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A Modern Car House.

An event of much interest to Pittsburgh railway men was the inspection of the new car house of the Citizens' Traction Company, of that city, on February 22, by the president and directors of that road, together with a few invited guests. The house stands at the intersection of Penn and Franklin Avenues at the terminus of the company's Penn Avenue cable line. The present building, a handsome structure with massive brick walls and interior supports of heavy iron beams and girders, is an enlargement and alteration on a radical scale of the shed that formerly occupied this site.

In the old quarters the storage space was so restricted that there was only room for three cars on the loop under the shed, and the storage and shifting had to be done by men and horses. While this was considered adequate at first, the business rapidly outgrew such slender provisions for service. When the cable cars were first put on, they were run under five minutes' headway; but at the end of one year, the business had so increased that the cars were run at intervals of only one and a half minutes during the busy hours of the day. The result was that with the limited room on the loop in the shed, the management often had to begin ahead and run cars in a waiting line on the street, in order to properly dispatch them on time. All this caused no end of inconvenience to the company, and finally became a source of considerable annoyance to the neighboring residents.

About a year ago the company decided to take steps to relieve the congestion of the street and to provide proper facilities for its increased and increasing business. It was left to J. E. Rugg, the widely known and efficient manager of the line to perfect and submit a plan of alteration suited to all the needs of the case. This he has not only done, but he has brought to bear on the task, as is shown by numerous details, knowledge that could only have been acquired through long years of experience.

The work was begun in April, 1893, and during its progress the operation of the line was continued as usual and, though the cars were often run under one minute headway, not a single trip was missed. In the carrying out of the project and the construction of the building, Mr. Rugg was ably seconded by the company's engineer, William Bradford.

The alterations included the enlargement of the old building by an additional structure, 175 × 101 ft. A part of the old shed was then converted into a housing station and terminus of the Wilkensburg electric division of the Citizens' Traction Company. The old loop was taken up, and a new rope, 400 ft. long, introduced, making a new loop. This enters the building at its west end from Penn Avenue; thence passes through it along the south and east walls to Frankstown Avenue; thence through the street along the north side of the house to Penn Avenue again.

Penn Avenue, at the intersection point, is considerably higher than Frankstown Avenue, and in the readaptation of the building this feature of the location has been ingeniously put to great use. As the cars enter the house from Penn Avenue, the cars drop the rope, and traverse all the loop by gravity. In addition to having a grade, the loop track is elevated, so that the grip does not have

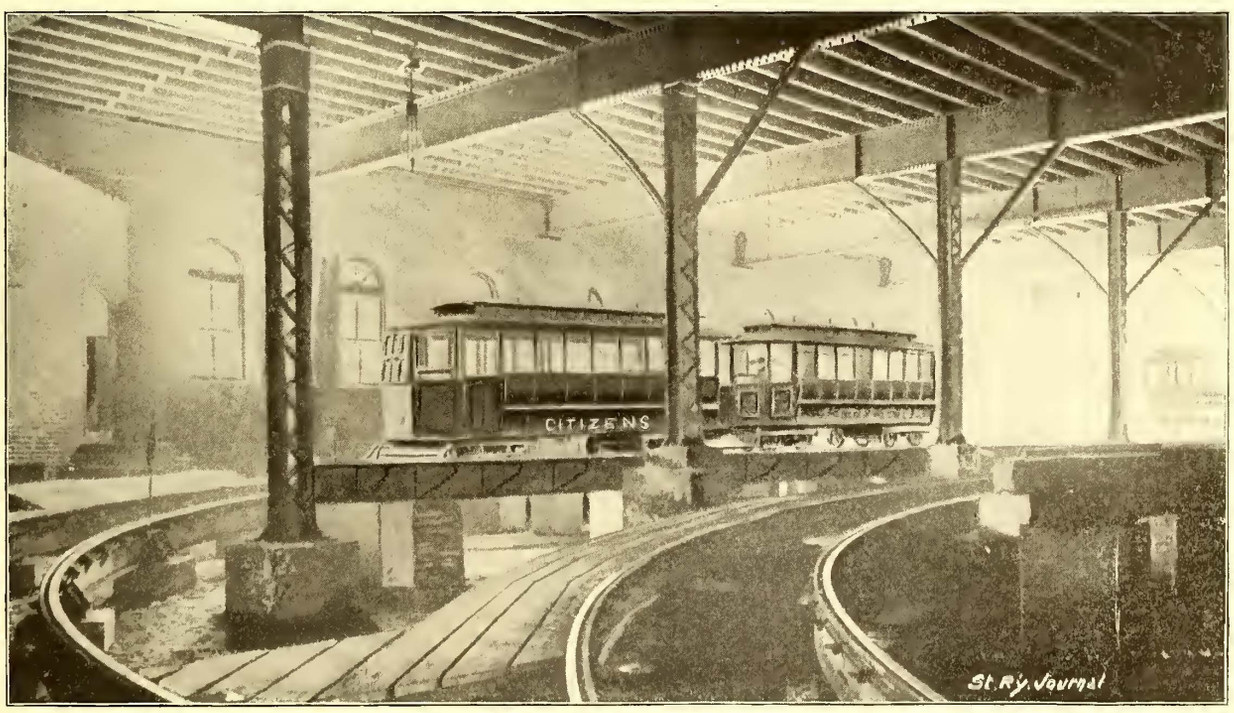
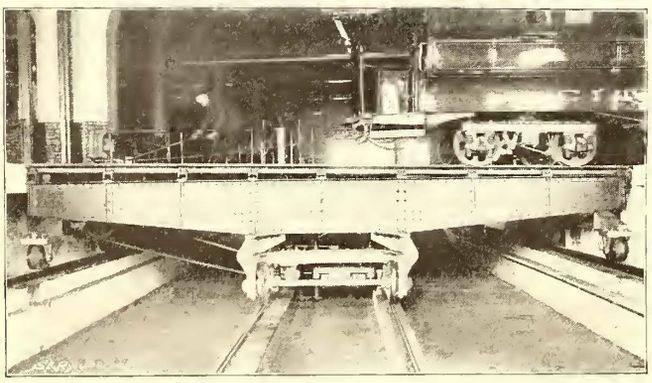


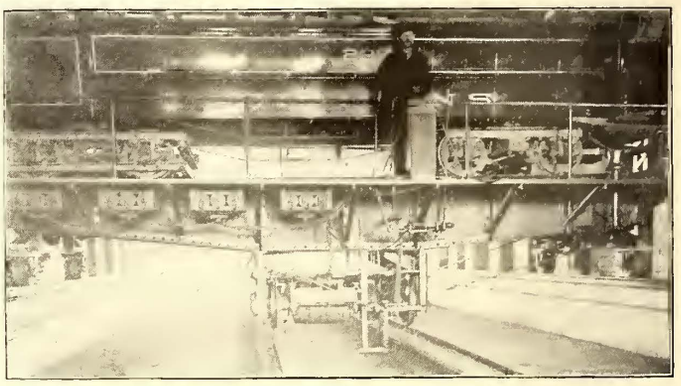
FIG. 1.—INTERIOR OF CAR HOUSE—CITIZENS' TRACTION CO., PITTSBURGH, PA.

to be taken out. (Fig. 1.) An interesting feature of this track is the compounded grade. From Penn Avenue to the curve of 48 degs. radius, shown in the engraving, the grade is 2 per cent.; at the curve, 3 per cent., and as the track leaves the building it falls to 0.6 per cent.

If it be intended to take the car out of service, as it enters the building it is shunted on to the switching track. As this track is slotted, and elevated above the floor of the house with a grade, the car runs by gravity on to the electric shifter, without the grip being taken up. The men. In the present arrangement there is employed one pitman to examine grips and do necessary cleaning, and one man has charge of the electric shifter and heating boiler. As a matter of time, the car can be taken off the cable connection on the street and put in proper place on the storage tracks in one minute. If in proper order of sequence, it can be put out for service in thirty seconds.

The building is thoroughly heated throughout, and steam pipes run under all storage tracks which are high



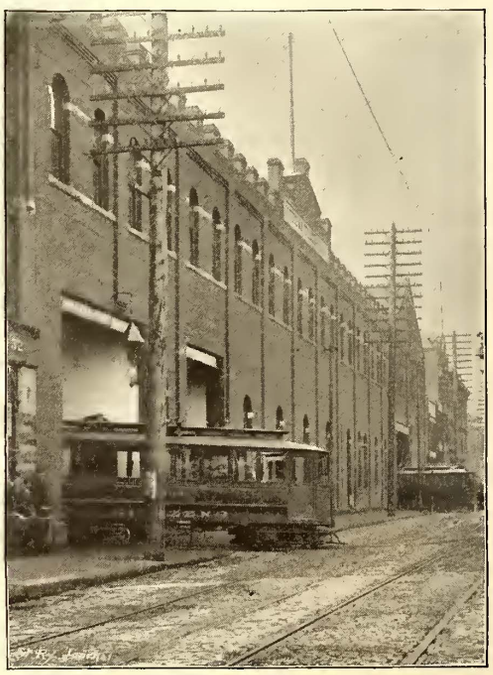


FIGS. 2 AND 3.—ELECTRIC TRANSFER TABLE—CAR HOUSE OF CITIZENS' TRACTION CO., PITTSBURGH, PA.

tracks on the transfer table of this shifter are about five feet above the rail on which the shifter works, and match, in grade and elevation, the storage tracks. When the shifter moves to a given position, the car runs off and to its place by gravity, and without taking up the grip. The shifter is designed to operate on a curve.

For bringing the car back on to the shifter, up the slight incline of the tracks, there is a little capstan on the transfer table. A rope with a hook, as shown in the engraving, is fastened to the car, and two or three turns enough to allow an inspector to examine the cars on them. There are no conduits in the building. All tracks are elevated and all inclined.

Other features of the house are a fireproof oil room and an admirably arranged office shown in Fig. 6. In this is a large box for receiving envelopes and reports, directly in front of the dispatcher. Beneath it is the cash drawer. Right behind the dispatcher is the telephone; on his left hand various drawers and cases of pigeon holes, while at the end of the office is the safe. Looking



FIGS. 4 AND 5.—VIEWS ON PENN AND FRANKLIN AVENUES—CAR HOUSE OF CITIZENS' TRACTION CO., PITTSBURGH. PA.

taken around the capstan; a man takes up the slack, and the car is pulled into position. To dispatch the car on to the line, the shifter is brought back to the switching track, and the car runs to its place on the loop by gravity, and without taking up the grip.

The advantages afforded by the ingenious substitution of gravity for power, and by elevated tracks leaving the grip untouched from the moment it enters the house until it leaves it, are obvious, both for economy of time and money. As compared with the method followed in the old shed, it means a saving of three horses and four through one window, the dispatcher can see down the street several hundred feet; without moving from his place he can see the tracks in the house through another. Behind the office is a room for the division superintendent, with every convenience, including provision for sleeping during storms or unusual service. Back of this is a large toilet, and at one side a room especially devoted to accident reports, so that the men can make them out calmly and without diversion of attention.

On the second story are large paint and repair shops lighted with monitor roofs, also a large forge, storage

rooms and additional storage tracks. The total storage capacity of the building is for 100 cars. The cars are taken to the second story by an electric lift elevator. The current for the electric lighting and all power purposes comes from the company's electric power house, more than two miles away. For dispatching, nine cars can stand on the loop in the house and four on the switching track, counting one on the shifter in line with it, thus making thirteen cars ready for service.

Throughout, the building is as orderly and clean as a well kept hotel. In convenient places waste barrels and

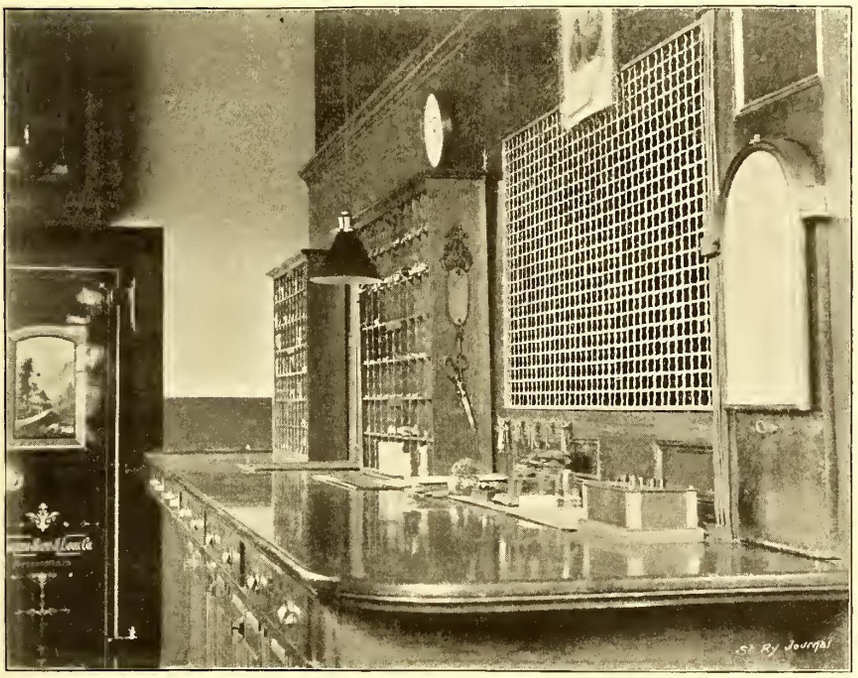


FIG. 6.—OFFICE OF DISPATCHER—CAR HOUSE OF CITIZENS' TRACTION CO., PITTSBURGH, PA.

cans for paper, oil rags, etc., are scattered through the house; and Mr. Rugg says that he is meeting with an encouraging use of them by the men.

Not the least of the excellent features, that strike a visitor to this house, are the provisions for the comfort of employes, coupled with a wise discipline. A lobby 29 × 19 ft., well heated and admirably lighted, is furnished the conductors and gripmen on the Frankstown Avenue side of the building. It is provided with an ample number of comfortable seats and connected with the office by electric calls. Out of it on one side opens a well kept lavatory, and on the other a coat room, 28 × 19 ft. In this each man has a separate locker, and each locker is provided with a wire door to let in light and heat on damp clothing. In the accident room previously referred to, a large shelf is provided, where the families of the employes can leave lunch or dinner pails. In speaking of this arrangement Mr. Rugg used these significant words: "We show the men that we respect them by doing this for them. Now, we expect them to respect themselves and show it by doing their duty to us."

The visiting party, consisting of John G. Holmes, president, H. L A. Stewart, C. L. Magee, James J. Donnell, John B. Jackson, directors, and George Wilson, solicitor of the company and a representative of the Street Railway Journal, expressed great satisfaction with the building and its arrangement.

