton, Mass.

Delta, Pa.—Thomas McKenzie, of Baltimore; Charles A. Hawkins and Perry J. M. Heindel, of York, Pa.; John B. Gemmill, of Stewartstown, Pa., and James McElwain, of Fawn Township, are the promoters of an electric railway from Delta to Stewartstown along the Maryland state line.

Elizabeth, N. J.—The Elizabeth & Rahway Traction Company has secured rights of way through Linden.

Enfield, Conn.—It is reported that the Enfield & Longmeadow Electric Railway Company will be reorganized with a capital stock of $25,000.

Frederick, Md.—On the evening of Aug. 23, a trolley car on the new line of the Frederick & Middletown Electric Railway Company while running down the Catocin Mountain got beyond the control of the motorman and in rounding a curve upset and was completely demolished. There were about 100 people on the car at the time of the accident, forty of whom were injured.

Gloucester, Mass.—At a meeting of the directors of the Gloucester, Essex & Beverly Street Railway Company, it was decided to build an electric line between Ipswich and Rowley at once. Rights of way in Rowley have been applied for.

Greenport, L. I., N. Y.—Newspaper reports state that a company of capitalists will build an electric railway from Greenport to Orient, a distance of eight miles. Road Commissioner E. W. Taber, of Orient, is securing rights of way along the proposed route. The estimated cost of the line is $150,000.

Hagerstown, Md.—The Hagerstown Railway Company has completed its lines between Hagerstown and Williamsport and cars are now running on them.

Hamilton, Ont.—F. G. Beckett, the promoter of the Hamilton, Chedoke & Ancaster Electric Railway, has secured the necessary right of way, and steps will be taken at once to complete the organization of the company.

Lorain, O.—Franchises and nearly all rights of way have been granted for the lines of the Lorain & Cleveland Railroad Company and construction work will be begun in about one month. The power house will be erected at Avon Point. Estimates and plans for the buildings and bridges are now being made by the engineers. (The estimated cost of the road is $200,000.) S. H. Short is president, and Barney Mahler general manager of the company.

Los Angeles, Cal.—The street railway franchise applied for by W. H. Workman is to be sold at public auction.

McKeesport, Pa.—The Versailles Traction Company may extend its lines across the Youghiogheny River and thence up the valley. A couple of bridges will be erected, one at Boston, and the other at Long Run in connection with the extension.

Marietta, O.—The Marietta Electric Company has elected the following officers: president, A. L. Gracey; secretary, J. S. H. Torner; superintendent, R. J. m. Danley.

Milwaukee, Wis.—The Milwaukee & Waukesha Railway Company expects to expend about $2,000,000 in building and equipping its line from Milwaukee to Waukesha.

Minneapolis, Minn.—It is probable that the Twin City Rapid Transit Company will build a new double track line between Minneapolis and St. Paul next year, on which fast express cars will be run.

Monroe, Mich.—The incorporators of the Toledo, Monroe & Detroit Traction Company are R. B. Thomas, J. A. Dawson, W. G. Gardner, J. A. Stewart, W. L. Hoyt and Chas. G. Watson, of Toledo.

Monterey, Cal.—A large electric power plant is being built at the Little Sur River, twenty-four miles down the coast from Monterey, and as soon as it is completed, the lines of the Monterey & Pacific Grove Street Railway & Electric Power Company will be equipped for the use of electricity to be transmitted from the power plant to monterey.

Monterey, Mex.—J. A. Robertson, an American capitalist of Monterey, has purchased the street railways of Monterey in the interests of New England men. Under the new management the lines will be improved and equipped with electricity.

Montpelier, Vt.—The Consolidated Lighting Company has been granted permission to build electric railways in Montpelier. C. P. Pitkin is president of the company.

Montreal, Can.—William McKenzie, president of the Toronto Railway Company, and James Ross, managing director of the Montreal Street Railway Company, have leased the Birmingham Central Tramways for twenty-one years at an annual rental of £5000. The tramways, which comprise 43½ miles of track and are operated by horses, will be rebuilt and equipped with electricity.

Nassau, N. Y.—The Greenbush, Nassau & Niverville Electric Railway Company has been incorporated.

Ogden, Utah.—It is reported that the Pioneer Electric Power Company will build an electric railway to Salt Lake City this fall, in connection with its electric transmission line to be built from Ogden to the same city.

Pittsburgh, Pa.—The Second Avenue Traction Company contemplates extending its Walnut Street line up the Youghiogheny Valley to Versailles. At present surveys are being made along the proposed route.

Rochester, N. Y.—The Irondequoit & Lake Shore Electric Railroad Company has decided to build from Summerville to Sodus Point, a distance of six miles along the lake shore, instead of from Windsor Beach to Sea Breeze and Forest Lawn. It is probable that work on the road will be begun soon

St. Louis, Mo.—The County Court held a special session on the 27th inst. for the purpose of considering a petition asking for a franchise to construct an electric railway along the St. Charles Rock road, from the city limits of St. Louis to St. Charles. Among the prominent promoters of the enterprise are E. T. Thomas, Frank Thompson, George W. Brown, Walter E. Post, J. E. Avery, J. E. Avery, Sr., John H. Bobb and J. H. Chambers.

Seneca Falls, N. Y.—It is probable that work will be begun in a few days on the lines of the Seneca County Railway Company. John F. Dolan is the contractor.

Torrington, Conn.—J. M. Murphy, inventor of a third rail system of electric car propulsion, is the promoter of an electric railway in Torrington and from Torrington to Litchfield, East Litchfield, Harwinton, Unionville, Bantam Lake, Thomaston and Winsted. At Unionville the road will connect with the lines of the Hartford Street Railway Company. The third rail system will be used on all the lines. Mr. Murphy says that he has $100,000 pledged to back the enterprise. He is about to apply for a charter.

Uniontown, Pa.—Reports state that the Chicago Construction Company has been awarded the contract for constructing the extension of the lines of the Uniontown Street Railway Company to Fairchance, a distance of six miles.

Worcester, Mass.—All the stock of the Clinton & Worcester Street Railway Company has been subscribed and a meeting will be held soon to perfect the organization of the company. After the company is formed, franchises will be applied for, and work will be begun as soon as these are granted.

Personals.

Mr. Walter W. Wheatley is appointed superintendent of the southern division of the Brooklyn Heights Railroad Company, *vice* Sheldon T. Bent, transferred.

Mr. J. S. Badger, of the General Electric Company, of New York, has arrived at Brisbane, Australia, where he will superintend the conversion of the horse railways in that city to electric power.

Mr. F. D. Rounds has been appointed general superintendent of the Metropolitan Street Railway Company of New York in addition to his present duties. J. W. Ritchie having resigned the position of assistant general manager, that office has been abolished.

Mr. Thomas H. McLean, on Aug. 18 assumed the management of the street railway system of the City of Mexico, the property having been turned over on that date to the English syndicate which has recently purchased it. The official title of the company operating the lines, of which Mr. McLean is president and general manager, is "Compania de Ferrocarriles del Distrito Federal de Mexico."

Mr. H. H. Vreeland is planning a pleasant and well merited vacation this fall—the first he has had during his three years' management of the Metropolitan Street Railway Company. He will leave New York with his family on Sept. 8, in the private car of T. F. Ryan, for a trip to the Pacific Coast, by way of Chicago, Kansas City, Denver and the Yellowstone National Park. West of Chicago, he will go via the Atchison system and will visit many of the points of interest, apart from the larger cities. After a brief stay in San Francisco, Los Angeles and other Californian places, he will return East, arriving about the middle of October. Mr. Vreeland states that he will probably attend the St. Louis convention this fall.

Mr. Wm. A. House, who has recently been elected president of the Baltimore Traction Company, is a railroad man by instinct and training, having been, though only now thirty-six years of age, for seventeen years engaged in railway work. He is a son of the late Wm. A. House, of Baltimore, who for many years was a prominent wholesale merchant in that city. Mr. House entered the employ of the People's Passenger Railway, of Baltimore, in 1879. Under the strict surveillance of T. Edward Hambleton, who served as president of the road almost from its inauguration, Mr. House soon became a valuable attaché of the company. In 1883 the People's line failed, and Mr. Hambleton was made receiver. A year later the line was sold, and Mr. Hambleton was the purchaser. The company was reorganized under the name of the People's Railway Company, and Mr. House was made general superintendent. This was his first step where vent could be given to his tact in railroading, and to this opportunity, and the support given him by Mr. Hambleton, is due his elevation to the presidency of the Traction Company. Under Mr. House's management the system has been greatly extended and improved.

Mr. George E. Pratt, the well-known representative of the Jackson & Sharp Company, of Wilmington, Del., will, on October 1, assume the management of the Hunt Air Brake Company, and will make his headquarters in Pittsburgh. Mr. Pratt has had a long experience in railroad matters, commencing with the acquiring of the practical knowledge of the manufacture of railroad machinery at the Taunton Locomotive Works. He has also served in the employ of the New York & New England Railroad, Fitchburg Railroad, West Shore & Chautauqua Lake Railroad, each time accepting a position of more responsibility. He was secretary of the New England Railroad Club, of Boston, for three years, and was associated for a number of years with the Master Car Builders' Association. After leaving the service of operating railroads he was associated with the Pullman Car Company as mechanical inspector. He has recently devoted his attention entirely to street railway work, first with the Lamokin Car Works, and recently with the Jackson & Sharp Company. He is a man of many friends and a good hustler for business.

GEORGE E. PRATT.

Obituary.

MR. JOB ABBOTT, of Canton, O., president of the Young Lock Nut Company, and one of the directors of the Wrought Iron Bridge Company died last month. Mr. Abbott was born in 1845, and was graduated from Harvard College in 1864. He took up the profession of engineering, and turning his attention to bridge building became connected with the Wrought Iron Bridge Company. He also organized the Toronto Bridge Company, of Toronto, and the Dominion Bridge Company, of Montreal.

MR. HENRY J. WINSER, of the Vernon Fare Register Company, died last month in New York. Mr. Winser acted as Consul at Saxe-Coburg, Germany, for twelve years. He was also at one time managing editor of the *New York Times*, and afterwards of the *Mail and Express*.

Prominent New Jersey Managers.

The Consolidated Traction Company of New Jersey, whose extensive system was described last month, was not the creation of a moment or of one man, but is the result of years of careful management and a thorough study of the business conditions presented. On this page are given the portraits of the five directors of the company who have given to its affairs the greatest amount of attention and to whom, more than to any others, the remarkable success of the enterprise is due.

David Young, the second vice-president of the company and active manager, has been most assiduous in his devotion to the interests of the company, whose affairs he controls, and to his executive ability and ceaseless care a large part of the success of the company must be attributed. Mr. Young was born in Scotland, May 6, 1849. When four years of age his parents moved to Newark and he was educated in Newark public schools. He selected civil engineering as his profession and first studied under, then became a partner, of W. L. Thompson. This partnership was dissolved and a new one formed with Harrison Van Duyne, in 1872. In 1890 this was dissolved and in 1893 Mr. Young entered the partnership of Young & Borrie. On June 1, 1893, he was elected general manager of the Consolidated Traction Company. Mr. Young has taken an active part in politics, was elected member of the Newark Council in 1876, and served six years; was president of that body four years, from 1878 to 1881 inclusive, and was member of the New Jersey Legislature in 1882 and 1883. He is personally very popular and has a large number of friends.

DAVID YOUNG.

E. F. C. Young, president of the Consolidated Traction Company, is one of the most prominent men in Jersey City. He was born in Morris County, N. J., in 1835, and began his financial career in 1852, as clerk in the Hudson County Bank. In 1865 he was elected City Treasurer, which position he held for five years. He was made cashier of the First National Bank in 1874 and in 1879 became president. In 1880 he was chosen as an elector on the Democratic ticket, and cast his vote for General Hancock. In 1889 he was appointed state railroad director, which position he has filled five years consecutively. Besides being a director in the Liberty National Bank, of New York, he is identified as president with the North River Bridge Company, the First National Bank, the New Coaldale Coal Company, and many other business interests too numerous to mention.

Mr. Young has twice been invited to become the candidate as Senator for New Jersey, three times to become candidate for Governor, and several times asked to stand for Congress, but has never had time enough on his hands to admit of him accepting. He is a member of a large number of social clubs and other organizations.

B. J. Shanley, the well known contractor of Newark, may be said to have been the originator of the Consolidated Traction Company and holds now one of the largest, if not the largest, interest in it. He was born in Newark in 1847, and comes of the sturdy Irish stock which has done so much toward the development of this country. He was educated in the schools of Newark and in Bryant & Stratton's Business College. His business qualifications and remarkable ability in the management of men soon asserted themselves, and his career as a contractor in railway work and for public improvements has been most successful. In the former he has performed a great deal of work for the Pennsylvania Railroad, the most important of which were, perhaps, the elevation of the tracks in Jersey City at a cost of $1,600,000 and at Elizabeth at a cost of $500,000. He has also done a large amount of track laying and bridge building for the Lehigh Valley Railroad, Erie Railroad, Central Railroad of New Jersey, Delaware, Lackawanna & Western Railroad, Philadelphia & Reading Railroad, etc. As a paving contractor he is well known in Philadelphia, Newark, Jersey City, Elizabeth and other cities, and has constructed macadam and telford roads in nearly every county of New Jersey. He has also built and constructed large plants for water companies in different New Jersey cities and towns and has developed great quarries on the Delaware, Raritan, Passaic, and Hackensack rivers.

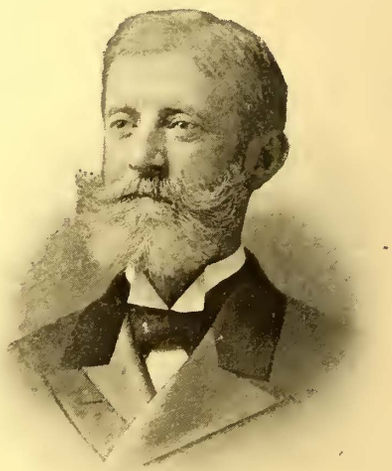
B. J. SHANLEY.

Mr. Shanley is very abstemious and is at the same time a fast friend, a good companion and popular among his acquaintances.

A. J. Cassatt, another of the prominent directors of the company, was born in Pittsburgh in 1839. His father was for a number of years closely identified with the financial and industrial interests of western Pennsylvania and was the first Mayor of Allegheny City. He afterwards removed to Philadelphia, where he established the banking house of Lloyd, Cassatt & Company. The subject of our sketch received an education in the schools of Pittsburgh, studied abroad and was afterwards, in 1859, graduated from the Rensselaer Polytechnic Institute, at Troy, N. Y., as a civil engineer. Mr. Cassatt then entered the employ of the Pennsylvania Railroad, first in its engineering department, and in 1866 was appointed superintendent of motive power and machinery of the Philadelphia & Erie Railroad which was owned by the Pennsylvania Railroad. In November, 1867, he was appointed to a like position in the latter company with headquarters at Altoona. In 1870, he succeeded Dr. Williams as general superintendent of the Pennsylvania Railroad and in the following year was made general manager of all the Pennsylvania Railroad lines, an office of which he was the first incumbent. His work in this department won him great fame, and established his reputation for executive and administrative ability of a high order. In 1874, Mr. Cassatt was advanced to the position of third vice-president, and in 1880, upon the accession to the presidency of Mr. Roberts, he became first vice-president of the company. In 1882, while still in the prime of life he voluntarily resigned this office and retired to private life, his object being, to quote from his letter of resignation, "to have more time at his disposal than any one occupying so responsible a position in railroad management could command." The private interests of Mr. Cassatt are very large. He is also well known through his connection with the

A. J. CASSATT.

E. F. C. YOUNG.



J. D. CRIMMINS.

American turf, and his Chesterbrook Farm at Berwyn, Chester County, is one of the most celebrated breeding farms of the East.

J. D. Crimmins, another director, is also prominent as a contractor and railway man. He was born in New York on May 18, 1844, and gained his first steps in education in the public schools of New York, until the age of fifteen, when he started in business helping his father; later he attended St. Francis Xavier's College, and at the age of eighteen was superintendent of his father's large contracting business. He soon showed his ability by cutting loose from the old line of business and started out to make independent contracts. In this he was eminently successful and the firm of J. D. & T. E. Crimmins has been prominently identified with all the largest contracting works of the metropolis for a number of years. One of the best known of its works are the electric subways which it constructed throughout. The most extensive work undertaken by Mr. Crimmins was the construction of the Broadway cable road which is regarded as his greatest success, the work having been accomplished in much less time than estimated by the engineers in charge. Through this connection with street railway work Mr. Crimmins gradually became prominently identified with a number of enterprises, and for several years was president of the Metropolitan Street Railway Company, of New York.

H. M. Littell.

The announcement was made late last month that the services of Mr. H. M. Littell, president of the Atlantic Avenue Railroad Company of Brooklyn, had been secured by the Metropolitan Street Rrilway Company, in the position of first vice-president and general manager. This step was taken, as explained elsewhere in this issue, in order to relieve Mr. Vreeland from the operating responsibilities of this great New York system, and it may be said of the new appointment that Mr. Vreeland's knowledge of men has been justified in his selection of Mr. Littell for this important position. No man is better known among street railway managers than the president of the American Street Railway Association. He has been connected for many years with street railway interests, originally in 1874 with the Louisville City Railway Company as clerk, starter, time-keeper, track-foreman and almost all other positions known to street railways. He then went into the service of the Louisville & Nashville Railroad Company, finally reaching, in the steam railroad field, the position of general freight and passenger agent with what is now known as the Chicago, St. Paul & Kansas City Railroad Company. In the meantime in 1883–85, he filled the position of general manager of the St. Paul City Railway Company. In 1888, he left the steam railroad field to take charge of the Cincinnati Inclined Plane Railroad, which was changed from horses to electricity under his administration. In January, 1893, he was engaged by the Seligmans, of New York, as president of the New Orleans City & Lake Railroad Company, the Crescent City Railroad Company and general manager of the New Orleans Traction Company, all in the city of New Orleans. During the next two years the work of equipping this system (operating 120 miles of horse railroad) by electricity was carried on under his superintendence. After its completion in June, 1892, he was made president and general manager of the Atlantic Avenue Railroad Company, of Brooklyn, in which the Seligmans were also largely interested. He operated this property for six or eight months until its lease to the Nassau Electric Railroad Company, of Brooklyn, which took place in the present year, since which time he has been winding up certain real estate and other business of the Atlantic Avenue Company. Mr. Littell will bring to the duties of his new position a clear head, a broad experience in both steam and street railway business, and a faculty of making friends which will be of the greatest service to him in the many difficulties which he will be called upon to meet.

H. M. LITTELL.

AT a recent meeting of the bondholders of the Los Angeles Railway Company, of Los Angeles, Cal., it was decided to accept the offer of Henry Butters, of San Francisco, representing a company of South African capitalists composed of Cecil Rhodes, Barney Barnato and others, to purchase 2923 of the 3000 bonds of the Los Angeles Railway Company and fifty-one per cent of its capital stock; also ninety-five per cent of the capital stock of the main Street & Agricultural Park Railroad Company (leased by the Los Angeles Railway Company) and all of the property and franchises of the Fifth Street Railroad Company (leased to the Main Street & Agricultural Park Railroad Company).