The Pennsylvania Traction Company proposes to build an electric line from Philadelphia to Harrisburg. This, with the line between Baltimore and Washington already started upon, and that between Philadelphia and Jersey City well under way, seems to indicate that the application of electric power to long distance transportation is fast approaching.

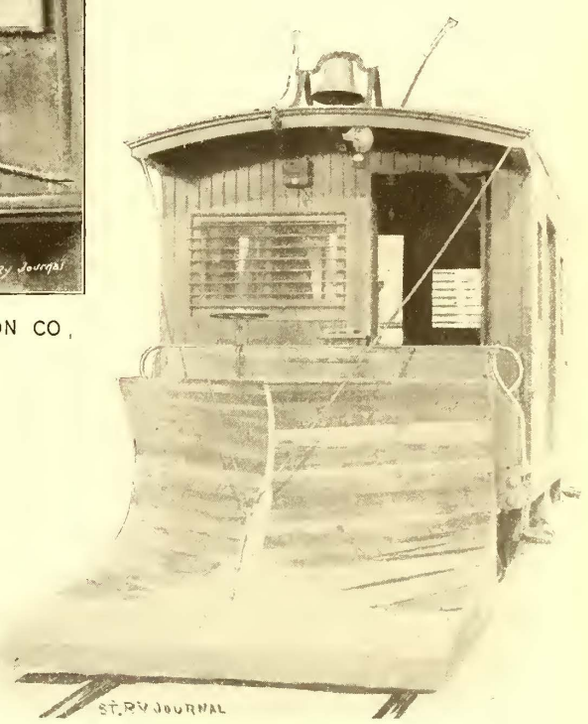
Superintendent George Coykendall, of the Kingston (N. Y.) Electric Railway, has invented a new fender which is being tried on the cars of that road.

A Snow Plow for Heavy Drifts.

We published in a recent issue of the Street Railway Journal a description of the electric locomotive of the Mousam River Railway Company of Sanford, Me., This locomotive weighs over ten tons, and has been found most convenient during the last winter for clearing heavy drifts from the track. The snow plow shown in the engraving on this page was used. With plenty of power and at full speed it was found that the car had no difficulty in throwing the snow, if not damp, a distance of seven feet from each side of the track.

February was the most severe month last winter for snow on this road, but in spite of the cold weather, business was carried on as usual. During the year ending March 1, 1894, over 38,000,000 lbs. of freight and 124,000 passengers were hauled on this line without the loss of an armature spool or diverter, or any other trouble, such as short circuits, grounds, etc. This is an excellent method, and speaks well for the care and management of Superintendent Day.

The results of operating a freight business on this railway have been so



ELECTRIC LOCOMOTIVE AND SNOW PLOW—SANFORD, ME.

satisfactory as to encourage other roads, so situated that a freight traffic is possible, to adopt a similar course.

Traffic of the Liverpool Elevated Railroad.

The result of the first complete half-year's working of the Liverpool Overhead Electric Railway, according to the London *Engineer*, has been that it carried 2,475,639 passengers, and ran 46,429 trains, of which 95.35 per cent. were punctual. The receipts amount to £18,518 4*s.* 7*d.*, and the working expenses to £13,732 11*s.* 2*d.*, or 74.15 per cent., a high proportion compared with the working expenses of other railways, but being only slightly over the working expenses of the South London Electrical Railway, the cost per mile of the former being 1*s.* 1½*d.*, and of the latter, 1*s.* 0⅜*d.* The amount available for dividend was £5,452, out of which dividends were declared of 5 per cent. on the preferred, 1 per cent. on the common stock, and £2,598 7*s.* 1*d.* carried forward to next half-year's account.

Electric Motors for the Erie Canal.

Frank W. Hawley, vice-president of the Cataract General Electric Company, secured March 11 from Superintendent Edward Hannan of the New York State Department of Public Works a fifty year permit for his electric company to put in some kind of an electric plant along the lines of the state canals by which boats may be operated by electricity.

The permit authorizes the company to enter upon all canal lands of the state for the purpose of constructing on or over or under either canal bank a system for propelling canal boats with electricity, without interfering with the present mode of operation. Central power houses may be erected. The rates for towage shall be subject to modification and review by the State Superintendent of Public Works, but such rate shall not exceed $20 an electrical horse power for any season of navigation. An important provision is that the company may, so long as the wants of the canal are supplied, employ its electric plant along the line of the canal in furnishing electric light, heat and power for distribution to any point or points beyond the line of the canal, and may thus furnish electricity for lighting and power purposes in all of the cities and villages along the canal. The company must furnish to the state, free of charge, sufficient power to operate motors to open all gateways leading to and from locks, and also electric lights sufficient properly to illuminate such locks at night. The company must have its plant in operation on the Erie Canal between Buffalo and Albany within three years from date, or forfeit the privileges accorded by the permit.

The permit has not yet been formally accepted by the company.

The directors and officers of the Cataract General Electric Company are: President William Mertens, of Von Hoffman & Company, bankers, of New York; vice-president, Frank W. Hawley; secretary and treasurer, Charlton T. Lewis, counsel for the Mutual Life Insurance Company, of New York City; Thomas C. Platt and ex-Senator Commodore P. Vedder.

There is another company, having the same directors as the Cataract Company, called the Erie Electric Towing & Power Company, with its principal office in New York City. This company will construct and put in operation as soon as possible a half-dozen tugboats operated by electricity, either on the storage or trolley system, with a view to showing the adaptability of electricity to canal navigation. These tugboats will also tow for a moderate consideration any horse boats, the captains of which desire to avail themselves of such method of navigation.

These two companies are subsidiaries of the Niagara Power Company. The principal stockholders of the latter company are: J. Pierpont Morgan, William K. Vanderbilt, D. O. Mills, Morris K. Jesup, Isaac N. Seligman, H. McK. Twombly, Brown Brothers, August Belmont and an English syndicate represented by Vermilye & Company, bankers, of New York City.

The Electric Railway System of Wheeling, W. Va.

Among the electric railways which have been installed in different sections of the country, that at Wheeling, W. Va., deserves mention for its excellent plant and the success which has attended its operation. This railway, situated close to extensive coal fields was in an excellent position to install electric power, and the results attained have been most satisfactory. The power station shown in Fig. 1 is a handsome brick structure with stone trimmings, on 42d Street, and measures 99 × 84 ft. The architect was M. F. Geisy, and the builders were Murray Brothers. The stack is octagonal in section, 125 ft. in height and fourteen feet in diameter at the base. The top is surmounted by an ornamental crown.

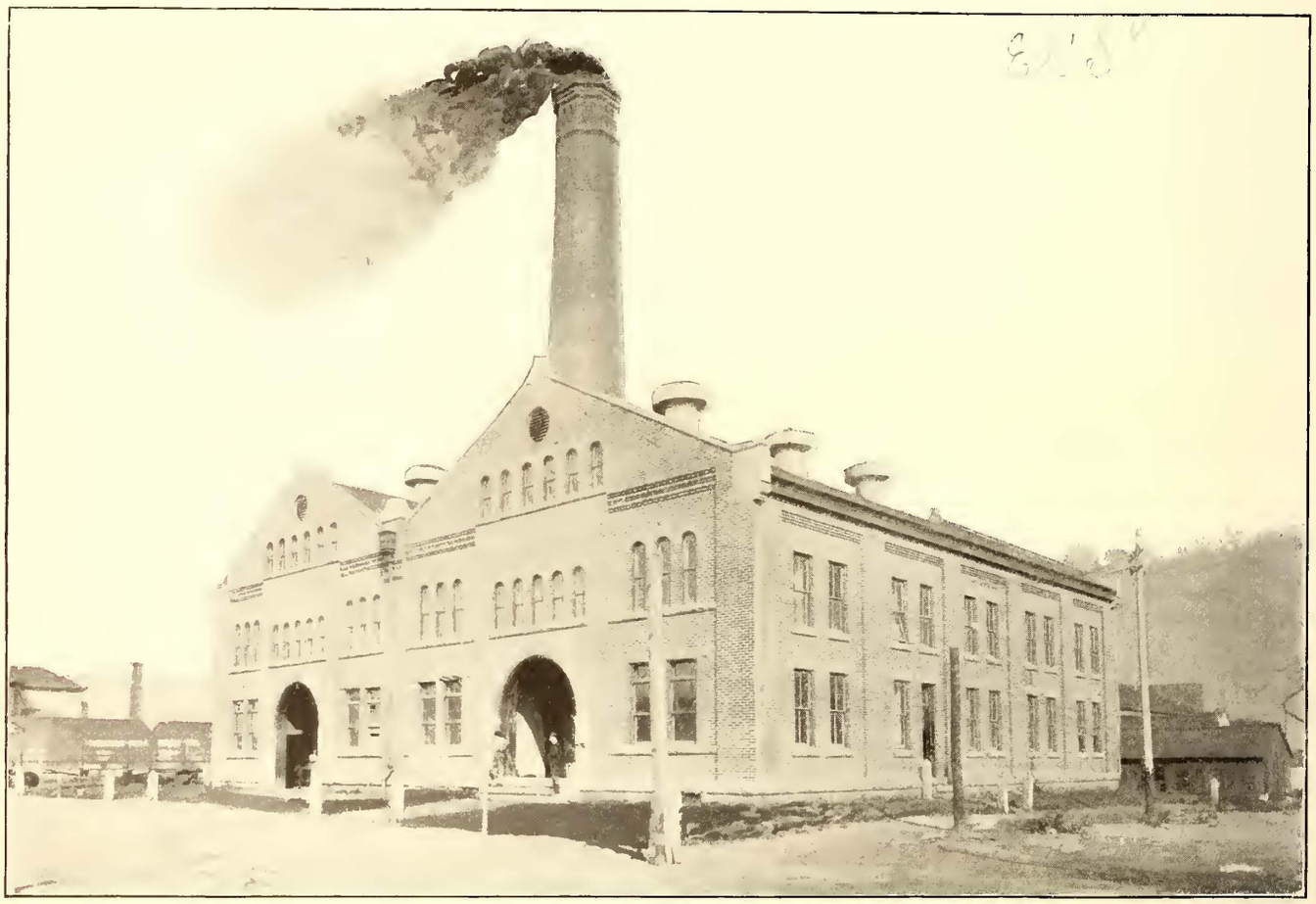


FIG. 1.—POWER STATION—WHEELING ELECTRIC RAILWAY.

The steam generating equipment consists of Abendroth & Root water tube boilers, shown in Fig. 3, and equipped with McClave grates. Abendroth & Root steam gauges, Stratton separators and Korting injectors are used. The piping is covered with magnesia sectional covering, and Jenkins valves are employed. The pumps were manufactured by the Titusville Pump Company.

A view of the engine room is presented in Fig. 2. The engine equipment consists of three Ball automatic, cross compound engines, of 250 H. P. each, with cylinder dimensions fifteen and twenty-five inches by fourteen inches. These are directly belted to one Westinghouse 270 H. P. and four General Electric M. P., 100 H. P. generators. The belts used were supplied by the Chas. Munson Belting Company and Gratton and Knight. The switchboard is located in the rear of the generators, on a raised platform, and is some distance from the wall, giving access to all connections. It is of the standard General Electric paneled type, equipped with all necessary ammeters, circuit breakers, switches, etc. A Yale & Towne traveling crane, which extends entirely across the room, completes the equipment of this portion of the station. The room is well lighted and ventilated by many windows.

The mileage of this company consists of two miles of single track and seven of double, or an equivalent of sixteen miles of single track. The maximum grade is 9 per cent., and the radii of the curves vary from forty to seventy-five feet. The track is laid principally with Johnson girder rails of from seventy-eight to eighty-five pounds in weight. Some fifty-two pound rails are also employed, and are laid with four inch bulb chairs. The ties are of white oak 6 × 8 ins. × 8 ft., and the rails are connected at the joints by six bolt fishplates. The paving is of vitrified brick. The return circuit is made by bonding the rails with riveted bonds of No. 0 wire, and also connecting to the water pipes. The trolley wire is No. 0 wire, and the feed wire No. 0000 and No. 00. The poles are octagonal and of wood, and were supplied by the Cleveland Cedar Company. General Electric and the Railway Equipment Company's line appliances are used in the overhead line.

We present in Figs. 4 and 5 two views of the car house. This is a handsome brick building, with a slate roof, and has a capacity sufficient for a very large number of cars. It measures 68 × 270 ft., and contains five tracks over pits 160 ft. in length. The appointments are very complete.

The rolling stock consists of twenty-five sixteen and eighteen foot motor cars, supplied by the J. G. Brill Company and the St. Louis Car Company, with nine trail cars of the St. Louis Car Company's make. The trucks used are of the Brill and McGuire types, and carry General Electric W. P. 30 motors. Lewis & Fowler and Meaker registers are used. The equipment of the road also includes one Walkaway snow plow and one tower wagon, made by the Toledo Wagon Company.

The repair shops of the company are equipped with a fourteen foot, thirty-three inch swinging-lathe, a shaper with twenty inch stroke, a thirty-six inch radial drill

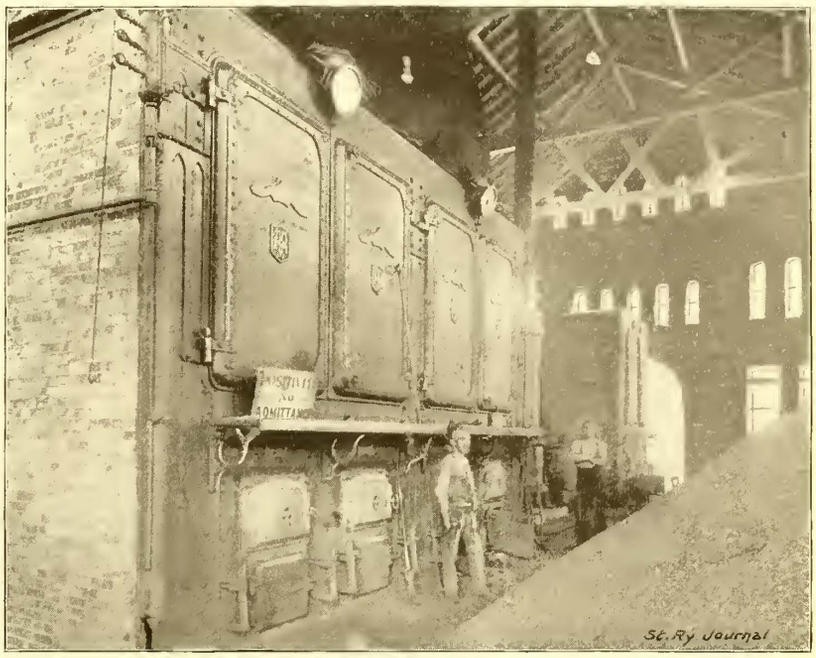


FIG. 3.—BOILER ROOM—WHEELING ELECTRIC RAILWAY STATION.