Annual Meeting of the Dublin United Tramways Company.

The annual meeting of the Dublin United Tramways Company, was held July 21, at Dublin. The report of the chairman showed the traffic receipts for the half-year £73,162 an increase of £9,457, advertisement £1828 an increase of £103, and parcels £1882 an increase of £143. Passengers carried were 11,866,534 an increase of 2,285,036. Of the total number over 7,000,000 were 1d passengers, the average fare being 1.47d, compared with 2.53d in 1881.

The most important announcement made, was that the company had decided to purchase the property of the Dublin Southern Tramways Company from the Thomson-Houston Company, the price agreed upon being £243,500. The Dublin Southern line is equipped with electric power, and electric power will be introduced on the Dublin United Tramways line as rapidly as possible.

AMONG THE MANUFACTURERS.

S. J. Wick, of the Electric Railway Equipment Company of Cincinnati, has received an order from the Laclede Car Company for all the bronze trimmings for 115 cars.

The National Switch & Signal Company, of Easton, Pa., has been awarded the contract for installing forty-six sets of block signals for the Ulster & Delaware Railroad.

W. P. Seguine, who is in charge of the railway department of the business of Joel H. Woodman, the well known manufacturer of veneers, in Hoboken, N. J., has not retired from business as has been reported, but is as active as usual in obtaining orders.

Elmer P. Morris has been appointed agent in New York for the Electric Railway Equipment Company of Cincinnati, and has taken an office at 36 Dey street. Mr. Morris also retains the agency for the Simplex Interior Telephone Company and the Bradford Belting Company, both of Cincinnati.

The American Stoker Company, of Dayton, O., has recently furnished, among other orders for stoker equipments, the following: Pennsylvania Railroad Company shops, Columbus, O., second order; Davis & Egan Machine Tool Company, Cincinnati, O.; Cleveland City Water Works, Cleveland, O.

The Forest City Electric Company, of Cleveland, O., has recently published a tasteful folder descriptive of its protected rail and improved Cleveland bond welder. The folder is strikingly illustrated by engravings, in which the views of the bond are printed in bronze.

J. M. Atkinson & Company, of Chicago, have been appointed agents for the Dorner & Dutton Company, of Cleveland, for the Middle Western States. They are also agents for the Buda track drills which are giving great satisfaction. They report a constantly increasing business with the horse shoe rail bond, having closed several good contracts during the past month.

The Taunton Manufacturing Company, of Taunton, Mass., has recently brought out a catalogue descriptive of the snow plows manufactured by it for electric railway service. These plows have achieved an excellent reputation in practice, and are growing in popularity, as the increasing list of the company's customers testifies. The catalogue is illustrated by a number of excellent half-tone engravings.

The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., in connection with the Baldwin Locomotive Works, of Philadelphia, Pa., has published a handsome catalogue descriptive of the electric locomotives manufactured by the two companies. The pamphlet also takes up the principles of electric motors, giving a number of working diagrams, characteristic curves and is well illustrated.

The Dorner & Dutton Manufacturing Company, of Cleveland, O., has just published a tasteful catalogue which gives an excellent idea of the extent of the company's business. As a manufacturer of trucks, car wheels, axles, gears, track cleaners, heaters, snow sweepers, wheel presses, etc., it is well known to the street railway trade, but the company does as well a large outside business as founders, machinists and engineers. The different street railway appliances are well illustrated.

J. Holt Gates, of Chicago, has been appointed Western sales agent of the Walker Company, manufacturer of street railway apparatus, of Cleveland, O. Mr. Gates is also Western sales agent of the C. & C. Electric Company, New York, and in his salesroom at 311 Dearborn Street, under Manhattan Building, he carries a full line of dynamos and motors, enabling him to make prompt shipments. With the Walker and C. & C. Companies' agencies almost any requirement in the electric equipment line can be filled immediately.

The Electrical Maintenance Company, of New York, having met with great success in New York and Philadelphia, has decided to open a Chicago office and has been fortunate in securing the services of W. R. Mason and Wm. Sharpe as agents. The plan of the company is to give expert advice on electrical matters and to maintain electrical machinery at its highest efficiency, replacing burned out armatures, field coils, commutators and brushes under contract for a small annual charge. Messrs. Mason and Sharpe may be found at 1202 Fisher Building, Chicago.

The Robinson Radial Car Truck Company and the Robinson Electric Truck & Supply Company, of Boston, have removed from their old quarters at 620 Atlantic Avenue, to the elegant offices Nos. 81 and 82 in the new Devonshire Building, located on Washington, State and Devonshire Streets, Boston, where they will always be glad to welcome their friends and all who may wish to investigate the radial truck. Mr. Robinson is at present developing several new and very important inventions in connection with electric railways. The Robinson Electric Truck & Supply Company reports more business offered than it is willing to accept.

The Consolidated Car Fender Company, of Providence, R. I., has published a very interesting catalogue relating to its well known fenders. The catalogue contains first a discussion of the principle of fender design and a statement of the cost of equipping cars with fenders and of maintaining the fenders. Following this is a tabulated statement, occupying some sixty pages, of the accidents occurring on two large lines equipped by the company—the Consolidated Traction Company, of New Jersey, and the Union Depot Railroad, of St. Louis. A summary of the accidents on these lines has been published in the STREET RAILWAY JOURNAL. The catalogue describes each accidents in detail and is very interesting as showing that the total number is largely reduced by the use of fenders.

E. F. deWitt & Company, of Troy, N. Y., report an increasing demand for their well known sand box. Users of it speak of its reliability in the highest terms and Mr. deWitt is in constant receipt of testimonials to its working qualities. One of these was received last month from the New Haven Street Railway Company, of New Haven, Conn., and reads as follows: "Please send at once to J. M. Jones & Sons, West Troy, N. Y., eight sand boxes to fit up four new cars now being built for us This gives us thirty-one cars fitted up complete with your sand boxes. We have tried a number of different kinds, but none have given us the satisfaction that yours have. We believe it to be the best sand box on the market."

The Falk Manufacturing Company, of Milwaukee, Wis., has made business arrangements with the Milwaukee Trackwork Company, by which the latter company has transferred its entire property and effects to the Falk Company. Clement C. Smith, the former managing partner and engineer of the Milwaukee Trackwork Company, has associated himself with the Falk Manufacturing Company and this company will continue with increased energy and enlarged capital the business hitherto so successfully carried on by that company. This arrangement, with the recent enlargement of its plant, and an extensive introduction of the best modern machinery, puts the Falk Company in position to furnish high grade special work for electric, cable and steam railways.

The Wells Light Manufacturing Company, of New York, reports a constantly increasing demand for the well known Wells light. This burns kerosene and gives a large, powerful flame which needs no protection and will stand in any weather. The lights are used very extensively in construction work, machine shops, etc., and are manufactured in several sizes from 800 c. p. up. The larger sized lights are fitted on wheels, so that they can be easily drawn from one point of the work to another. The Wells Light Manufacturing Company has received excellent testimonials from users. Among the latter may be mentioned the well known firm of J. D. & T. E. Crimmins, of New York, who employed the Wells lights on the Broadway and Third Avenue cable construction and found them very satisfactory.

The Electric Mutual Casualty Association, of Scranton, Pa , has out a very favorable report of the first four months of its existence. On a membership basis of thirty electric roads for three months, the company states that it has paid but $1200 in settlement of liability claims with no suits pending, and no claims unsettled where liability exists against any of its members. This is a surprisingly good showing, and is owing not only to the careful selection of risks, but to the fact that skillful railway officials and attorneys are at the head of the association, who are especially fitted by their technical knowledge to adjust the claims at the smallest possible cost. The association is said to be growing in strength daily, and its members are particularly pleased with its business-like management and handling of claims.

The Palermo Mica Company, of New York, is doing an excellent business in the importation and sale of mica for electrical purposes. The company supplies sheet mica in a variety of sizes, and makes a specialty of selecting from block or sheet mica pieces that will cut specified or special sizes. It is very careful in selecting the pieces so that the patterns can be cut with but little waste. It also supplies stamped mica segments in both India and amber mica for all of the standard types of electric motors in use. The segments are carefully gauged to thickness by micrometer calipers to .001 in., and are then pressed and packed. When received they are ready for instant use between the copper bars. The company is also prepared to do a large business in solid mica rings for commutators, mica washers, etc.

W. Tod & Company, of Cortlandt Street, New York, report, amongst their other orders, that they are now erecting at the power station of the Electric Illuminating Company, of Long Island City, two Williams improved vertical compound engines of 500 h. p. and 800 h. p. respectively, directly connected to Westinghouse multiphase generators. In these engines flat-faced, multiported, unbalanced valves are used throughout, effectually preventing leakage. Heavy wheels are used, insuring immediate and quick governing action. The steam valves of both cylinders are controlled by the governor. The engines are adapted for both railway and lighting service. The Craven Supply Company, of 39-41 Cortlandt Street, New York, is the Eastern and Southern selling agent for the Williams improved vertical engine, and speaks favorably of the business outlook in this line.