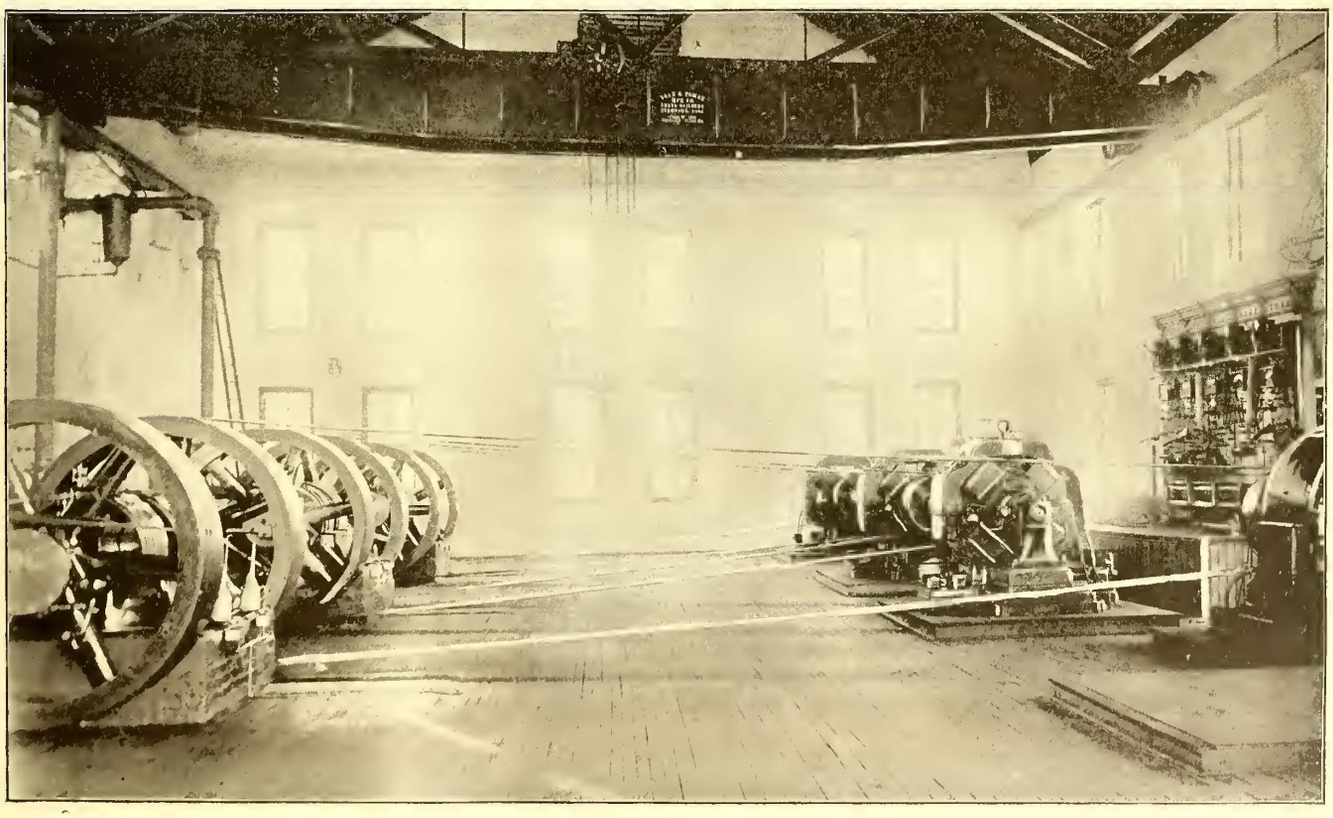


FIG. 2.—INTERIOR OF ENGINE ROOM—WHEELING ELECTRIC RAILWAY STATION.

press, single spindle band and circular saw, wheel press, etc.

The company's capital stock consists of $700,000 authorized and issued, and its bonded indebtedness of $500,000 first mortgage, 6 per cent. bonds.

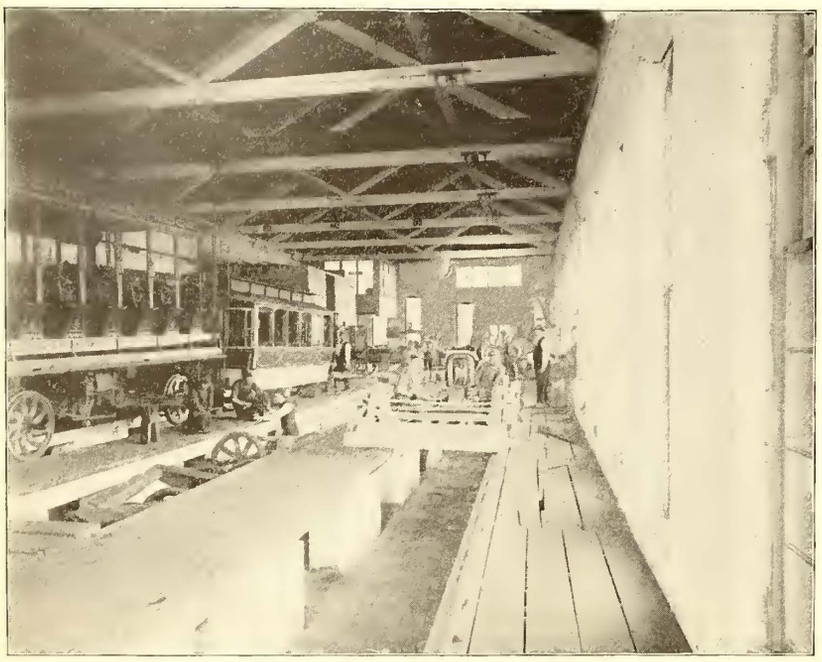


FIG. 4.—INTERIOR OF CAR HOUSE SHOWING REPAIRING DEPARTMENT—WHEELING ELECTRIC RAILWAY CO.

The officers of the company are: President, J. Jacob; secretary, W. A. Shirley, and general manager, A. M. Jolly.

New Vertical 600 H. P. Engine.

A new vertical engine of 600 H. P., which possesses a number of novel features, has recently been constructed by the Ball & Wood Company, of Elizabeth, N. J. An inspection of this engine was made by a number of prominent electrical, mechanical and consulting engineers, of New York and vicinity, on March 31, upon invitation of the Ball & Wood Company. The engine attracted a great deal of interest and admiration. It is destined for the Chicago Edison Company.

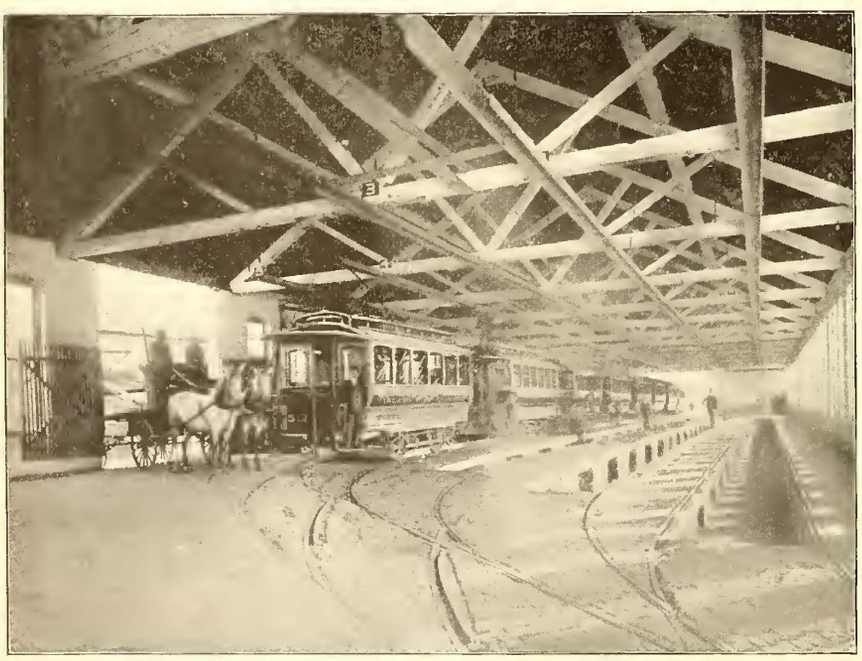


FIG. 5.—GENERAL VIEW OF CAR HOUSE INTERIOR—WHEELING ELECTRIC RAILWAY CO.

The Silvey Storage Battery Car.

The early history of the storage battery, together with the struggles of its inventors to perfect an economical, durable and reliable cell, are familiar to electricians generally. The repeated failures in this line can be traced largely to the crudeness of design and development of the different battery systems, and also in part to the use of motors designed and constructed for use with the overhead system.

In the year 1890 W. L. Silvey, of Dayton, O., began to make storage batteries after a long series of experiments on different types of batteries, and in the summer of the same year a train of cars on the Big Four Railway was equipped with the Silvey electric light. Twelve cells of battery and ten sixteen candle power, twenty-five volt lamps were used to each car. The light having been operated during a run of 90,000 miles between Cincinnati and Dayton, was so successful that fifty-five cars were similarly equipped on the Chesapeake & Ohio Railroad, and during three years no such thing as a short circuited cell or buckled plate has ever occurred. The relative cost of the oil, Pintsch gas and the Silvey storage battery incandescent light for the year 1893, is shown by the report of Chief Electrician W. S. Greene, of the Chesapeake & Ohio Railroad, just published, to be as follows: Electric light, $17.73 per year per lamp; oil lights, $24.12 per year per lamp, and Pintsch gas light, $29.42 per year per gas burner or tip. The relative candle power of each light was: Oil, ten candle power, gas, eight candle power, and electric light, sixteen candle power.

In the spring of 1893 Mr. Silvey undertook the construction of the storage battery car here described. This car has a sixteen foot car body, built especially for the work by the American Car Company, of St. Louis, provision being made for placing batteries in iron trays, and sliding them under the seats through openings at the end of the car. A McGuire truck is used, with especially heavy axles. Fastened crosswise to the truck frame are two ten pound Carnegie I beams which support the motor.

The motor proper is constructed as follows: Two rings of steel, having numerous wedge shaped pole pieces, are wound with coils of wire, the winding being in such a way as to make a consequential pole out of each projection. These two rings are tied together by rods extending from one to the other, and constitute the field magnets. The armature is composed of a central, non-magnetic spider and rim, around which is wound and securely fastened a ribbon of the best quality of soft iron, until a diameter is produced as large as the field magnet rings. The armature is turned true on each face, and provided with notches for the coils. Each slot is thoroughly insulated by mica troughs, and the armature being very narrow, the coils are completely insulated from each other, rendering a burned out coil a matter of almost absolute impossibility; besides, no bands are required. The armature coils are connected to a multiple bar commutator, as shown in the cuts. By this arrangement a very light motor has been produced.

This motor has an armature ring three and three-quarters inches through, and twenty-four inches in diameter, wound with 2,000 turns of No. 14 B. & S. double insulated wire, weighing about forty pounds. The entire machine, complete, weighs 1,350 lbs., and develops forty horse power. The entire equipment of the motor,

together with all gears, gear cases, etc., weighs less than 2,000 lbs. It will be observed that the motor is placed with its armature shaft at right angles to the car axles, and is geared to both, the proportion being 5 to 1. The motor proper is placed entirely on the frame of the truck, the car axles carrying no weight, except the large bevel gears which are entirely encased and run in oil. A cushioned coupling is employed between the motor shaft and the shaft carrying the small bevel gears, by which the car wheels are free to move in any direction without in any way affecting the other parts; at the same time the gears are always kept in alignment. As an experiment, the truck has been made to ascend a 17½ per cent grade, being stopped and started on this gradient without the use of sand. The entire lower half of the machine is encased in a waterproof case. The upper half of the field magnets are made removable, enabling any ordinary mechanic to rewind a section in the armature in an hour, without removing it from the motor or taking the truck from under the car body. It has been the aim to make every part so simple as to be easily accessible, easy to repair, strong, light and durable.

The aim in the construction of the battery has not been to push the efficiency of the apparatus to the utmost limit, making it very light in weight, but rather to make an apparatus capable of withstanding almost any amount

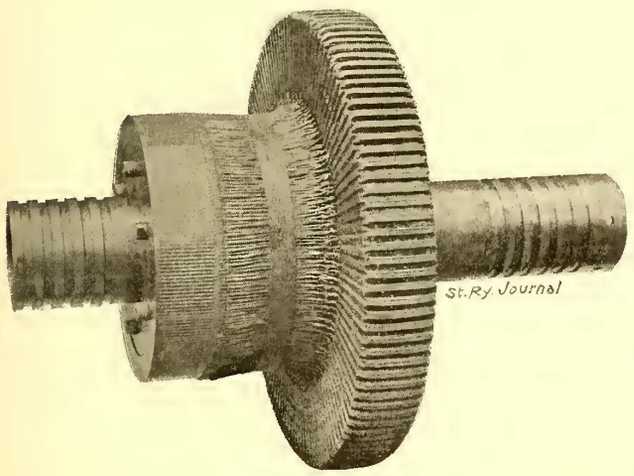


FIG. 1.—ARMATURE—SILVEY MOTOR.

of hard usage. The batteries used have been doing constant service, operating the street car for the last nine months, without trouble from short circuits or buckled plates. Cells having a rated capacity of thirty amperes discharge have frequently been entirely discharged at the rate of 120 amperes, and charged at the rate of 100 amperes without doing any harm. These extreme charges are of frequent occurrence as the batteries are charged in three hours and discharged every three and a half hours. The battery plate proper consists of an inoxidizable, alloyed lead metal grating 5 × 7 ins. and about one-eighth of an inch thick, twenty-one of which constitute a complete battery cell. The perforations in the grid are filled with superficially oxidized particles of metallic lead and oxide of lead, after which they are subjected to a pickling process which hardens the charging material into a firm, coherent mass, and by which it becomes firmly fixed into the holes and forms a surface layer over the entire plate. The plates are clamped together by means of a lead screw passing through the holes, a nut being placed between each plate and firmly screwed down, making a metallic contact, after which they are all welded on the surface. In case it becomes desirable to take the cell apart, it is easily done by removing these nuts, breaking the welded parts. The filling for the battery plates is chemically pure lead which has been found in practice to give a useful working output of about 20 per cent. greater efficiency than is possible with batteries employing a mechanically filled plate of lead oxide alone, which necessarily contains large quantities of impurities.