Edward Smith & Company, of New York, is one of the pioneer houses in the manufacture of varnishes, dating back to 1827. This firm makes a full line of high class varnishes and colors suitable for railway use, and its productions are well and favorably known. Its durable metal coating for the preservation of all structural metal work is attracting much attention among engineers and those having to do with the erection of bridges, depots and the modern steel and iron structures. It has been used on much important work of this character with splendid results. Its use is specially recommended on electric lines wherever it is necessary to protect iron and steel from rust, the action of acids, gases, etc. A pamphlet on "Application of Paints, Varnishes and Enamels for the Protection of Iron and Steel Structures and Hydraulic Work," prepared by the firm's chemist, Prof. A. H. Sabin, may be had on application.

The Q. & C. Company, of Chicago, manufacturer of railway supplies and special machinery, has had no difficulty in keeping busy its new and large works which have recently been erected at Chicago Heights, a suburb of Chicago. The company has recently secured orders for six large metal sawing machines, a number of which will carry saw blades thirty-six inches in diameter, and all but one of these machines are to be run by electric motors. The Bryant patent metal saw, as manufactured by this company, requires such a small amount of power to operate successfully that there is a growing demand for these machines equipped with motors, as the saving in actual cost for operation is considerable, at the same time giving equally efficient results. The managers of the company state that the sales of the Servis tie plate for the present year will be in excess of that of any previous year, aggregating many millions. There is also considerable interest now being manifested in the Servis longitudinal flange plate by street railway managers.

W. T. Van Dorn, manager of the Fitzgerald-Van Dorn Company, of Chicago, manufacturer of the Van Dorn automatic drawbar for elevated, cable and electric roads, reports some very good orders of late from new roads. This company is furnishing full equipment for the Suburban Electric Railway Company, of Chicago, using the same couplings as put on the Metropolitan Elevated motor cars in that city. The company has lately received an order from the Lacede Car Company for couplings for 170 cars for the Pittsburgh Traction Company; from the American Car Company for 120 cars for the Metropolitan Street Railroad Company, of Washington, D. C., an order for all the cars of the Washington, Alexandria & Mt. Vernon road, also a good order from the Portland Railway Company, of Portland, Ore. The company is constantly receiving orders from different roads which have made the Van Dorn bar a standard. The Van Dorn improved ball joint attachment for fastening the couplers to the body of the car is meeting with great success, having been adopted by a great many new roads lately.

The Brown Hoisting & Conveying Machine Company, of Cleveland, O., General Eastern Office, Havemeyer Building, New York, has just received an order from Fried. Krupp. at Essen, Germany, for a complete hoisting and conveying plant for his blast furnace at Rheinhausen. This plant consists of three standard Brown overhead bridge tramways, to be operated by electricity, each machine having independent winding drums and electric motors. The Brown Hoisting & Conveying Machine Company, is to furnish all the working parts, including sheaves, engines, motors, hoisting and conveying machines, etc., in fact, everything but the bridges proper, which will be built in Germany, the Brown Company sending a man abroad for that purpose. There will be three Elwell-Parker motors used, of about sixty horse power each. The entire plant is to be in operation during the early part of 1897. The company has also just received an order for three of its largest overhead bridge tramways for the handling of coal and ore, from the Krainische Industrie Gesellschaft, a large manufacturing concern of Austria. Both this and the Krupp order are really very large orders, and have been given to the company entirely through correspondence. The company has had many foreign inquiries in the past, but has paid little or no attention to them until recently, with these results.

The McGuire Manufacturing Company, of Chicago, reports a very large list of orders for trucks during the past month; in fact, the demand has increased, instead of following the expected decrease at this season of the year. The demand for the McGuire Company's winter specialties is unprecedented, and the company looks forward to the next season as the most successful in the history of the firm. These expectations are based on the fact that nearly every road that used the company's track cleaners last year has endorsed them, and the large roads have adopted them as standard. The number of orders already on hand assure the company of plenty of work in this department for quite a while. The stove department is running to its full capacity as the number of orders on hand make it necessary. Although we still have a few "dog days" left the street railways have commenced making preparations for the winter, and the McGuire Company already has orders for over 500 of its Columbia heaters. Some of these orders are from such roads as the West Chicago Street Railway, the Pittsburgh & West End Railway, the Consolidated Traction Company, of Pittsburgh, and the Chicago City Railway, all of which have adopted them as standard. The orders for the company's ratchet handles show a large increase, and nearly all the roads using them speak highly of their durability and appearance.

The Wheeler Reflector Company, of Boston, reports a large increase of orders for its well known headlights. It is evident from the large number of roads adopting the new headlight manufactured by this company, that its superior merits are rapidly being recognized. The reason for this is apparent, when it is understood that the reflector is a perfect parabola, as are all those used in the various styles manufactured by this company, and when account is taken of how carefully it is constructed to meet all other requirements of railway managers. The headlight is equally adapted to use on vestibules as well as the ordinary dashboards, is economically produced and sold at a low price. A sample of the endorsements received from users is one just at hand from the Lowell (Mass.) & Suburban Street Railway Company, which, after testing several makes, says that "although others are offered at lower prices, we willingly pay more for the Wheeler," and places a second order for eighty of them. Other roads recently adopting them are the Norfolk Suburban Street Railway Company, the Norfolk Central Street Railway Company, the Marlboro Street Railway Company, the Commonwealth Avenue Street Railway Company, the Calais Street Railway Company, West Roxbury & Roslindale Street Railway Company, the Southbridge & Sturbridge Street Railway Company; besides many others who are asking for samples and testing them.

The Phoenix Iron Works Company, of Meadville, Pa., manufacturer of the "Dick & Church" automatic cut-off engine, boilers and heaters, writes us that it has just finished the installation of a 400 h. p. direct connected engine for the Rapid Railway Company, Detroit, Mich., where it previously installed two 300 h. p. engines, and also a battery of special horizontal tubular boilers constructed for 150 lbs. working pressure. The company has also just completed a 300 h. p. steam plant for the Oakland Railway, Detroit, consisting of two simple engines, boilers, etc.; a 350 h. p. steam plant for the Lincoln (Ill.) Water, Light & Power Company, consisting of two compound, non-condensing engines, boilers, etc.; two 125 h. p. compound, non-condensing engines for the new State Asylum at Polk, Pa.; two 150 h. p. simple engines for the Bureau of Printing & Engraving, Washington, D. C.; two 40 h. p. simple engines for the Syracuse (N. Y.) Gas Company; three 125 h. p. non-condensing, compound engines, Union Trust Building, Detroit; three 125 h. p. non-condensing, compound engines for the Guaranty Building, Buffalo—both of these are direct connected. The company is also constructing three boilers of 200 h. p. each—Strong's patent—150 lbs. working pressure, for the new Great Northern Building, Chicago, and two 150 h. p. Manning boilers for the Syracuse Gas Company. The managers of the company report their works as quite busy, and that they have about all they can take care of for the next sixty or ninety days, in both engine and boiler departments.

The Ball Engine Company, of Erie, Pa., reports the following among recent installations: Ohio State Reformatory, Mansfield, O., two 150 h. p. engines, direct connected to Card dynamos; Warner Lock Company, Lyons, Ia., one 60 h. p. engine; Aberdeen Electric Light Company, Aberdeen, Miss., one 100 h. p. engine; Baltimore Sugar Refining Company, Baltimore, Md., one 40 h. p. engine; Lynchburg Cotton Mills, Lynchburg, Va., one 60 h. p. engine; Carpentersville, Elgin & Aurora Railway Company, Elgin, Ill., one 400 h. p. vertical, compound, condensing engine, direct connected to General Electric Company generator; Electric Light Plant, Ovid, N. Y., one 70 h. p. compound engine and steam plant, complete; one 35 h. p. engine for Mexico; Edison Electric Illuminating Company, Baltimore, Md., one 300 h. p. cross compound engine; McIntosh, Hemphill & Company, Pittsburgh, Pa., one 100 h. p. engine, direct connected to Westinghouse generator; Crocker-Wheeler Electric Company, Versailles, Pa., one 150 h. p. engine; Western Electric Company, Janesville, Wis., one 40 h. p. engine; Danville Street Car Company, Danville, Va., one 150 h. p. engine; Mohawk Building, Cleveland, O., three 50 h. p. engines, direct connected to Walker dynamos; Harper Hospital, Detroit Mich., two 70 h. p. engines, direct connected to General Electric dynamos; Booth Packing Company, Baltimore, Md., one 80 h. p. engine; Mt. Washington Electric Light & Power Company, Mt. Washington, Md., one 100 h. p. engine; Lehigh Valley Coal Company, Wilkesbarre, Pa., one 250 h. p. tandem compound; G. & O. Braniff & Company, City of Mexico, one 80 h. p. and one 30 h. p. engine; Tremont Building, Boston, Mass., one 100 h. p. and one 50 h. p. engine, direct connected to General Electric dynamos.

George Kissam & Company, of New York, have now on the floor of the show room in their office a very handsome trolley car. It is quite an innovation and the only one of the kind ever exhibited by a street car advertising concern. The car was built by the J. G. Brill Company, of Philadelphia, and is mounted on that company's trucks. The electrical equipment came from the Walker Manufacturing Company, and the rails upon which the wheels rest were furnished by the Johnson Company. The car is twenty-three feet four inches long and is a fine specimen of the Brill Company's work, being finished in mahogany and equipped with platform guard gates and gongs under both platforms. The upholstery is in dark red plush, and is finished throughout in the Brill Company's well known superior style. The rails are the seven inch, Broadway groove, steel rail resting on steel sleepers. The advertising cards located in the appropriate mouldings are changed daily from the thousands of the different announcements in the extensive card room of the firm, thereby giving a practical and continuous diurnal example of street car advertising properly conducted, as is always done by this well known firm. The car has attracted a great deal of attention and many people are constantly walking in to view the novel display of a real car inside of a prominent building. The office of George Kissam & Company is located on the first floor of the Postal Telegraph Building, the main entrance opening into the principal receiving office of the Postal Telegraph Company. Being near the elevators the car is readily seen by the thousands who daily enter the building and utilize the elevators to visit the offices above and the Hardware Club. The enterprise and originality of the manufacturers making the exhibit is worthy of commendation.

New Publications.

SCHUYLKILL VALLEY TRACTION COMPANY'S LINES. Published by the Schuylkill Valley Traction Company, Norristown, Pa. Forty-four pages. Illustrated.

The practice of publishing pamphlets descriptive of their lines is growing among street railway companies, and it affords an excellent method of describing the different interesting points reached on any system, and of advertising the transportation facilities. That published by the Schuylkill Valley Traction Company is larger and more pretentious than most of those which have come to our notice, and is illustrated by fifteen or twenty good sized half-tone engravings.

STREET RAILWAY GUIDE FOR EASTERN MASSACHUSETTS. Published by Robert H. Derrah, 286 Washington Street, Boston, Mass. Twenty-one pages and map. Price ten cents.

This pamphlet has been compiled with a great deal of care by the aid of the officials of the different street railway companies in eastern Massachusetts, and shows at a glance the method of reaching from Boston any point available for electric cars. The different connections, rates of fare, distance from Boston, and time required for the journey are given, together with the number of cars operated per hour between the places mentioned. The map is taken from a large map of the entire state of Massachusetts showing all the electric lines in the state, and to which reference is made elsewhere in this issue.

Trade Catalogues.

CATALOGUE. Published by the Dorner & Dutton Manufacturing Company, Cleveland, O. Twenty-eight pages. Illustrated.

ELECTRIC CAR HEATERS. Published by the American Electric Heating Corporation, Boston, Mass. Eighteen pages. Illustrated.

THE PROVIDENCE CAR FENDER. Published by the Consolidated Car Fender Company, Providence, R. I. Seventy-eight pages. Illustrated.

DESCRIPTIVE CATALOGUE OF STREET RAILWAY SNOW PLOWS. Published by the Taunton Locomotive Manufacturing Company, Taunton, Mass. Sixteen pages. Illustrated.

ELECTRIC LOCOMOTIVES. By D. L. Barnes. Published by the Baldwin Locomotive Works, of Philadelphia, and the Westinghouse Electric & Manufacturing Company, of Pittsburgh. 122 pages. Illustrated.

List of Street Railway Patents.

U. S. PATENTS ISSUED JULY 21, 1896, TO AUG. 18, 1896, INCLUSIVE.

JULY 21.

ELECTRIC CAR BRAKE.—J. C. Henry, Colorado Springs, Colo. No. 564,195.

Electric train brake of the momentum class, comprising a direct current dynamo on each car, a magnetic clutch in series therewith, and brake gearing operated by said clutch, the dynamos on the several cars being connected together in parallel.

CAR FENDER.—W. H. Hortsmann, Philadelphia, Pa. No. 564,198.

RAIL BOND.—F. H. Daniels, Worcester, Mass. No. 564,243.

OPERATING DEVICE FOR FARE REGISTERS.—J. W. Meaker, Chicago, Ill. No. 564,252.

The combination with the sections of a register operating rod, of couplings uniting the rod sections, and hand levers for rotating said rod engaging severally with the couplings.

TROLLEY.—W. H. Russell, Newcastle, Can. No. 564,395.

CAR FENDER.—H. A. Webster, Haverhill, Mass. No. 564,400.

EMERGENCY CAR BRAKE AND FENDER.—C. C. Peck, Middlebury, Vt. No. 564,533.

A combination track and wheel brake composed of an electric magnet which can be excited to increase the friction.

JULY 28.

CAR FENDER.—P. B. Donahoo, San Francisco, Cal. No. 564,599.

A series of double spring arms adapted to act independently of each other, and terminating in rollers which prevent the arms from catching and binding in the track.

STREET CAR MOTOR.—T. D. Hoskins, Springfield, O. No. 564,618

Trolley Finder.—H. Ogborn, Indianapolis, Ind. No. 564,638.

Trolley.—D. Lippy and others, Mansfield, O. No. 564,793.

Trolley.—D. Lippy and others, Mansfield, O. No. 564,794.

Trolley.—D. Lippy and others, Mansfield, O. No. 564,795.

Air Brake for Street Cars.—D. Beemer, Detroit, Mich. No. 564,863.

Electric Motor Support.—S. H. Short, Cleveland, O. No. 564,902.

Aug. 4.

Brake Staff.—A. M. Ammons, St. Louis, Mo. No. 564,960.

Rail Bond.—Frank E. Buxton, Worcester, Mass. No. 564,968.

Device for Suspending and Supporting Trolley Wires.—C. H. Fisk, Washington Court House, O. No. 564,984.

Consists of two main portions, one carrying a holder and a tightening device and bevels, and the other carrying hooks for engaging said bevels, the construction enabling the tightener to close the lower jaws of the device upon the electric wire.

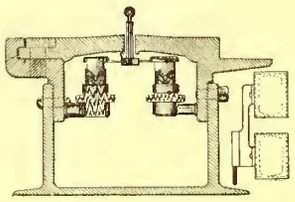
Street Railway Snow Plow.—Matthias Hoffman, Wilkesbarre, Pa. No. 564,998.

Car Fender.—William B. Altick, Lancaster, Pa. No. 565,065.

Conduit for Electric Railways.—Charles D. Mattison, New York, N. Y. No. 565,085.

Electric Railway.—H. Brandenburg, Chicago, Ill. No. 565,102.

The combination with the conduit having the continuous upwardly extending side with a longitudinal groove therein outside of the conduit chamber, of the slot rail overlying the side of the conduit having its rear edge confined in said groove, and fastening devices for retaining said slot rail in place.



PAT. NO. 565,102.

Track Brush Holder.—William E. Shepard, Long Island City, N. Y. No. 565,144.

Trolley Wire Support.—L. McCarthy, Boston, Mass. No. 565,174.

Underground Trolley System.—R. E. Sherman and D. E. Kenyon, Chicago, Ill. No. 565,240.

The combination with the slotted conduit of a housing therein, containing longitudinal slotted tubular openings for the outgoing and return conductors of the line, and a bifurcated trolley device comprising conducting arms branching from the trolley pole and terminating in contacts, and straddling said housing to enter said contacts into said tubular openings through their slots from sides of said housing.

Safety Car Fender.—W. A. Blackeney and Harry W. Blackeney, Chestertown, Md. No. 565,256.

Electric Locomotive.—Rudolf Eickemeyer. No. 565,407.

Aug. 11.

Electric Railway.—W. Grunow, Jr., Bridgeport, Conn. No. 565,453.

The combination in a closed conduit for electric railways, the bottom of which is filled in with asphaltum, the upper surface of which is inclined to form a gutter, of an electrical conductor supported centrally in said conduit and insulated therefrom, and a flexible curved cover for the conduit, a depressible rail, disposed between the elastic cover and insulated therefrom.

Rail Scraper.—W. Grunow, Jr., Bridgeport, Conn. No. 565,454.

Car Fender.—P. McMenamin, Jersey City, N. J. No. 565,558.

Car Fender.—N. J. Bishoprock, Brooklyn, N. Y. No. 565,595.

A permanent frame attached to the truck, one of its cross bars bearing two mutually operating, spring actuated levers provided with terminal vertical lugs engaging a cross rod on a tilting cradle, to maintain the cradle and scoop in operative position and to insure their uniformity of action.

Car Fender.—W. H. Kaltenbeck, Roxbury, N. Y. No. 565,621.

Electric Conduit Railway.—J. B. Linn, Cleveland, O. No. 565,624.

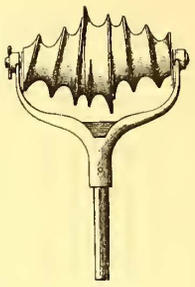
In electric railways, a wooden box constructed to be filled with oil and located at the side of the track and having double ends, and a contact block in each end provided with spring contact points and a switch in said box.

Rail Bond.—Fred H. Daniels, Worcester, Mass. No. 565,672.

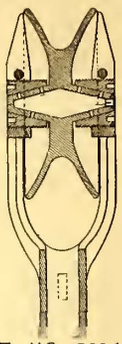
Emergency Car Brake—O. H. Rieths, Brooklyn, N. Y. No. 565,693.

Trolley Wheel.—J. B. Dailey, Philadelphia, Pa. No. 565,725.

A fork having secured in its extremity a shaft rod, a coil spring arranged around said shaft, a trolley wheel and two grooved pulleys, one upon either side of said wheel, journaled upon said shaft, and contact springs adapted to bear against the ends of said pulleys.



PAT. NO. 565,725.



PAT. NO. 566,161.

Cut-Out for Electric Motors.—Ernest P. Warner, Chicago, Ill. No. 565,867.

Aug. 18.

Railway Switch.—Frederick Greenwald, New York, N. Y. No. 565,894.

Rail Joint.—J. M. Halfpenny, Swengel, Pa. No. 565,895.

Power Gearing for Electric or Other Motors.—E. A. Sperry, Cleveland, O. No. 565,936.

Electric Brake.—E. A. Sperry, Cleveland, O. No. 565,937.

Power Transmitting Gearing for Electric Railway Trucks.—E. A. Sperry, Cleveland, O. No. 565, 938.

Controller for Electric Railway Cars.—E. A. Sperry, Cleveland, O. No. 565,939.