Between each set of plates there is placed a sheet of a porous separating material, the edges of which are saturated with a preservative compound and which has been treated until it becomes practically indestructible in the electrolyte, and capable of absorbing about fifty times its own weight of the acids used in the battery. The latter, in fact, becomes nearly a dry cell, as there is very little free liquid to become spilled. Should the rubber cell ever become broken, the liquid held in suspension in the separating material is sufficient to operate the car properly during a trip. In order to prevent splashing of the free liquid, the cell is made very deep, and as an additional

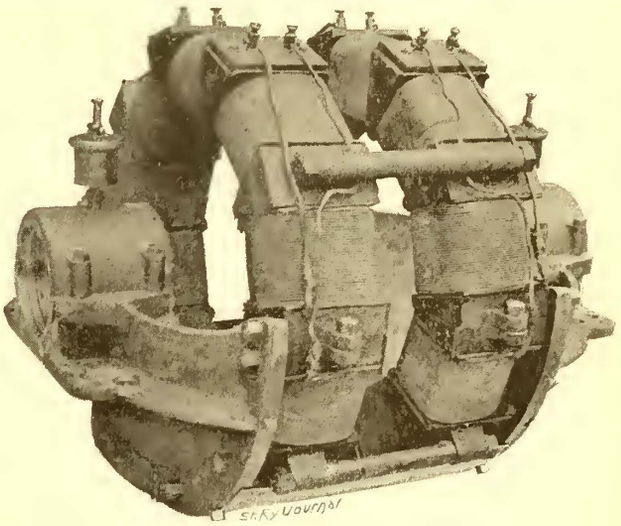


FIG 2.—FIELD—SILVEY MOTOR.

precaution a sort of wooden crate, also shown in Fig. 3, is placed on top of the plates, dividing the interior of the cell into small pockets, preventing the formation of waves incident to a car in rapid motion over an uneven road.

In the operation of the car 108 cells of battery are employed, each cell weighing twenty-seven pounds, making a total weight of batteries of about 3,000 lbs., which practice has demonstrated will in every day service operate the car about thirty miles at each charge running at full

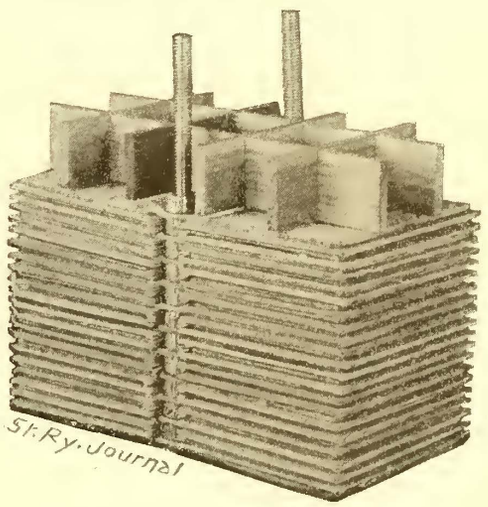


FIG 3.—STORAGE BATTERY PLATES.

speed. In a test run made in November last, the car made a round trip over the Third Street road in Dayton, O., in thirty-five minutes, the distance being nine miles. This included several complete stops besides climbing two hills, each about 1,500 ft. long and 4½ per. cent. grade, crossing sixteen railroad tracks and a bridge 500 ft. long, so that it is evident the car can easily make twenty to twenty-five miles an hour if desired. The car has a controller on each platform containing a reversing switch and three complete changes of electrical circuits, by means of which three speeds of the car are produced. The changes are accomplished entirely by commuting the batteries, no resistance of any description being employed.

The car up to March 21, 1894, had made 6,000 car miles, and neither the batteries nor the motor have required any repairs, except a new set of carbon brushes.

The total expense of every kind has been $2.50, all of which was applied to the trucks. It is claimed that with this system a car can easily be operated at a cost not to exceed eight cents per car mile. The batteries at present are apparently nearly as good as new and good for several thousand miles more before requiring the renewals of the positive plates. By a process on which patents are now pending, the worn out plates are taken and the material worked over so that there is practically no waste whatever. The patentee is now prepared to maintain the positive plates of a battery at three cents per mile, and has found by actual test in building batteries that for every 1,620 miles, at three cents per mile, he can entirely rebuild a set of batteries of 108 cells, or for the two sets required to keep a car in constant use, 3,240 miles at three cents per mile. As these batteries have already made 6,000 miles and are still in good condition, it is evident that there is a wide margin for profit at three cents per mile, and that a car can be easily operated for eight cents per car mile total cost.

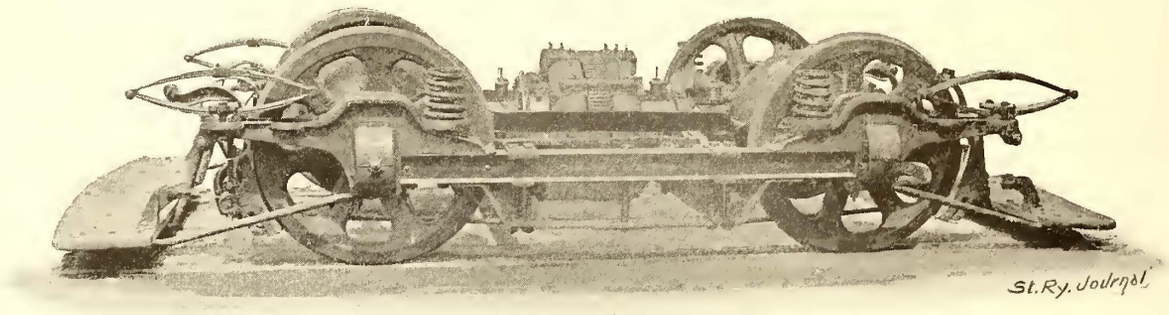


FIG. 4.—MOTOR TRUCK AND EQUIPMENT.

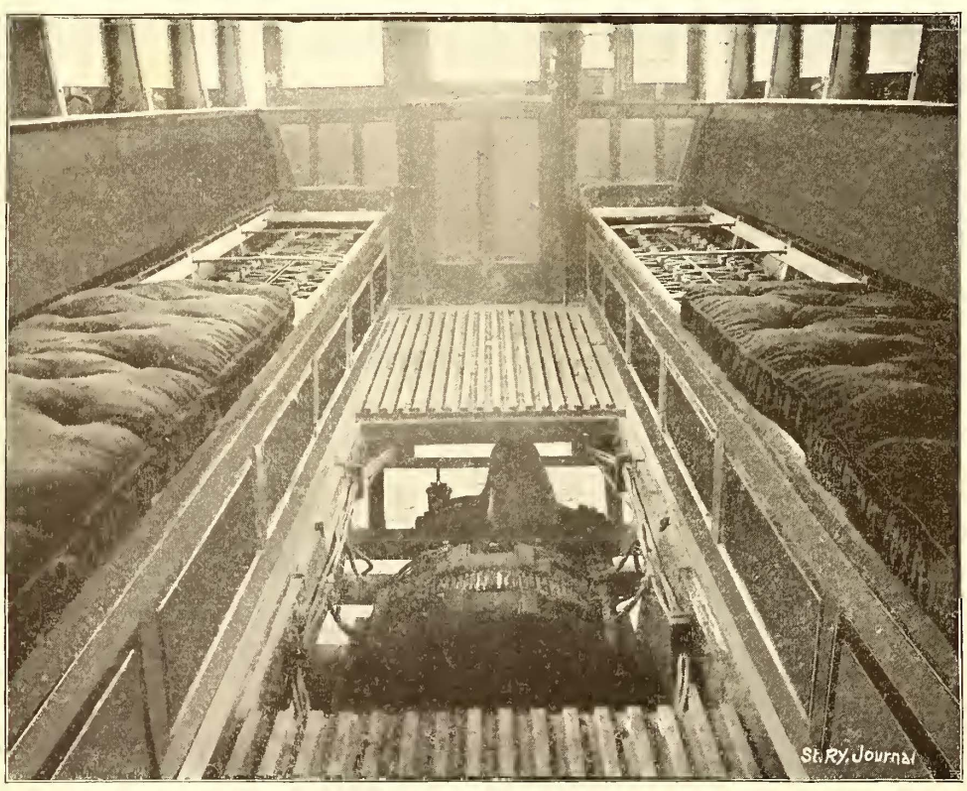


FIG. 5.—INTERIOR OF STORAGE BATTERY CAR.

St. Louis Car House Fire.

The Cardinal Avenue car house of the Laclede Avenue Division of the Missouri Railway Company, at St. Louis, was struck by lightning March 21, and burned to the ground, causing a loss of $100,000, fully covered by insurance. Eleven motors and fifty-three trailers were destroyed.

Possibility of an Underground Trolley in New York City.

The competition for the prize of $50,000 offered last December by the Metropolitan Traction Company, of New York, for a system of street railroad motive power superior to the overhead trolley system, and equally cheap in respect to operating expenses, is likely to result in the substitution of an underground trolley system on some of the company's lines.

Over 3,000 applications for the prize have been received by the company from all parts of the world. Many of the schemes proposed are ludicrous. One inventor proposed to furnish motive power by means of windmills on the top of the cars. Another proposed to utilize the force exerted by the rise and fall of the tides at Sandy Hook, and a third made a proposition to run street railways by harnessing the cars to balloons.

President H. H. Vreeland, of the Traction Company, said last month to a representative of the Street Railway Journal, that the underground trolley system at present in operation in Buda-Pesth, Hungary, was under consideration. This system was introduced five years ago by Siemens & Halske, and an account of the method and results of operation has been published in former issues. Plans have also been submitted by the General Electric Company, the Westinghouse Electric Company and other companies, which are also under consideration.

This company does not propose to change the cable system on Broadway. For thoroughfares where passenger traffic is heavy enough to warrant the outlay required to build cable roads, that system is regarded by the managers of the Traction Company as superior to all others. For this reason the company is at present engaged constructing cable roads on Lexington Avenue and Columbus Avenue, on which roads heavy passenger traffic is expected.

Should a test of the underground trolley prove satisfactory, it will be introduced on all the other lines at present operated by the Traction Company as horse car routes. These roads include, among others, the lines in University Place, Seventh Avenue below Fiftieth Street, Avenue C, Twenty-third Street, Bleecker Street, Fourteenth Street, Forty-second Street, and Sixth and Ninth Avenues.

A bill recently passed by the Legislature giving the Commissioners authority to pass on the merits of the various plans submitted to the Metropolitan Traction Company is now in the hands of Governor Flower awaiting signature.

Battling the Snow in St. Paul.

The heavy falls of snow in St. Paul have compelled the management of the roads in that city to take special means for clearing the tracks of this obstruction. Some new principles have been put into application in this work, and a new type of snow plow has been devised. By this the snow, instead of being brushed to one side, is raised from the track by a series of conveyors somewhat similar in principle to the ordinary bucket conveyor. The blades of this are of five-sixteenths inch steel, measure 24×6 ins, and are riveted to an endless sprocket chain running on rollers. There are altogether sixty-six blades in the front conveyor. The snow is then carried to one side by a side conveyor, and thrown to one side of the car, where it is taken care of by wing plows which clear the roadway of the drifts which would otherwise be piled at the side of the track by the ordinary type of plow.

The snow plow is mounted on two Bemis pivotal trucks, having seven foot six inch wheel bases, and twenty foot pivotal centers.

Car Manufacturing.

The Census Department, Washington, D. C., has just issued an extra bulletin presenting preliminary totals for all classes of manufacturing industries in the United States, as prepared by the Division of Manufacturers. In the line of "cars, general shop construction, and repairs by street railroad companies," appear the following figures: Number of establishments reporting, seventy-eight, representing an aggregate capital of $2,351,162, employing a total number of 2,034 men. Under the heading of "street railway cars, not including operations of railroad companies," seventy one establishments are reported, with a capital of $2,468,351 in the aggregate, and employing 1,873 men.

The Columbia & Donegal Railway.

One of the latest roads in the State of Pennsylvania to be put in operation is the Columbia & Donegal Railway. This company was organized on January 4, 1893, with the following officers: President, Wm. B. Given; treasurer, H. L. Haldeman; secretary, Frank S. Given. The road is a little over five miles in length, and is full of grades, there being hardly a level piece of road from the time the car leaves Columbia until it reaches Marietta. The railway, with that of the Columbia & Ironville Street Railway Passenger Company, is operated by the Columbia Traction Company, which has the same officers as those given above, with F. S. Given as general manager. The route of these two lines is most picturesque, owing to the variety of the scenery, and the beautiful glimpses of the winding Susquehanna and Donegal valleys which it discloses.

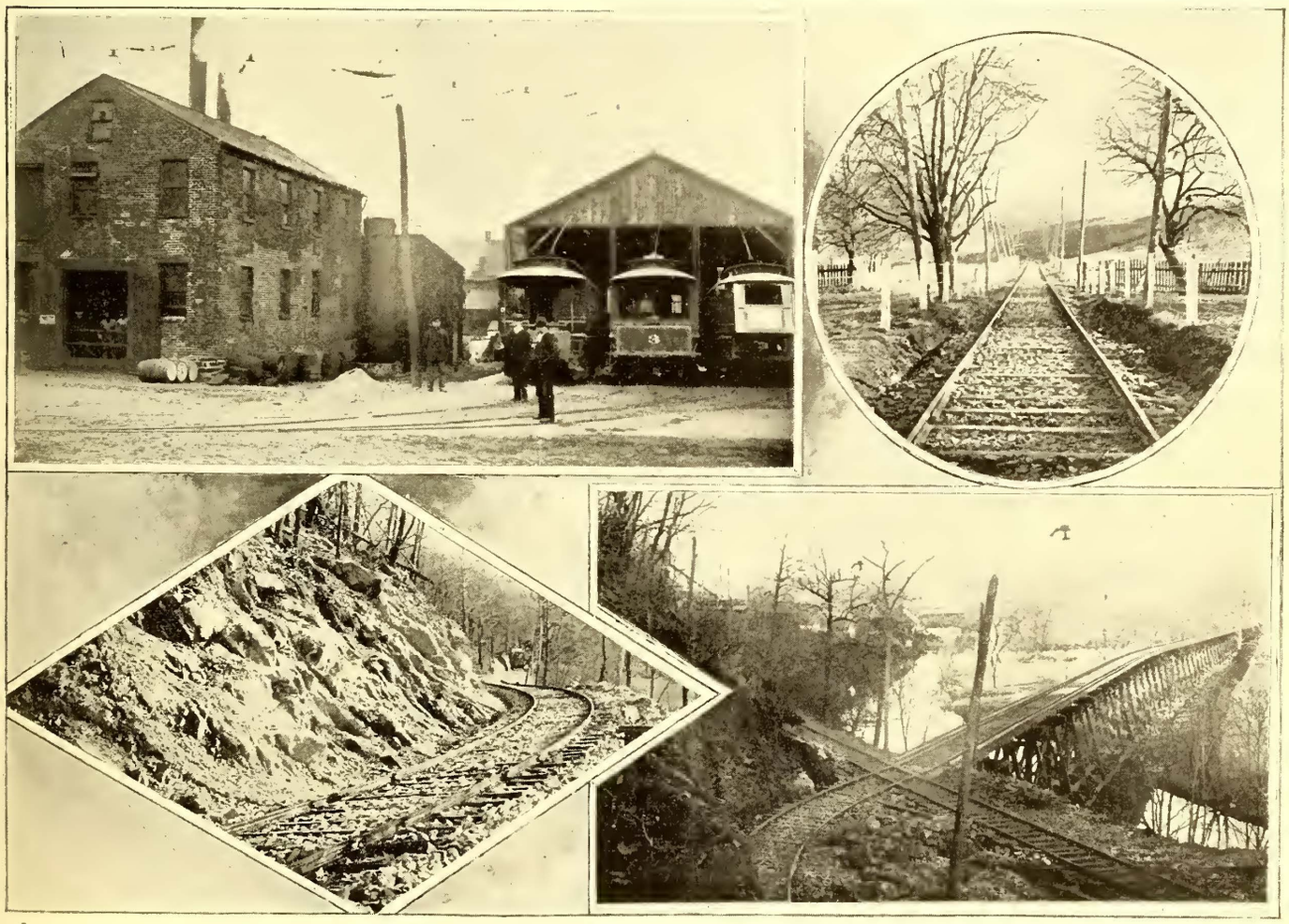


FIG. 1.—VIEWS ON THE LINE OF THE COLUMBIA & DONEGAL RAILWAY—COLUMBIA, PA.

To add to the other attractions, the company owns on the line of route a pleasure resort of about seventy acres, called Chickies Park. This is a well wooded tract of land, furnished with running water, dancing pavilion, merry-go-round, dining hall and other features. This point is about 300 ft. above the river and commands an extensive view of the river, Blue Ridge range of mountains and the Donegal valley. It has become a popular resort for the towns of Lancaster, Columbia, Marietta and other towns reached by electric lines.

Some of the engineering features of the Columbia & Donegal road are quite interesting. One of these is the long bridge and trestle built over the Chickies Creek, and shown in Fig. 1. This is 960 ft. in length, and where it crosses the creek is thirty-two feet high. It was constructed of North Carolina pine.

The power station, which is located on Commerce Street, Columbia, is of brick, and has two stacks each sixty-five feet in height. The engine equipment consists

of one Westinghouse engine of 150 H. P. and one Ball & Wood engine of 125 H. P., which operate two Westinghouse generators of 150 and 100 H. P. each. Steam is generated in three 150 H. P. boilers supplied by the Supplee Steam Engine Company, of Columbia. Korting injectors and Worthington pumps are used.

The roadbed has been well constructed. Several

FIG. 2.—CHICKIES PARK—COLUMBIA & DONEGAL RAILWAY CO

views of the track are given on page 223. The rail employed in the towns is sixty-six pounds in weight, and outside of the towns a fifty pound T rail is employed, all from the Johnson Company. The track is ballasted with six inches of broken stone.

The rolling stock consists of eight cars, sixteen feet in length, four of which were supplied by the J. G. Brill Company, and four by the Lamokin works. These are mounted on Brill and Robinson trucks. The motors are of the Westinghouse type, sixty horse power to a car. St. Louis registers are used.

WM. B. GIVEN,

PRESIDENT COLUMBIA & DONEGAL RAILWAY CO. AND COLUMBIA TRACTION CO.

There are a number of extensions proposed for the near future, and before the close of the present year Maytown, Mt. Joy and Ironville may be connected by electric railway with Columbia.

William B. Given, the president of the Columbia & Donegal Railway Company, is also president of the Columbia Traction Company, and is interested as stockholder in all the electric railways of Lancaster County. Mr. Given is thirty-nine years of age, a member of the legal profession and enjoys a large and lucrative practice. He is a director in the Columbia National Bank, Keeley Stove Company, East Columbia Land Company and numerous other organizations having for their object the industrial and corporate growth of Columbia.

Heating by Exhaust Steam at Springfield, Ill.

The practicability of utilizing the exhaust steam from electric light and power plants for heating purposes, and the distribution of the same to consumers situated within moderate distances of the central station, by means of underground pipes, has been proved by successful experiment and use to be both practicable and economical for the consumer as well as for the plant furnishing the supply. The utilization of exhaust steam for this purpose opens a new source of profit to numerous central stations situated in densely populated localities, where the users are located within a comparatively small radius, so as to justify the expense of underground piping. It is a well known fact that only about one-tenth of the total heat in the steam is utilized by passing through the engines, and the ability to recover for heating purposes the greater part of the remaining nine-tenths, without materially increasing the back pressure at the engines, opens a wide field for this system. The question of income accruing to the power company through this means of utilization of what would otherwise be a waste product, is one of the greatest importance, as heat may be furnished to the consumers at a price that will make it an object to them, and at the same time yield revenue to the company.

Through the courtesy of A. L. Ide, of the Springfield (Ill.) Electric Light & Power Company, we are enabled to present some recent information in regard to the very successful results obtained by the system at that plant. The exhaust steam system used is that controlled by the American District Steam Company, of Lockport, N. Y., and known as the Holly system, which was illustrated and described in the Street Railway Journal of July, 1893. This system uses exhaust steam at about five pounds, or less, back pressure, and, by an arrangement of condensing coils and indirect radiators at each point of consumption, dispenses altogether with return and drip pipes. It is also arranged so that in case the exhaust steam is not sufficient, live steam from the boilers may be passed into the pipes through suitable reducing valves.

The system at Springfield has been in use about three years. The original plant was installed in the winter of 1890, and was supplied from the lighting station. The plant has been steadily increased since that time, and now supplies heat to over 100 buildings. Last fall about 1,500 ft. of ten inch steam pipe was put in to connect with the power house of the Consolidated Railway Company, thus allowing the utilization of the exhaust from its engines. This supply enables the company to warm fifteen additional buildings containing over 1,000,000 cu. ft. of space. No difficulty has been found in keeping buildings warm with five pounds pressure in the mains when the temperature was 15 degs. below zero. The greatest distance steam is carried is about 4,000 ft. from the station, and heat is supplied to over 100 buildings. Exhaust steam from seven 14 × 14 in. Ideal engines in the electric light station, and one 200 H. P. Corliss engine in the power house of the Consolidated Railway Company, is utilized. When the railway company has twenty cars in operation all its exhaust steam is utilized; this in addition to the steam from three of the 14 × 14 engines is sufficient to warm about 4,000,000 cu. ft. of space. If all the engines are running, the exhaust steam will warm 5,000,000 cu. ft. of space. Experience has shown that exhaust steam from 100 H. P. of engines will warm, satisfactorily, about 1,000,000 cu. ft. of space. The entire system requires very little attention, and is proving a profitable investment to the

power company. In the winter of 1893 the company received about $3,000 from heating, at an additional expense on its coal bill of about $100.

Heat is furnished by contract agreement with the consumers at the rate of twenty cents per year per square foot of direct radiation, and twenty-five cents per year per square foot of indirect radiation. Where a contract for five years or longer is entered into, the company agrees to make all connections with the street main to the consumer's building wall, and furnish cut-off valve, etc. On contracts for less than five years' lease the consumer pays the cost of connection. The company requires all new consumers to have a cooling coil inserted between the steam trap and the sewer connection, to utilize the heat in the condensed water before letting it pass into the sewer. This coil is used as an indirect radiator, but is charged for, according to surface, as direct radiation. An arrangement is also made, where the customer has a steam boiler already installed for heating purposes, to pass the water of condensation through this boiler and trap the same to the sewer automatically, so that in case of any cause of shutdown at the station the consumer's plant is ready to furnish steam at very short notice, the boiler already being partially filled with hot water. The engravings, which are from the *Electrical Engineer*, give a view of the interior of the station and of main and exhaust connection.

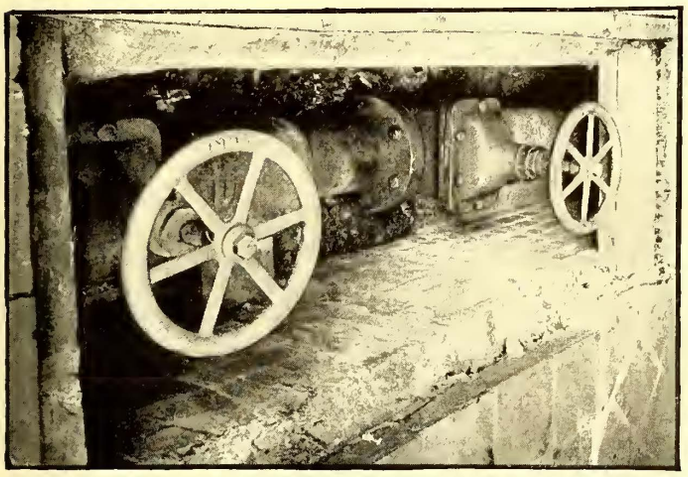


FIG. 1.—CONNECTION OF MAIN AND EXHAUST PIPING.

The same system has given very satisfactory results in connection with the plant of the Cedar Rapids (Ia.) Electric Light Company, and elsewhere. The boiler plant of the Cedar Rapids company consists of two 150 one 200 and one 125 H. P. boilers, all of which are used to supply steam to the engines. The exhaust is distributed through over two miles of underground mains, the longest single lines being about three-quarters of a mile long, running in opposite directions from the stations. With six pounds pressure in the exhaust mains at the station, perfect circulation is obtained. The charges are $1 per 1,000 units on the inch meter, which corresponds to about $8 per ton for anthracite coal, which is the price in the local market. The steam supply business is constantly growing, and is a source of profitable income, the receipts at present from this source being about $15,000 per annum. The manager of the company is authority for the statement that the exhaust steam plant is by far the best paying part of its business, and further, that without it the station could not be made to pay in that location. The heating is almost entirely done with exhaust, only a small amount of live steam being used in the middle of the day in extremely cold weather when some of the engines are shut down.

From these facts it would seem as if the exhaust steam plant should be regarded almost in the light of a necessary feature in connection with any electric system so situated that this principle may be utilized, as by the use of the exhaust system what might be called a by-product, and otherwise be allowed to run to waste, becomes one of the principal features of income.

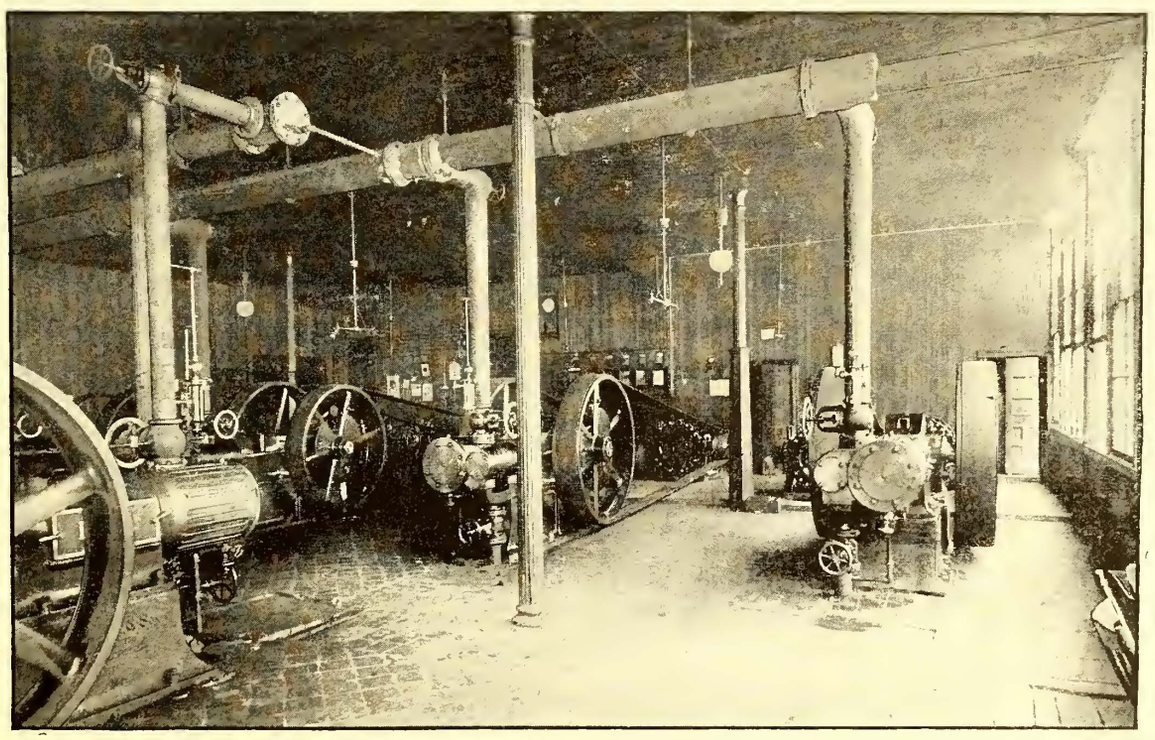


FIG. 2.—INTERIOR OF STATION—SPRINGFIELD ELECTRIC LIGHT & POWER CO.

The Compagnie Générale d'Electricité has now at its works at Lyons a new high speed electric locomotive, nearly completed. The dimensions of this are: Length, 16½ ft.; height, 11½ ft.; width, 8 ft. It runs on four wheels 46 ins. in diameter. The locomotive weighs 30 tons, and has been constructed for a normal speed of 30 miles per hour.

Formal announcement has been made that the line of the Consolidated Traction Company, of New Jersey, between Newark and Jersey City, will be opened to the public on April 8.

THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS.*

By Edward E. Higgins.

FOURTH PAPER.

Class IV. Surface Railways in American Cities of from 50,000 to 100,000 Inhabitants.

There are thirty cities in the United States having a population of from 50,000 to 100,000 by the census of 1890. Twenty-two are in the Eastern States, four in the Southern, three in the Central and one in the Western. The total track mileage is nearly 1600, of which 81 per cent. is operated by electricity, 15 per cent. by horses, and the balance by various systems of motive power.

Twenty-three of these cities are repesented in the Table of Statistics, twenty appearing in the class now under consideration. The population of two cities with their suburbs exceeds 100,000, one is connected with a metropolitan system and cannot be represented separately, and the statistics of the remaining seven cannot be obtained in a sufficiently complete form for present purposes. Two cities of less than 50,000 inhabitants are also represented in the table, being brought into this class by reason of the suburban population served, and one city is represented twice, first alone, and again with the added population of a suburb served by another and separate road.

At the end of the various fiscal years ending in 1890, eleven of the twenty-three systems represented in the table were in operation wholly by horses, one wholly by electricity, six had commenced equipment by electricity, four were in operation by horses, cable, steam and electricity in varying proportions, and one—the "metropolitan system" referred to above—had not built its suburban line and is not therefore represented in 1890. At the end of the fiscal years of 1892, eleven systems were in substantially complete operation by electricity, two by horses, and ten were still in the process of conversion from horses to electricity. In 1890 445 miles of track were in operation by horses, and 145 miles by electricity and other motive powers; while in 1892, 258 miles were in operation by horses, and 564 miles by electricity and other motive powers.