Contact Device for Conduit Electric Railways.—M. Stobrawa, Dresden, Germany. No, 565,035.

Car Fender.—E. McCreary, Cohoes, N. Y. No. 565,914.

Underground Trolley System.—J. Hoffman, Schenectady, N. Y. No. 565,985.

A frame for underground trolley systems, comprising a centrally located support for the conduit, which contains the feeding conductor, a continuous, insulated bridge or support for an insulated contract rail, and a hood or bell supported from the bridge, which incloses the contact points within the frame.

Trolley Wheel.—M. C. Furstenau, Detroit, Mich. No. 566,161.

A trolley wheel having hollow tapering stub axles forming a centrally enlarged lubricant chamber tapering toward each end, a fill opening at one end thereof; a cap therefor and perforations in the sides of the stub axles, in combination with a supporting fork having corresponding tapered journal bearings for said stub axles.

Car Fender.—D. Hitchcock, Norwalk, Conn. No. 566,174.

The combination of the opposing spring gripper arms each formed of a single piece, means for holding said arms normally distended, and devices extending from one gripper arm to the other for releasing said gripper arms to permit them to move together.

Trolley Pole for Electric Cars.—S. H. Short, Cleveland, O. No. 566,237.

In an electric railway, the combination with a track, a supply conductor suspended above the track and an electric car, of a flexible or elastic trolley pole attached to the roof of the car, devices for regulating the tension of said pole and a contact device carried by said pole.

Trolley for Electric Railway Cars.—J. V. Hoogstrate, Chicago. No. 566,252.

A trolley pole comprising a main portion, an upper flexible portion, a controlling rope arranged thereon so as to be automatically grasped between such portions when overhead pressure is removed and prevent rising of the pole beyond a predetermined position.

Street Car Rail.—C. Parker, Monroeville, O. No. 566,012.

Car Brake for Street Railways.—Patrick Flood, Albany, N. Y. No. 566,072.

Car Truck.—Walter S. Adams, Philadelphia, Pa. No. 566,118.

Car Truck.—G. W. Mansfield and I. F. Baker, of Lynn, Mass. No. 566,202.

Car Fender.—Frederic Reeve, Stockton, Cal. No. 566,225.

Car Fender.—C. N. Washburn and J. V. R. Ferris, Brooklyn, N. Y. No. 566,256.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. The Street Railway Publishing Company, Havemeyer Building, New York.

TABLE OF OPERATING STATISTICS.

Notice.—These statistics are carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement, "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years.

Abbreviations.—The following abbreviations are used: * Including taxes. d. deficiency. m. months.

Company.	Period.	Gross Receipts.	Operating Expenses.	Earnings from Operation.	Fixed Charges.	Net Income.
ALBANY, N. Y.						
The Albany Ry	3 m. Dec. '94	122 382	85,240	37 142	22,579*	14,564
	3 " " '95	132,407	83,928	48.479	21,457*	27,022
	12 " " '94	461,918	298,972	162,947	92,592*	70,354
	12 " " '95	522,276	314,319	207,957	88,657*	119,300
BALTIMORE, MD.						
Baltimore Traction Co	12 m. Dec. '94	1,012 319	623,010	389,279	359,243*	30,037
	12 " " '95	1,179,191	639,707	539,485	413,097*	126,387
BATH, ME.						
Bath St. Ry. Co	12 m. June '94	16,300	12,862	3,438	2,500	938
	12 " " '95	21,703	14,698	7,005	3,400	3,605
BAY CITY, MICH.						
Bay Cities Cons. Ry. Co.	12 m. Dec. '94	83,450	52,011	31,439	30,000	1,439
	12 " " '95	88,658	58,517	30,141	30,000	141
	1 " June '95	9.778	4.930	4,848		
	1 " " '96	8 696	4,298	4,398		
	6 " " '95	40,241	26 883	13,958		
	6 " " '96	41,455	27,325	14,130		
BIDDEFORD, ME.						
Biddeford & Saco R R Co	12 m. June '94	24,219	14,813	9,406	6,391*	3 016
	12 " " '95	24,287	12,186	12,101	5,915*	6,186
BINGHAMTON, N. Y.						
Binghamton R. R. Co.	12 m. Jan. '95	121 969	69.581	52.388	30,152*	22.237
	12 " " '96	128,972	73,345	55,628	35,459*	20,169
	1 " May '95	10,860	5,981	4,879		
	1 " " '96	12,725	6,619	6,106		
	4 " " '95	35 176	23,962	11,214		
	4 " " '96	42,849	25,487	17,364		
BOSTON, MASS.						
West End St. Ry. Co...	12 m. Sept. '94	6 823,879	4,807,082	2,016,796	725,064*	1,291,732
	12 " " '95	7,746,171	5,633,163	2,113,008	746,963*	1,366,044
North Shore Traction Co	12 m. Sept. '95	1,381,359	784,392	59,997	391,681*	205,316
	1 " Apr. '95	93,714	66,523	27,191		
	1 " " '96	104,316	65,127	39,189		
	7 " " '95	631,830	440,120	191,710		
	7 " " '96	681,538	466,054	215,484		
Lynn & Boston R. R. Co.	12 " Sept. '94	1,238,410	746,304	492,106	379,029*	113,077
BRIDGEPORT, CONN.						
Bridgeport Traction Co	12 m. Dec. '94	144,447				
	12 " " '95	298,883	151,697*	147,186	75,000	72,186
	1 " May '95	25,523	12,351	13.172		
	1 " " '96	30.012	15,368	14 644		
	5 " " '95	102,770	63,852	38 918		
	5 " " '96	119,839	69,469	50,370		
BROCKTON, MASS.						
Brockton St. Ry. Co.	12 m. Sept. '94	214,370	143.511	70,859	70,974*	d 115
	12 " " '95	266,892	154,950	111.942	84,691*	27,251
	1 " May '95	22,549	11,847	10,701		
	1 " " '96	26.698	15,274	11,424		
	8 " " '95	152 891	88,323	64,568		
	8 " " '96	179,400	113,962	65,438		
BROOKLYN, N. Y.						
Brooklyn Elev. R.R. Co	12 m. Dec. '94	1,730,848	1,041,095		831,093*	d 141339
	12 " " '95	2,082,937	1,158,219		859,447*	65,271
	1 " May '95	186,930	97,396	89,534		
	1 " " '96	152,243	90,439	61,804		
	5 " " '95	954,976	509,540	445,435		
	5 " " '96	775,704	457,917	317,787		
Brooklyn Traction Co.	1 " Jan. '95	44,599	56,347	d 11,728		
	1 " " '96	82,796	52,236	30,560		
Atlantic Ave. R. R. Co.	12 m. Dec. '94	1,011.258	615,863	395,395	265,118	130.277
	12 " " '95	891,940	706,900	185.040	302,918	d 117877
Brooklyn, Bath & West End R. R. Co	12 m. June '94	111,605	86,717	24,888	39.718*	d 14,830
	12 " " '95	130,928	79.394	51,535	61,150*	d 9,616
Brooklyn City & Newtown R. R. Co.	12 m. Dec. '94	595,449	346,285	249,164	120,632*	128,532
	12 " " '95	598,691	372 554	226,137	127,647*	98,489
Brooklyn, Queens Co. & Sub. R. R. Co.	12 m. June '94	543.413	427,101	116,312	169,225*	d 52,913
	12 " " '95	625,537	415,255	210,282	339.068	d 128,786
	9 " Mar. '95	443,790	303,612	140.178	250,594	d 110,416
	9 " " '96	508,819	329,146	179,673	257,293	d 77,620
Brooklyn Heights R.R. Co	12 m. Dec. '94	3,509,016	2.143.567	1,365,448	1,468,553	d 103,105
	12 " " '95	4,076,117	2.682 614	1,393,504	2,102,061	d 706,758
	3 " Mar. '95	655.600	669.850	d 14.250	512.760	d 527.010
	3 " " '96	1,003 611	635,382	368,229	497,210	d 128,981
Coney Island & Brooklyn R. R. Co	12 m. Dec. '94	316.183	207,478	108,706	52,157*	56,549
	12 " " '95	383,367	236,547	146,820	52,861*	93,959
	1 " Feb. '95	24.418				
	1 " " '96	19,313				
	2 " " '95	51,242				
	2 " " '96	40,801				
Nassau Elec. R. R. Co.	3 m. Dec. '95	82,140	59,904	22,236	20,286*	1,950
	6 " " '95	173,757	106,127	67,630	33,627*	34,003
BUFFALO, N. Y.						
Buffalo Ry. Co	12 m. Dec. '94	1,536,284	856,631	679,653	468,917*	210,736
	12 " " '95	1,351,919	649,097	702,822	417,038*	285,783
CHICAGO, ILL.						
Chicago City Ry. Co...	12 m. Dec. '94	4,264,618	2,838,684*	1,425,934	207,878	1,218,057
	12 " " '95	4,476,824	2,807,726	1,669,098	300,389	1,368,709
Chicago Gener l Ry. Co	12 m. Dec. '95	82,082	64,334	17,748		
Lake St. Elev. Ry. Co..	12 m. Dec. '94	428.095	290,090	138,005		
	12 " " '95	517,301	319,606	197,695		
	1 " Jan. '95	44,670	28 180	16.490		
	1 " " '96	52,855	30,713	22,142		
No. Chicago R. R. Co...	12 m., Dec. '94	2,565,618	1,347,326	1,218,292	465,648	752,644
	12 " " '95	2 790.487	1.311,607	1,468,880	471,251	997,629
West Chicago R. R. Co	12 m. Dec '94	4.181,237	2,518,627	1.662 610	859,471	803,139
	12 " " '95	4,201,477	2,267,195	1,931,282	902,016	1,032,266
Chicago & So. Side R. T. Co.	12 m., Dec. '94	711,685	551,811	159 874	541,750	d381,876
	12 " " '95	744,167	513.704	230,463	571,680	d341,217
	1 " June '95	54 908	42 867	11,041		
	1 " " '96	59 941	37,864	22.077		
	6 " " '95	377,790	280,402	97,388		
	6 " " '96	370,158	238,429	131,729		
CINCINNATI, O.						
Cinn. Newport & Cov. Ry. Co	12 m., Dec. '94	497,950	370,606	127,344		
	12 " " '95	624,034	418 710	205.324		
	1 " Apr. '95	45.959	33,701	12.258		
	1 " " '96	50 950	35,733	15 217		
	4 " " '95	165 994	132,249	33,745		
	4 " " '96	185,825	142,750	43,075		
CLEVELAND, O.						
Cleveland Elec. Ry. Co	12 m. Dec. '94	1,306,522	783 366	523.156		
	12 " " '95	1.503,620	912,538	591.082		
	3 " Mar. '95	311,051	221.311	89,740		
	3 " " '96	372,666	252,524	120,142		
COLUMBUS, O.						
Columbus St. Ry. Co..	12 m., Dec. '94	566,811	269 362	297.449	176,648	120.801
	12 " " '95	629.995	311.594	318.401	183,506	134,895
	1 " Apr. '95	55,077	26,979	28 098		
	1 " " '96	58 169	26,038	32 131		
	4 " " '95	188,803	96 550	92,253		
	4 " " '96	206,676	104,587	102 089		
DENVER, COL.						
Denver Cons. Tramway Co	12 m., Dec. '94	753,483	445,684	307.798	244,172*	63,625
	12 " " '95	723,480	441.283	282.198		
	1 " May '95	59 302	36.133	23.169		
	1 " " '96	64,713	37,502	25.211		
	5 " " '95	273,908	171.936	101,972		
	5 " " '96	284,831	174,871	109,960		
DULUTH, MINN.						
Duluth St. Ry. Co.	12 m , Dec. '94	208.105	111,105	97,000		
	12 " " '95	213,229	95.329	117,900		
	1 " Apr. '95	17,765	8 347	9 418		
	1 " " '96	17,564	8,863	8,701		
	4 " " '95	65,591	36,481	28,810		
	4 " " '96	65,706	34,879	30,827		
FITCHBURG, MASS.						
Fitchburg & Leominster St. Ry. Co.	12 m., Sept. '94	89,260	61,416	27,845	7,209	20,636
	12 " " '95	110,275	74,103	36,172	7,017	29,155
GALVESTON, TEX.						
Galveston City R. R. Co.	12 m., Dec. '94	199,133	131,407*	67,726	50,000	17,726
	12 " " '95	216.271	141,080	75,191	50,000	25,191
	1 " Feb. '95	12,449	8,741	3,708		
	1 " " '96	13,058	9,303	3,755		
	2 " " '95	27,010	18,602	8,408		
	2 " " '96	26,317	19.610	6,707		
GIRARDVILLE, PA.						
Schuylkill Traction Co.	12 m. Sept. '94	88,288	56 564	31,724	25,000	6.724
	12 " " '95	90.981	52.851	38,130	29,770*	8.360
	1 " June '95	8.224	4 822*	3,402	2,083	1,319
	1 " " '96	7,080	4,161*	2,919	2,083	836
	9 " " '95	63 198	43,090*	20,108		
	9 " " '96	69,597	40,158*	29,439		
GREAT FALLS, MONT.						
Great Falls St. Ry. Co	12 m., Dec. '94	26,431	24.905*	1,526		
	12 " " '95	26,650	28.126	d 1,476		
HAZLETON, PA.						
Lehigh Traction Co.	12 m., Dec. '94	97,202	50,605	46,597		
	12 " " '95	119,588	67,979	51,609	39,297	12,312
	1 " June '96	9,451	4,805	4,646		
	6 " " '96	57,433	33,142	24,291		
HOBOKEN, N. J.						
No. Hudson Co. Ry. Co.	12 m., Dec. '94	818,280	611,482*	206,798		
	12 " " '95	871,273	619,830	251,443	246,649*	4,794
HOLYOKE, MASS.						
Holyoke St. Ry. Co.	12 m., Sept. '94	75,427	48,546	26,881	3.524*	23.356
	12 " " '95	112,547	69,627	42,920	20,058*	22,862
KANSAS CITY, MO.						
Metropolitan St.Ry.Co	12 m, May, '95	1,701.155	1,058,136	643,019	371,720	271,299
	12 " " '96	1,780,910	1,033,042	747,898	484,227	263,671
LAWRENCE, MASS.						
Lowell, Lawrence & Haverhill St. Ry. Co	12 m , Sept. '95	269,740	205,816	63,924	73,423*	d 8,498
	12 " " '96	403,530	262 935	140,595	84,081*	56,514
	1 " May, '95	36,554	20,945	15,609		
	1 " " '96	36,652	19,598	17,054		
	8 " " '95	205,520	150,883	54 637		
	8 " " '96	236,018	157,495	78 523		

Company.	Period.	Gross Receipts.	Operating Expenses.	Earnings from Operation.	Fixed Charges.	Net Income.
LORAIN, O.						
Lorain St. Ry.	12 m., Dec. '95	80,176	46,092	34,084		
	1 " May, '95	7,164	3,132	4,032		
	1 " " '96	6,147	4,370	1,777	1,000	777
	5 " " '95	29,632	17,328	12,304		
	5 " " '96	26,532	20,581	5,951	5,000	951
LOUISVILLE, Ky.						
Louisville Ry. Co.	12 m, Dec. '94	1,176,790	633,206	543,584	355,799*	187,784
	12 " " '95	1,288,172	672,080	616,092	359,366*	256,726
LOWELL, MASS.						
Lowell & Suburban St. Ry. Co.	12 m. Sept. '94	277,029	179,409	97,620	66,624*	30.99
	12 " " '95	329,817	199,346	130,471	66 575*	63,896
MACON, GA.						
Macon Cons. St. Ry. Co.	12 m., Dec, '95	69,190	44,529	24,661	16,711*	7.951
MARSHALLTOWN, IA.						
Marshalltown Light, Power & Ry. Co.	12 m., Dec. '94	38,758	24,190*	14,568	7,650	6,918
	12 " " '95	40,757	24,307*	16,450	7,500	8,950
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	12 m., Dec. '94	2,003,679	1,044,548	959,131	738,961*	220.170
	12 " " '95	1,988,803	979,485	1,009.319	750,839*	25.,479
	1 " May, '95	164,006	70,539	93.467		
	1 " " '96	170,108	74,015	96,093		
	5 " " '95	754,080	354,433	399,647		
	5 " " '96	789,695	363,461	426,234		
MONTGOMERY, ALA.						
Montgomery St. Ry. Co	12 m., Dec. '94	35,216	21,724	13,492		
	12 " " '95	50.645	27,915	22,730		
	1 " June '95	4,910	2,085	2,825		
	1 " " '96	5,215	2,192	3,023		
	6 " " '95	23 082	13,971	9,111		
	6 " " '96	26,510	13,329	13,181		
MONTREAL, CAN.						
Montreal St. Ry. Co.	12 m ,Sept. '94	897,838	628,454	269,384	55 363*	214,021
	12 " " '95	1,102.778	652,812	449,966	98,617	351,349
	1 " Mar. '95	78,638				
	1 " " '96	92,146				
	6 " " '95	462,431				
	6 " " '96	664,997				
NEWBURGH, N. Y.						
Newburgh Elec. Ry. Co.	12 m., Feb. '96	91,156	55,190*	35,966	26,458	9,507
NEWBURYPORT, MASS.						
Haverhill & Amesbury St. Ry. Co.	12 m.,Sept. '94	98,346	58.061	40.284	27,664*	12,671
	12 " " '95	104 853	65,936	38,917	28,223*	10,694
NEW HAVEN, CONN.						
New Haven St. Ry. Co	12 m., Dec. '94	126,183	69,517	56.666		
	12 " " '95	198,719	124,454	74,265		
	1 " Mar. '95	11.742				
	1 " " '96	12,679				
	3 " " '95	34,712				
	3 " " '96	39,988				
NEW LONDON, CONN.						
New London St. Ry. Co.	12 m., Sept. '94	49,899	29,150	20,749	6,423*	14,326
	12 " " '95	51,759	30,230	21,528	7,650*	13,878
NEW ORLEANS, LA.						
New Orleans Traction Co.	12 m., Nov. '94	951,528	620,508	331,020		
	12 " " '95	1,327,756	752,158	575,598		
	1 " May '95	123,436	65,298	58.138		
	1 " " '96	125,698	70,440	55.258		
	6 " " '95	619,489	344,164	275,325		
	6 " " '96	689,536	375,994	313,542		
NEWTON, MASS.						
Newton & Boston St. Ry. Co.	12 m , Sept. '94	33,478	25,262	8,216	7.677*	539
	12 " " '95	32,297	24,685	7,613	7,108*	504
Newtonville & Watertown St. Ry. Co.	12 m., Sept. '95	7,580	6,599	981	809*	172
NEW YORK, N. Y.,						
Third Ave. R. R. Co.	12 m., Dec. '94	2,178,336	1,177,344	1,000,991	341,083*	659,909
	12 " " '95	2,355,154	1,456 782	1,198,372	328,917*	869,454
Metropolitan St. Ry. Co.	12 m., June '9'	5,398,466	3.223.956	2 174,510	1,859,971*	314,539
	12 " " '95	5,772,260	3,183.210	2,589,050	2,016,889*	572,161
	9 " Mar. '95	4,201.147	2 384,571	1,816,576	1,466,449	350,127
	9 " " '96	5,553,530	2,933,224	2,620,306	1,813,483	806,823
Manhattan Ry. Co.	12 m., Dec. '94	9,953,840	5,446,029	4,507,811	2,674,049*	1,833,762
	12 " " '95	9.731,203	5.533.959	4,197,254	2.988,167*	1,209,087
	3 " Mar. '95	2 525,955	1,407,082	1,118 873	661,323	457,550
	3 " " '96	2,412.891	1,417,712	995.179	610,418	384,761
Central Crosstown R. R. Co.	12 m., Dec. '94	546,026	385,309	160,717	90.427*	70,291
	12 " " '95	547,491	379,523	167,968	101,526*	66,442
D. D., E. B. & Bat'y R. R. Co.	12 m., Dec. '94	691.861	465,236	226,626	171.423*	55,202
	12 " " '95	748.443	557,074	191,369	138,112*	53,256
Eighth Ave. R. R. Co.	12 m., Dec. '94	768.064	565.927	202,138	95,545*	106.592
	12 " " '95	580.009	424,706	105,303	68,978*	36,324
42d St., Man. & St. N. Ave. R. R. Co.	12 m., Dec. '94	645,130	517,445	127,685	122,804*	4,881
	12 " " '95	626,337	527,155	99,182	122,800*	d23,618
New York & Harlem R. R. Co.	12 m., Dec '94	1.106,017	670,970	435,047	37,524*	397,523
	12 " " '95	1,015,076	693,487	321,589	40,150*	281,439
Second Avenue R.R. Co	12 m., Dec. '94	987,923	755,395	232,529	140.078*	92,450
	12 " " '95	941,290	721,417	216,873	124.566*	92.308
Union Ry. Co.	12 m., Dec. '94	470,446	254,973	215,473	141,931*	73,539
	12 " " '95	457,457	280,435	177,022	127,287*	49,735
NORRISTOWN, PA.,						
Schuylkill Val. Trac. Co	12 m., Dec. '95	50,752	36.580	14,172		
NO. ABINGTON, MASS.						
Rockland & Abington St. Ry. Co.	12 m.,Sept. '94	52.762	38,836	13,926	5,282*	8,644
	12 " " '95	67,815	49,759	18,056	6.008*	12,048
NORTHAMPT'N, MASS.						
Northampton St. Ry. Co	12 m.,Sept. '94	50.090	28,904	21,186	2,375*	18,811
	12 " " '95	83,504	46,240	37,264	3,131*	34,133
NORWALK, CONN.						
Norwalk Tramway Co.	12 m. Sept. '95	43,315	29,858	13,457		
NORWICH, CONN.						
Norwich St. Ry. Co.	12 m. Sept. '94	80.069	50,693	29,376	16,035*	13.341
	12 " " '95	85,210	53,454	31.756	17,400*	14,356