THE HORSE RAILWAYS OF 1890.

Again we find that the horse railways of 1890 were not in general overcapitalized. 16 per cent. of the total mileage had no funded debt, the funded debt of 38 per cent. was less than $10,000 per mile, that of 38 per cent was between $10,000 and $20,000 and that of only 8 per cent. exceeded $20,000 per mile. The total capital liabilities of 42 per cent. were less than $20,000 per mile.

The sixteen horse railways now under consideration may be separated into four clearly defined groups based as usual on the passenger earnings per capita. The first group contains two systems which earned $.98 and $1.32 per capita respectively. The second group contains five systems which earned from $1.98 to $2.31 per capita; the third group contains seven systems which earned from $2.62 to $3.24 per capita; and the fourth group contains two systems which earned $3.76 and $4.03 respectively.

Case No. 94 was practically a new road in 1890 and was developing rapidly. Its passenger income for the year ending December 31, 1890, was nearly $100,000, and as will be seen by the table, it had risen to over $200,000. by 1892. Case No. 85 is a horse railway system connecting three townships of from 3,000 to 6,000 inhabitants with a manufacturing city of 45,000 inhabitants. It operated but 7 miles of street and but 5 car miles per capita, and in spite of small passenger income it earned 20 per cent. on capital liabilities of $7,400 per mile of track.

The five systems of the second group earning from $1.98 to $2.31 per capita with horses may be passed over with brief mention. Case No. 80 is a system serving a sleepy Southern city well laid out for moderately large street railway traffic, but with a large colored population and with little local enterprise. Cases No. 81 and 82 are combined residential and manufacturing towns of some importance. Cases No. 83 and 91 are railroad and manufacturing cities. The track mileage in these five cities ranges from 15 to 26, and the street mileage (reported) from 12 to 20. The car mileage in cases No. 80 and 82 were probably sufficient to secure the maximum traffic, but the low car mileage of Case No. 91 is partly responsible for the small gross earnings. The net earnings of the three roads reporting are fairly good, the returns being equivalent to about 5, 8 and 11 per cent. respectively on capital liabilities of from $17,200 to $19,600 per mile of road.

The average gross earning power of the horse railways of this class seems to be best represented by the seven systems of the third group, earning from $2.62 to $3.24 per capita. These systems all serve busy manufacturing cities, six of the seven being in three of the Eastern Atlantic States. It is at once evident that the track and street mileage of this group is considerably greater than that of the second group, the average street mileage being 20.4 as against 16.9 in the second group This is probably responsible in part for the better average results. The car mileage per capita ranges from 8 to 16, the one Western city showing 22. The percentage of net income to capital liabilities is quite satisfactory, the smallest return being 5 per cent. on capital liabilities of $32,800 per mile of track, and the largest 16 per cent. on $22,000 per mile of track. The operating expenses of three systems are between 73 and 78 per cent., of three systems between 87 and 90 per cent., while the Western city referred to is apparently operating at 66.7 per cent., and $.09 per car mile, an unusual but perhaps not impossible figure.

The two systems of the fourth group show the maximum horse railway gross earning power of the class. Case No. 98 served an important railroad, manufacturing and residential city, with 21 miles of road and 27 car miles per capita. It earned $4.03 per capita gross, operated at 70 per cent. of the passenger income and $.10 per car mile and returned 6.1 per cent. on capital liabilities of nearly $50,000 per mile of track, which is decided overcapitalization of costs. Case No. 100 served a city of 61,000 inhabitants and suburban townships aggregating 34,000 inhabitants, with 16.5 miles of road and 12.6 car miles per capita, and earned nearly 10 per cent. on capital liabilities of $33,000 per mile of track. Both these population centers are nearly the largest of the class.

THE STREET RAILROADS OF 1892.

Passing now from the horse railroads of 1890 to the discussion of later results, it will be found profitable to divide the entire list of cases into three groups, the first containing five systems which have been so fully developed that their 1892 reports may be considered as exhibiting nearly or quite their maximum permanent earning power, the second containing ten systems whose earning power was not in that year a maximum, and the third containing eight systems which are not fully reported in 1892.

DISCUSSION OF FIVE SYSTEMS EXHIBITING PROBABLE MAXIMUM EARNING POWER IN 1892.

The gross and net earning power of three of these systems is unsatisfactory, while that of the other three is extraordinarily good.

Case No. 85 has been already referred to as a horse road in 1890, whose gross and net earnings were small in amount, but which was so moderately capitalized that the net was equal to over 20 per cent. on the capital liabilities

of 1890. Its extension of mileage, equipment by electricity and increase in car service, brought about a substantial increase in both gross and net income in 1892, but the latter was equivalent to a return of but 8 per cent. on the new capital liabilities of $31,200 per mile of track. It may be said here that the gross income in 1893 was greater than that of 1892, but a much larger increase in operating expenses effected an actual reduction in the net income, and as before stated, it is probable that the net earning power of this system is not much in excess of $40,000, although the gross income will undoubtedly show a gradual increase from year to year, due to, and commensurate with increase of population served.

Case No. 92 was one of the few street railway systems of this class which were in nearly complete operation by electricity as early as 1890. It serves a prosperous mining and manufacturing city with large street and track mileage; its passenger income is gradually increasing, but is decidedly small in proportion to the population served; its operating expenses in spite of cheap fuel are nearly 70 per cent. of the passenger income, probably because of the purchase of early and inferior apparatus; and the net income, although reasonably good, is equivalent to the return in 1892 of less than 5 per cent. on capital liabilities of $37,500 per mile.

One of the best and most conservative street railway statements so far discussed is that of Case No. 89. This system has never indulged in the luxury of a funded debt, it has promptly paid off its floating debt, which is to-day merely nominal, and it has always been carefully and conservatively managed both with horse and electric operation. It has not been "syndicated" and its capitalization is probably but little in excess of the actual present value of the tangible assets, including real estate, cash assets, etc. It is one of the few roads which have established a reserved fund in anticipation of increased depreciation. It reaches several suburban townships tributary to a principal city of 44,000 inhabitants, and its road mileage is therefore large. Its car service is good but not excessive. Its passenger income in 1892 was $5.22 per capita and in 1893 about $6.00; its operating expenses in 1892 were but 61.4 per cent. of the income, but in 1893 the percentage had risen to 75, partly because of the charge to operating expenses of the reserve fund credit; so that while the net income in 1892 was sufficient for a return of 13.2 per cent. on the capital liabilities, that in 1893 was but about 10 per cent.

Another excellent operating report is that of Case No. 98 previously mentioned. In this case the net income in 1893, while considerably in excess of interest charges, is equivalent to a return of but 3.3 per cent. on the total capital liabilities. I believe it probable that this net income will be little if any greater in succeeding years than at present owing to increasing depreciation of plant and equipment. While it is not impossible that a system of this size, if equipped with the best apparatus and material, can be operated at from 60 to 65 per cent. of the passenger income, it is also true that few roads are at present so equipped, or are free from the burdens of mistaken judgment in engineering matters, and the establishment of a proper reserve or depreciation fund would naturally increase the percentage of operating expenses to passenger income as with Case No. 89.

Case No. 84 is a remarkable instance of the saving power of electricity. In years gone by, local capitalists conceived the idea that a cable system in this city would be a profitable investment. Instead of choosing the main business thoroughfare (which was then in the hands of another corporation), and thereby minimizing the inevitable loss, they built a road out into the suburbs, with results which can be imagined. A little later a consolidation was effected with the larger and fairly prosperous horse railway system of the city, and, in the hope of repairing some of the previous losses, new capital was obtained for the electrical equipment of the cable as well as of the horse lines. The results have more than justified the most sanguine expectations. A practical engineer and business man was retained as manager, and under his wise supervision the road has been reconstructed with great economy and is handled with unusual skill. The system is earning over $7.00 per capita gross, $16,500 per mile of road, and $.17 per car mile on an unusually large car service; is operating at $.11 per car mile and 64 per cent. of the passenger income; and its net earnings are equivalent to a return of 4.3 per cent. on the accumulated capital liabilities of $88,000 per mile of track. It is probable that this net earning power will not be much greater in subsequent years, but even at present figures the results are interesting, and, to the owners of the property, decidedly satisfactory.

DISCUSSION OF TEN SYSTEMS WHOSE EARNING POWER WAS NOT A MAXIMUM IN 1892.

Four of these systems earned less than $3.00 per capita gross, four earned between $3.00 and $3.75, and two between $4.25 and $4.50.

Two of the four systems earning less than $3.00 per capita were still practically horse roads in 1892, since which time they have been equipped for electrical operation, and will doubtless develop their maximum earning power in 1895. The third system, Case No. 95, the electrical equipment of which was not completed in 1892, shows gross earnings in 1893 of about $3.40 per capita as against $2.65 in 1892; an operating percentage of 68 as against 86 in 1892; and net earnings nearly three times as great as those of 1892, equivalent to a return of 6.8 per cent. on capital liabilities of about $26,000 per mile of track. The maximum earning power of this property will not be exhibited until 1894 or possibly 1895. The information given concerning Cases No. 94 and 81 are insufficient for a just criticism.

Three of the systems earning from $3.00 to $3 75 per capita in 1892 have been only partially equipped by electricity even at present. Case No. 83 is a moderately good horse railway statement. Case No. 96 is an excellent statement for a comparatively small system as yet undeveloped, the net earnings being equivalent to about 7.4 per cent. on capital liabilities of nearly $34,000 per mile of track. Case No. 99, with a far larger track and road mileage, a considerable portion of which was operated by electricity in 1892, earned but little more gross and net than Case No. 96. The capital liabilities are excessive, the net income being equivalent to less than 2 per cent. thereon, and the system is now in the hands of a receiver, because of default in interest charges.

Case No. 101 is Case No. 96 with the addition of a suburban city and road. It is evident that this addition is important and profitable since the net income of the combination materially increased the percentage return on the capital liabilities, as well as the passenger income per capita served. Case No. 100 has always been an important and profitable system, whose original owners have retained their property and equipped it by electricity without calling upon outside capital, and its comparatively low percentage of operating expenses to passenger income shows that "early apparatus," when carefully handled, is capable of producing quite satisfactory results. Its net income in 1892 was equivalent to over 13 per cent. on capital liabilities exceeding $50,000 per mile, and both gross and net income were materially increased in 1893.

DISCUSSION OF SEVEN SYSTEMS NOT FULLY REPORTED IN 1892.

Five of these systems may be dismissed with no further comment than that they are capable of much better returns than are shown in 1890, and have doubtless already achieved a considerable increase in both gross and net income, although but one has as yet been fully equipped by electricity. Cases No. 90 and 93 are noteworthy as showing fairly high gross earnings per capita in 1890, when but partially equipped electrically. Since that date both gross and net income have been much increased, but the systems have been burdened with excessive capital liabilities and are passing through partial reorganizations, one being now in the hands of a receiver, and the other having arbitrarily scaled down its interest charges. I can but believe that the road and track mileage is far greater

TABLE IV.—AMERICAN STREET RAILWAY SYSTEMS

PART I.—STATISTICS OF CAPITALIZATION.