Company.	Period.	Gross Receipts.	Operating Expenses.	Earnings from Operation.	Fixed Charges.	Net Income
OAKLAND, CAL.,						
Central Av. Ry. Co	12 m. Oct. '94	32 668	26,781	5,887	1,852	4,035
	12 " " '95	30,808	26,148	4,660	3,785	875
Oakland Consol. St. Ry. Co.	12 m. Dec. '94	129,351	95 821	33,530	31,139*	2,390
	12 " " '95	125,485	94,115	31,370	25,140	6,230
ORANGE, N. J.						
Suburban Traction Co.	12 m. Dec. '94	42 502	42,938*	d 431		
	12 " " '95	52,000	56,000	d 4,000		
PATERSON, N. J.,						
Paterson Ry. Co.	12 m. Dec. '94	243,921	157,520	86.401	88,597	2,196*
	12 " " '95	298,689	174,619	124.070	97,264	26,806
	1 " June '95	31.065	17,619	13.446		
	1 " " '96	27,951	15,856	12,095		
	6 " June '95	133.592	82,429	51,163		
	6 " " '96	155,739	90,419	65,320		
PHILADELPHIA, PA.,						
People's Traction Co.	12 m. June '94	1,044.159	673,479	370 680		
	12 " " '95	1,660,676	829,815	830,861		
Hestonville M. & F. P. Ry. Co.	12 m. Dec. '94	286,021	315,762	207,450	97,966	109,485
	12 " " '95	523,212				
Electric Traction Co.	12 m. June '94	1,900 606	1,120.026	780,580		
	12 " " '95	2.151.853	1,241,584	910,269		
PORT HURON, MICH.						
City Elec. Ry. Co.	12 m. Dec. '94	46,702	32,585	14,117		
	12 " " '95	52.848	34,771	18,076		
POUGHKEEPSIE, N. Y.,						
Poughkeepsie City & Wappinger's Falls E. R. Co.	12 m. Dec. '95	93.557	60,257	33 300		
	1 " May '96	8.453	3,472	4,981		
	5 " " '96	31,040	19.979	11,061		
ROCHESTER, N. Y.,						
Rochester Ry. Co.	12 m. Dec. '94	782.520	448,304	334,216	269,045*	65,171
	12 " " '95	873,445	517,519	355,926	307,118*	48,808
ST. LOUIS, MO.,						
National Ry. Co.	12 m. Dec. '94	1,353,136	776,582	576,554	337,684	238,870
	12 " " '95	1,403.957	821,315	582,642	366,587	216,055
SCRANTON, PA.,						
Scranton Trac. Co.	1 m. June '95	26,867	12,344	14,523		
	1 " " '96	29,275	14,162	15,113		
	12 " " '95	270,628	157.183	113,445		
	12 " " '96	330,308	164,009	166,279	124,426	41,853
SEATTLE, WASH.,						
West St. & No. End Elec. Ry. Co.	12 m. Dec. '95	29,737	15,031	14,706		
SPRINGFIELD, MASS.						
Springfield St. Ry. Co.	12 m Sept. '94	373,903	252.269	121,634	18,210*	103,424
	12 " " '95	442,006	277,156	164,850	30,637*	134,213
SYRACUSE, N. Y.,						
Syracuse Cons. St. Ry. Co.	12 m. Dec. '94	194,547	181,105	13,442	197*	13,244
	12 " " '95	164,626	178.072	d 13,446	304*	d 13,750
TERRE HAUTE, IND.						
Terre Haute Elec. Ry. Co.	1 m. Dec. '94	8.354				
	1 " " '95	11,602	7,939	3,663		
	6 " " '94	60,336				
	6 " " '95	83,507	48,855	34,652		
TRENTON, N. J.						
Trenton Pass. Ry. Co.	21 m. Dec. '94	198,681				1,129
	12 " " '95	222,761				1,771
TORONTO, ONT.,						
Toronto St. Ry. Co.	12 m. Dec. '94	958,371	517,708	440,663		
	12 " " '95	992,801	489,915	502,886		
	1 " Apr. '95	75,199	39,205	35.994		
	1 " " '96	76,241	41.217	35,024		
	4 " " '95	278,404	161,048	117.356		
	4 " " '96	298,536	171,533	127,003		
TROY, N. Y.,						
Troy City Ry. Co.	12 m Dec. '94	432.596	212,407	220,189	130,474	89,705
	12 " " '95	490,489	242,775	247,714	126,116*	121.598
UTICA, N. Y.						
Utica Belt Line St. RR.	12 m. Dec. '94	119,105	90,754	58,351	29,844*	28,508
	12 " " '95	160,284	105,297	54.988	44,791*	10.197
	3 " Mar. '95	33 613	21,455	12.158		
	3 " " '96	38,650	24,866	13,784		
WASHINGTON, D. C.						
Capital Traction Co.	12 m. Dec. '95	1,063,776	634,013	429,754		
WATERBURY, CONN.,						
Waterbury Trac. Co.	12 m. Dec. '95	247,730	142,073	105.657		
	1 " May '95	20,386				
	1 " " '96	20,254	9,798	10,456	3,648	6,808
	5 " " '95	89,153				
	5 " " '96	97 343	54,212	43,131	16,280	26,851
WHEELING, W. VA.						
Wheeling Ry. Co.	12 m. Dec. '94	133,517	119,378	14,139		
	12 " " '95	150,094	88,552	61,542	32,248*	29,294
WILKESBARRE, PA.,						
Wilkes Barre & Wyoming Val. Trac. Co.	12 m. Dec. '94	400,143	196,824	203,319	122,607*	80,711
	12 " " '95	451,941	209,600	242,341	134,215*	108.127
	1 " June '95	38,372	17,319	21,053		
	1 " " '96	43,101	20,626	22,475		
	6 " " '95	189,798	97,513	92,285		
	6 " " '96	236,505	113,908	122,597		
WILLIAMSPORT, PA.						
Williamsport Pass. Ry. Co	12 m. June '94	64,863	49,646	15,217	10,255	4,962
	12 " " '95	66,845	52,459	14,386	9,691	4,695
WORCESTER, MASS.,						
Worcester Cons. St. Ry. Co.	12 m. Sept. '94	355,000	284,215	70,785	45,479	25,306
	12 " " '95	420,498	309,787	110,711	51,778	58,933
	1 " May '95	37,549	25,231	12,318		
	1 " " '96	45,728	32,424	13 304		
	8 " " '95	157,286	121,326	35,960		
	8 " " '96	191,528	144,116	47,412		

REPRESENTATIVE STREET RAILWAY MANAGERS OF ST LOUIS