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

Case Number	Miles of Track					Miles of Street	Capital Stock			Funded Debt			Capital Liabilities			Floating Debt		Case Number
	Horse	Electric	Cable	Miscel.	Total		Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Memo.	
A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T
79	16.0	.....	.....	12.5	28.5	21.4	150,000	5,300	2.90	75,000	2,600	1.50	225,000	7,900	4.40	73,055	B.A.P	79
	.....	*19.0*	.....	.....	*19.0*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
80	26.0	.....	.....	.....	26.0	20.7	365,000	14,000	6.60	144,000	5,500	2.60	509,000	19,600	9.30	.....	.....	80
	28.8	.....	.....	.....	28.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
81	21.0	.....	.....	.....	21.0	.....	126,100	6,000	2.20	190,000	9,000	3.30	316,100	15,000	5.50	53,400	.....	81
	.....	*32.0*	.....	.....	*32.0*	.....	*1,500,000*	*46,900*	*26.30*	*521,100*	*16,300*	*9.10*	*2,021,100*	*63,100*	*35.40*	*380,401*	.....	
82	15.0	.....	.....	.....	15.0	14.1	250,000	16,700	4.30	250,000	16,700	4.30	500,000	33,300	8.60	3,127	.....	82
	11.5	6.8	.....	.....	18.3	z 17.4	250,000	13,700	4.30	350,000	19,100	6.00	600,000	32,800	10.30	33,713	.....	
83	18.5	3.2	.....	.....	21.7	20.5	293,450	13,500	4.90	112,000	5,200	1.90	405,450	18,700	6.80	32,920	B. P.	83
	25.0	8.7	.....	.....	z 33.7	31.5	580,000	17,200	9.70	112,000	3.300	1.90	692,000	20,500	11.50	26,243	B. P.	
84	30.8	.....	11.6	.....	42.4	28.6	750,200	17,700	12.50	1,201,000	28,200	20.00	1,951,200	46,000	32.50	235,288	B.A.P	84
	.....	*44.1*	.....	.....	*44.1*	*25.7*	*1,500,000*	*34,000*	*25.00*	*2,380,000*	*54,000*	*39.70*	*3,880,000*	*88,000*	*64.70*	.....	.....	
85	10.8	.....	.....	.....	10.8	7.1	80,000	7,400	1.30	.....	.....	.....	80,000	7,400	1.30	19,431	Net.	85
	.....	*17.0*	.....	.....	*17.0*	*12.3*	*180,000*	*10,600*	*3.00*	*350,000*	*20.600*	*5.80*	*530,000*	*31,200*	*8.80*	*105,676*	"	
p 86	4.9	3.3	.....	.....	8.2	7.8	168,653	20,600	2.80	130,000	16,000	2.10	298,653	36,500	4.90	35,000	B.A.P	p 86
	4.7	*9.3*	.....	.....	*14.0*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
p 87	30.0	.....	.....	.....	30.0	15.7	725,375	24,200	11.90	.....	.....	.....	725,375	24,200	11.90	.....	.....	p 87
	33.0	15.5	.....	.....	48.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
88	23.0	3.0	.....	.....	26.0	18.0	200,000	7,700	3.20	100,000	3,800	1.60	300,000	11,500	4.80	84,785	B A P	88
	20.0	15.0	.....	....	35.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
89	18.9	2.5	.....	.....	21.4	20.8	400,000	18,700	6.40	.....	.....	.....	400,000	18,700	6.40	62,709	Net	89
	3.0	*29.5*	.....	.....	*32.5*	*29.0*	*1,000 000*	*30,800*	*15.90*	.....	.....	.....	*1,000,000*	*30,800*	*15.90*	s *96.173*	"	
90	27.5	13.3	.....	11.0	51.8	47.4	477,475	9,200	7.20	807,000	15,600	12.20	1,284,475	24,700	19.40	109,215	B.A.P	90
	.....	*66.0*	.....	.....	*66.0*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
91	17.4	.....	.....	.....	17.4	12.3	300,000	17,200	4.10	.....	.....	.....	300,000	17,200	4.10	s 1,812	Net.	91
	17.5	.....	.....	.....	17.5	12.4	300,000	17,200	4.10	750,000	42,900	10.10	1,050,000	60 000	14.20	s 723,850	"	
92	.....	*26.0*	.....	.....	z *26.0*	z *22.0*	*525,000*	*20,200*	*7.00*	*400,000*	*15,400*	*5.30*	*925,000*	*35,600*	*12.30*	.....	.....	92
	.....	*30.0*	.....	.....	z *30.0*	z *27.0*	*525.000*	*17,500*	*7.00*	*600,000*	*20,000*	*8.00*	*1,125,000*	*37,500*	*15.10*	.....	.....	
93	.....	*40.0*	.....	*9.8*	*49.8*	*38.6*	*1,100,000*	*22,100*	*14.50*	*2,600,000*	*52,200*	*34.20*	*3,700,000*	*74,300*	*48.70*	.....	.....	93
	.....	*56.5*	.....	*16.3*	*72.8*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
94	17.0	.....	.....	.....	17.0	14.0	135,000	7,900	1.70	183,000	10,800	2.30	318,000	18,700	4.10	a 19,917	.....	94
	.....	*35.0*	.....	.....	*35.0*	.....	*1,105,000*	*31,600*	*14.20*	*845,000*	*24,100*	*10.80*	*1,950,000*	*55,700*	*25.00*	*394,000*	.....	
95	21.9	5.2	.....	.....	27.1	20.8	300,000	11,100	3.80	100,000	3,700	1.30	400,000	14,800	5.00	136,566	Net.	95
	7.4	*33.2*	.....	.....	*40.6*	*28.5*	*300,000*	*7,400*	*3.80*	*600,000*	*14,800*	*7.50*	*900,000*	*22,200*	*11.30*	*292,173*	"	
96	20.4	.....	.....	.....	20.4	12.5	350,000	17,100	4.10	150,000	7,400	1.80	500,000	24,500	5.90	124,864	Net.	96
	21.5	3.6	.....	.....	25.1	16.6	700,000	27,900	8.20	150,000	6,000	1.80	850,000	33,900	10.00	s 27,353	"	
97	26.1	.....	.....	.....	26.1	20.9	464,900	17,800	5.40	110,300	4,200	1.30	575,200	22,000	6.70	84,329	B.A.P	97
	22.4	12.3	.....	.....	34.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
98	34.8	.....	.....	.....	34.8	21.0	1,100,000	31,600	12.50	619,000	17,800	7.00	1,719,000	49,400	19.50	.....	.....	98
	.....	*55.0*	.....	.....	*55.0*	*35.0*	*3,000,000*	*54,500*	*34.10*	*2,802,500*	*50,900*	*31.80*	*5,802,500*	*105,500*	*65.90*	.....	.....	
99	38.7	4.0	.....	.....	42.7	33.9	851,700	20,000	9.00	550,655	12,900	5.80	1,402,355	32,800	14.70	14,147	Net.	99
	37.8	17.8	.....	.....	55.6	38.9	2,250,000	40,500	23.70	1,984,400	35,600	20.80	4,234,400	76,100	44.50	156,985	"	
100	26.1	.....	.....	.....	26.1	16.5	534,700	20,500	5.60	334,155	12,800	3.50	868,855	33,300	9.20	s 42,956	Net.	100
	3.8	*24.4*	.....	.....	*28.2*	*17.6*	*1,090,000*	*38,700*	*11.50*	*333,955*	*11,800*	*3.50*	*1,423,955*	*50,400*	*15.00*	*13,039*	"	
101	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	101
	21.5	16.6	.....	.....	38.1	29.1	970,536	25,500	10.00	150,000	3,900	1.60	1,120,536	29,400	11.60	56,058	Net.	

a. From all sources. b. Operating expenses include interest payments and cannot be properly represented. z. Approximate.
p. This report does not include one insignificant horse road. s. Current assets exceed current liabilities.

than is necessary for cities of this size and that the comparatively large passenger income has been obtained at too great a cost. The combination of excessive mileage and excessive capital liabilities per mile cannot fail to be disastrous to any property.

There now remains for final consideration the usual comparison between the horse and electric statements of those roads in which the process of conversion to electricity has been practically completed between the years 1890 and 1892.

DISCUSSION OF FIVE SYSTEMS OPERATING CHIEFLY BY HORSES IN 1890 AND BY ELECTRICITY IN 1892.

There are two fully reported systems of this number which were in operation by horses, with but small electric railway mileage in 1890; two which were in operation by

SERVING FROM 50,000 TO 100,000 POPULATION.

PART II.—STATISTICS OF OPERATION.

Electric, Cable and Steam Railways are given in italics.

Case Number	Population Served	Area	Population Per Mile Street	Population Per Square Mile	Year Ending	Car Mileage Total	Car Mileage Per Capita	Passenger Income Total	Passenger Income Per Mile Street	Passenger Income Per Car Mile	Passenger Income Per Capita	Operating Expenses Total	Operating Expenses Per Car Mile	Operating Expenses % Passenger Income	Net Earnings Total	Net Earnings Per Car Mile	Net Earnings % Passenger Income	Net Earnings % Cap. Liab.	Case Number
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
79	51,000	....	2,400	.....	6-30-1890	1,009,800	19.8	89,323	4,200	.088	1.75	72,047	.071	80.6	19,225	.019	21.5	8.5	79
80	55,000	....	2,700	.....	n 1890	1,005,870	18.4	126,952	6,100	.126	2.31	107,531	.107	85.4	25,059	.025	19.8	4.9	80
81	57,000	....	.....	.....	12-31-1890	.....	.....	a 124,004	.....	....	2.18	b	....	.....	.....	.....	.....	.....	81
	57,000	....	.....	.....	*12-31-1892*	.....	.....	a *175,792*	.....	....	*3.09*	b	....	.....	.... ..	.....	.....	.....	
82	58,000	....	4,100	.....	6-30-1890	802,828	13.8	114,869	8,200	.143	1.98	.....	....	.....	.....	....	....	....	82
	58,000	....	3,300	.....	12-31-1892	.....	.....	159,868	9,200	....	2.76	.....	....	.....	.....	.....	.....	.....	
83	60,000	....	2,900	.....	6-30-1890	.....	.....	130,649	6,400	....	2.18	96,529	....	73.7	34,120	....	26.0	8.4	83
	60,000	....	1,900	.....	6-30-1892	.....	.....	a 183,321	5,800	....	3.05	152,577	....	83.6	30,883	....	16.9	4.5	
84	60,000	....	2,100	.....	6-30-1890	2,423,012	40.3	234,791	8,200	.097	3.92	215,357	.089	91.5	21,534	....	9.2	1.1	84
	60,000	....	*2,300*	.....	*7-31-1893*	*2,444,967*	*40.7*	*424,255*	*16,500*	*.173*	*7.07*	*270,949*	*.111*	*63.9*	*165,477*	*.067*	*38.9*	*4.3*	
85	60,000	....	8,500	.....	9-30-1890	294,000	4.9	79,251	11,000	.270	1.32	64,083	.218	80.9	16,298	.056	20.6	20.4	85
	60,000	....	*4,900*	.....	*9-30-1892*	*461,953*	7.7	*123,413*	*10,000*	*.266*	*2.05*	*81,348*	*.176*	*66.1*	*42,605*	*.092*	*34.6*	*8.0*	
p 86	61,000	....	7,800	.....	6-30-1890	483,021	7.9	89,167	11,400	.184	1.46	68,190	.141	76.4	22,181	.045	24.9	7.4	p 86
p 87	61,000	....	3,900	.....	6-30-1890	1,353,060	22.1	185,999	11,800	.138	3 05	124,487	.091	66.7	66,206	.049	35.6	9.1	p 87
88	62,000	....	3,400	.....	6-30-1890	758,572	12.2	168,568	9,400	.223	2.70	147,530	.195	87.6	26,135	.034	15.5	8.7	88
89	63,000	....	3,000	.....	9-30-1890	683,991	10.9	180,991	8,700	.265	2.87	157,635	.231	87.3	30,473	.045	16.9	7.6	89
	63,000	....	*2,200*	.....	*9-30-1892*	*1,088,965*	*17.3*	*328,800*	*11,345*	*.302*	*5.22*	*201,602*	*.185*	*61.4*	*131,949*	*.121*	*40.1*	*13.2*	
90	66,000	....	1,400	.....	n 1890	1,268,893	19.2	289,109	6,100	.228	4.38	219,014	.172	75.8	69,829	.055	24.2	5.5	90
91	74,000	....	6,000	.....	9-30-1890	499,219	6.7	154,748	12,600	.311	2.09	122,973	.246	79.4	34,327	.069	22.1	11.4	91
	74,000	....	6,000	.....	9-30-1892	551,926	7.5	175,417	14,100	.317	2.36	135,063	.245	77.1	42,478	.077	24.3	4.1	
92	*75,000*	....	*3,400*	.....	*6-30-1890*	.....	.....	*146,801*	*6,700*	....	*1.96*	*99,331*	....	*67.6*	o *47,470*	....	*32.3*	*5.1*	92
	75,000	....	*2,800*	.....	*6-30-1892*	.....	.....	*174,048*	*6,400*	....	*2.32*	*120,835*	....	*69.5*	o *53,213*	....	*30.6*	*4.7*	
93	*76,000*	....	*2,000*	.....	*6-30-1890*	.....	.....	*350,346*	*9,000*	....	*4.60*	*256,907*	....	*73.4*	*94,739*	....	*27.1*	*2.6*	93
94	78,000	....	5,600	.....	6-30-1890	542,755	7.0	76,484	5,500	.141	.98	61,861	.114	80.9	14,975	.028	19.6	4.7	94
	78,000	....	.....	.....	*12-31-1892*	.....	.....	*215,190*	.....	....	*2.76*	.....	.....	.....	.....	.....	.....	.....	
95	80,000	....	3,800	.....	9-30-1890	988,658	12.4	209,830	10,100	.211	2.62	188,755	.191	90.0	22,628	.023	10.8	5.7	95
	80,000	....	*2,800*	.....	*9-30-1892*	*1,027,058*	*12.9*	*212,314*	*7,400*	*.206*	*2.65*	*182,423*	*.177*	*85.8*	*30,147*	*.029*	*14.2*	*3.3*	
96	85,000	....	6,800	.....	9-30-1890	706,905	8.3	232,475	18,600	.328	2.73	178,382	.253	76.7	57,017	.081	24.6	11.4	96
	85,000	....	5,100	.....	9-30-1892	1,045,571	12.4	314,004	18,900	.299	3.69	255,496	.243	81.2	62,977	.060	20.1	7.4	
97	86,000	....	4,100	.....	6-30-1890	1,366,841	15.9	279,238	13,300	.204	3.24	203,126	.148	72.8	91,731	.067	32.8	15.9	97
98	88,000	....	4,200	.....	n 1890	2,424,500	27.5	354,751	16,900	.147	4.03	250,151	.103	70.4	104,196	.043	29.3	6.1	98
	88,000	....	*2,500*	.....	*12-31-1893*	*3,560,790*	*40.5*	*532,191*	*15,200*	*.149*	*6.05*	*336,949*	*.095*	*63.3*	*189,773*	*.053*	*35.7*	*3.3*	
99	95,000	....	2,800	.....	6-30-1890	.....	.....	299,249	8,800	....	3.14	233,932	....	78.3	70,428	....	23.5	5.0	99
	95,000	....	2,400	.....	6-30-1892	.....	.....	352,783	9,100	....	3.72	277,712	....	78.8	77,964	....	22.1	1.8	
100	95,000	....	5,800	.....	6-30-1890	1,194,994	12.6	356,868	21,600	.300	3.76	272,964	.229	76.5	83,936	.071	23.5	9.7	100
	95,000	....	*5,400*	.....	*6-30-1892*	.....	.....	*419,415*	*23,800*	....	*4.41*	*233,205*	....	*55.6*	*188,119*	....	*44.9*	*13.2*	
101	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	101
	97,000	....	3,300	.....	9-30-1892	1,418,509	14.6	414,850	14,300	.292	4.28	322,914	.227	77.8	97,119	.068	23.4	8.7	

a. From all sources. b. Operating expenses include interest payments and cannot be properly represented. o. From operation.
n. Fiscal years of the several roads end at different dates. p. This report does not include one insignificant horse road.

horses only; and one which was in operation partly by horses and partly by the cable system. In 1892 the process of conversion to electricity was substantially completed in four of the five systems, the fifth still operating about 25 per cent. of its track mileage by horses. The total track mileage was increased from 128 (108 horse, 8 electric and 12 cable) in 1890 to 162 (14 horse, 148 electric) in 1892. The funded debt in 1890 was $12,800 per mile of track and in 1892 $22,600, while the total capital liabilities which were $28,900 in 1890 were $47,700 in 1892. The later figures represent a large overcapitalization of the present value of the tangible assets, although, for reasons which have been partially explained in the discussion of the separate roads, the overcapitalization of actual costs is probably not extreme.

The passenger income of these five roads in 1890 was

$1,061,731, equivalent to $11,300 per mile of road, and $2.96 per capita. The passenger income in 1892 was $1,508,197, equivalent to $13,400 per mile of road and $4.21 per capita, an increase of 42.1 per cent.

The operating expenses in 1890 were 84.8 per cent. of the passenger income and in 1892 64.2 per cent. This is a remarkable reduction which will hardly be fully maintained in subsequent years.

The net income in 1890 was $174,866 and in 1892 $558,297, an increase of 218.9 per cent. The return on the capital liabilities was 4.8 per cent. in 1890, and 7.2 per cent. in 1892. If we may consider the funded debt, averaging $22,600 per mile of track, as a fairer measure of the real cash value of the tangible assets, the net income in 1892 would be equivalent to over 15 per cent., but in cities of this size it would probably be impossible to duplicate the tangible assets for less than from $25,000 to $30,000 per mile of track.

GENERAL CONCLUSIONS.

1. Well managed electric street railway systems of from 25 to 40 miles in length in the best American cities of from 50,000 to 100,000 inhabitants will probably develop a maximum earning power of from $5.00 to $6.00 gross per capita, with one or two exceptional cases rising above these figures; a larger number will earn from $4.00 to $5.00 per capita; and few will be unable to earn $4.00 per capita.

2. Those properties which have been improperly constructed and equipped, particularly in the matter of roadbed, cannot probably be permanently operated at less than 75 per cent. of the passenger income, higher figures rather than lower being probable. Those properties which have postponed equipment until a comparatively recent period and which have been carefully and thoroughly built can usually be operated at from 65 to 70 per cent. of the passenger income.

3. Under the most favorable conditions of operation a maximum net earning power of about $2.00 per capita is possible, but more usual figures will range from $1.00 to $1.50 per capita.

4. $1.50 per capita is a return of 12 per cent. per annum on capital liabilities of $12.50 per capita, which represents about the average present cost of building and equipping in the most perfect manner electric railway systems of average length in cities of this class, where the cost of taking up and replacing pavement forms an important item of original investment. In general therefore it may be said that these properties are, intrinsically, investments returning from 10 to 15 per cent on the actual value of tangible assets apart from franchises.

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 50,000 TO 100,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
MILES OF TRACK.				
No. of miles operated	444.8	145.4	257.9	563.6
FUNDED DEBT PER MILE OF TRACK.				
No. of miles not reporting	.....	.....	147.0	171.8
" " having no funded debt	79.6	.....	.....	32.5
" " " an indebtedness less than $5,000 per mile	107.7	.....	71.8	.....
" " " " " from $ 5,000 to $10,000 " ..	89.1	.....	25.1	.....
" " " " " " 10,000 to 15,000 " ..	85.8	.....	.....	68.8
" " " " " " 15,000 to 20,000 " ..	109.8	26.0	18.3	32.0
" " " " " " 20,000 to 30,000 " ..	42.4	.....	.....	82.0
" " " " " " 30,000 to 50,000 " ..	.....	.....	73.1	.....
" " " " " over 50,000	.....	49.8	.....	99.1
CAPITAL LIABILITIES PER MILE OF TRACK.				
No. of miles not reporting	.....	.....	147.0	171.8
" " capitalized at less than $10,000 per mile	39.3	.....	.....	.....
" " " at from $10,000 to $ 15,000 "	53.1	.....	.....	.....
" " " " 15,000 " 20,000 "	124.5	.....	.....	.....
" " " " 20,000 " 30,000 "	128.3	.....	71.8	40.6
" " " " 30,000 " 40,000 "	92.0	26.0	43.4	79.5
" " " " 40,000 " 50,000 "	77.2	.....	.....	.....
" " " " 50,000 " 75,000 "	.....	49.8	17.5	95.2
" " " over 75,000 "	.....	.....	55.6	99.1

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 50,000 TO 100,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
POPULATION SERVED PER MILE OF STREET.				
No. of roads not reporting	2	.....	4	6
" " serving less than 2,000 inhabit. per mile	1	.....	1	.....
" " " from 2,000 to 3,000 " "	5	1	1	5
" " " " 3,000 " 4,000 " "	4	1	2	.....
" " " " 4,000 " 5,000 " "	3	.....	.....	1
" " " " 5,000 " 6,000 " "	2	.....	1	1
" " " " 6,000 " 8,000 " "	3	.....	1	.....
" " " over 8,000 "	1	.....	.....	.....
CAR MILEAGE PER CAPITA.				
No. of roads not reporting	4	2	7	8
" " giving a service of less than 5 car miles per capita	1	.....	.....	.....
" " " " of from 5 to 10 " " "	4	.....	1	1
" " " " " 10 " 15 " " "	5	.....	1	2
" " " " " 15 " 20 " " "	4	.....	.....	1
" " " " " 20 " 25 " " "	1	.....	.....	.....
" " " " over 25 " " "	2	.....	.....	2
PASSENGER INCOME.				
No of roads not reporting	1	.....	4	4
" " earning less than $100,000 gross per annum	4	.....	.....	.....
" " " from $100,000 to $125,000 gross per annum	2	.....	.....	1
" " " " 125,000 " 150,000 " "	2	1	.....	.....
" " " " 150,000 " 200,000 " "	4	.....	3	2
" " " " 200,000 " 300,000 " "	6	.....	.....	2
" " " " 300,000 " 400,000 " "	2	1	2	1
" " " over 400,000 " "	.....	.....	1	3
PASSENGER INCOME PER MILE OF STREET.				
No. of roads not reporting	2	.....	4	6
" " earning less than $5,000 per mile	1	.....	.....	.....
" " " " $5,000 " $6,000 per mile	1	.....	1	.....
" " " " 6,000 " 7,000 "	3	1	.....	1
" " " " 7,000 " 8,000 "	.....	.....	.....	1
" " " " 8,000 " 9,000 "	4	.....	.....	.....
" " " " 9,000 " 10,000 "	1	1	2	.....
" " " " 10,000 " 15,000 "	6	.....	2	2
" " " over 15,000 "	3	.....	1	3
PASSENGER INCOME PER CAR MILE.				
No. of roads not reporting	4	2	7	8
" " earning less than 10 cents per car mile	2	.....	.....	.....
" " " from 10 to 15 " " "	5	.....	.....	1
" " " " 15 " 20 " " "	1	.....	.....	1
" " " " 20 " 25 " " "	4	.....	.....	1
" " " " 25 " 30 " " "	2	.....	2	1
" " " " 30 " 35 " " "	3	.....	1	1
PASSENGER INCOME PER CAPITA.				
No. of roads not reporting	1	.....	4	4
" " earning less than $1.50 per capita	3	.....	.....	.....
" " " from $1.50 to $2.00 per capita	2	1	.....	.....
" " " " 2.00 " 2.50 "	4	.....	1	2
" " " " 2.50 " 3.00 "	4	.....	1	2
" " " " 3.00 " 3.50 "	3	.....	1	1
" " " " 3.50 " 4.00 "	2	.....	2	.....
" " " " 4.00 " 4.50 "	2	.....	1	1
" " " " 4.50 " 5.00 "	.....	1	.....	.....
" " " over 5.00 "	.....	.....	.....	3
OPERATING EXPENSES PER CAR MILE.				
No. of roads not reporting	5	2	6	9
" " operating at less than 10 cents per car mile	3	.....	.....	1
" " " from 10 to 15 " "	5	.....	.....	1
" " " " 15 " 20 " "	3	.....	.....	3
" " " " 20 " 25 " "	4	.....	3	.....
" " " " 25 " 30 " "	1	.....	.....	.....
PERCENTAGE OF OPERATING EXPENSES.				
No. of roads not reporting	3	.....	5	6
" " operating at less than 60 % of pass. income	.....	.....	.....	1
" " " from 60 to 65 % " "	.....	.....	.....	3
" " " " 65 " 70 % " "	1	1	.....	2
" " " " 70 " 75 % " "	3	1	.....	.....
" " " " 75 " 80 % " "	6	.....	3	.....
" " " " 80 " 85 % " "	3	.....	2	.....
" " " " 85 " 90 % " "	3	.....	.....	1
" " " " 90 " 95 % " "	2	.....	.....	.....
NET EARNINGS.				
No. of roads not reporting	3	.....	5	6
" " earning less than $20,000 net	3	.....	.....	.....
" " " from $20,000 to $30,000 net	5	.....	.....	.....
" " " " 30,000 " 40,000 "	3	.....	1	1
" " " " 40,000 " 50,000 "	.....	1	1	1
" " " " 50,000 " 75,000 "	4	.....	1	1
" " " " 75,000 " 100,000 "	2	1	2	.....
" " " " 100,000 " 200,000 "	1	.....	.....	4
PERCENTAGE OF NET EARNINGS TO CAPITAL LIABILITIES.				
No. of roads not reporting	3	.....	5	6
" " earning less than 2½ % on capital liabilities	1	.....	1	.....
" " " from 2½ to 5 % " "	2	1	2	4
" " " " 5 " 7½ % " "	5	1	1	.....
" " " " 7½ " 10 % " "	6	.....	1	1
" " " " 10 " 12½ % " "	2	.....	.....	.....
" " " " 12½ " 15 % " "	.....	.....	.....	2
" " " over 15 % " "	2	.....	.....	.....

A CONSOLIDATION of the Savannah (Ga.) roads, it is reported, has been consummated; the City & Suburban Railway being united to the Savannah Electric Railway.

New Electric Railway Apparatus of the Walker Manufacturing Company.

The announcement that the Walker Manufacturing Company, which as our readers well know, has for many years enjoyed the highest reputation in the construction of cable railway equipments, power transmission plants, and all classes of very large machinery, has now added to its extensive business an electrical department, was made in a recent issue. The company now enters the market, ready to supply electric generators for both direct and alternating currents of any capacity, from 150 to 5,000 H. P., with an electro-motive force varying from 500 to 10,000 volts; and a complete line of electric motors for both direct and alternating current work. These new machines, both generators and motors, are constructed for street railway use, ordinary power transmission, mining, also in a special line in which is anticipated large developments in the near future, extra large alternating machines for long distance transmission of power.

The plant of the Walker Manufacturing Company is one of the largest and most complete in the country, and was fully described and illustrated in our Souvenir number for 1892, issued just before the Cleveland Convention of the American Street Railway Association. The buildings cover about 250,000 sq. ft. of ground, are constructed of brick, iron and glass, and are situated on the shore of Lake Erie, at Cleveland, O. The machine shop consists of three long bays, each containing a thirty ton traveling crane, which moves through its entire length. Iron galleries at either end are fitted up as winding rooms, and for the manufacture of insulating materials. The testing room is equipped with switchboards and resistances for testing generators, brakes for testing motors, and a 1,000 H. P. engine will be erected immediately for testing the large multipolar, direct coupled generators. The tracks of the Lake Shore & Michigan Southern Railroad enter the testing room below the floor level, and all machines can be lifted by the large cranes from the testing racks directly to the cars. The pattern shops occupy a large two-story building completely fitted up with modern wood working machinery. Two large foundries occupy another building, and are perfect in their equipment. They contain four mammoth cupolas, spacious core ovens, numerous traveling cranes, from five to thirty tons capacity each. Fifty tons of iron can be poured at once into a single mould, which enables the company to cast its large machines in fewer parts, thereby attaining greater rigidity.

The generator for street railway and direct current power transmission, shown in Fig. 1, is 250 H. P., of the well known four pole type, slow speed. The frame is cast in one piece, with three bearings which are of the ball and socket, self oiling type. The field magnets are of wrought iron, and are wound with enough copper to allow them to run perfectly cold. The armature is series wound, and insulated entirely with mica. With the two path windings—the only kind used by this company—there can be no unbalanced armatures, no sparking and no heating. The windings are entirely below the surface of the armature, which is iron clad, with no binding wires. There are no joints in the windings, except where the wires connect with the commutator bars, and the insulation throughout the entire machine is sufficient to withstand at least ten times its normal requirements. The armature and commutator are thoroughly ventilated, as a current of cool air passes all through the interior of the machine. The commutator is excessively large, and runs cold in regular operation.

The small machines of this type are belted machines, and the larger ones are usually built on the engine shaft.

Experience has taught street railway men that one of the greatest expenses in operating roads by electric motors has been the repairs made necessary by the rapid deterioration of the track and rail joints. The only way to correct this evil is to entirely disconnect the motor itself from iron to iron contact with the axle, and prevent, not only the hammer blow due to the weight of the motor, but the inertia blow due to the unyielding mass of the motor. Attempts have been made to accomplish this by suspending the motor at or near the center of gravity. This eliminates the weight, but not the inertia blow.

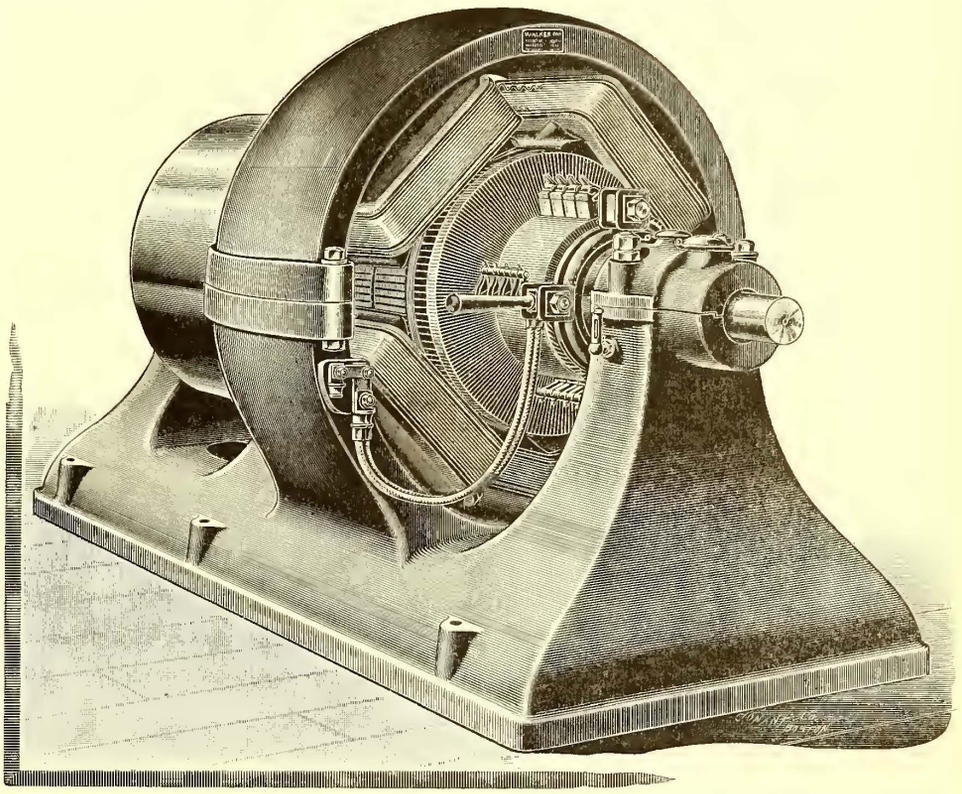


FIG. 1.—WALKER 250 H. P. GENERATOR.

This has forced those interested to the conclusion that the perfect motor must weigh as little as possible, be extremely strong in mechanical construction, should work to twenty-five horse power without heating, and not be in any way attached to the axle and wheels, except through springs which will do away with the hammering of the the track to the greatest possible extent. This method of suspension gives the freedom of movement necessary for the removal of strain in rounding curves. The motor being built by the Walker Manufacturing Company combines these suggestions of practical experience. It is a four pole, steel motor, weighing 1,200 lbs., has an easy capacity of twenty-five horse power, will run at any speed up to twenty-five miles an hour, is controlled by a series-parallel controller of superior type and simplicity, and is not attached to the axle in any way, except through yielding supports.

The illustration (Fig. 2) given shows the general form of the motor, mounted upon thirty inch wheels and ordinary truck, portions of the truck being cut away to enable the motor to be more readily seen. The motor is entirely water and dust tight, the only opening being the lid over the commutator, which enables the two brushes to be easily reached. The frame is in two parts and made of steel. The gear housing and commutator lid are of malleable iron. Both gears and pinions are of steel.

The shaft is large, being three and a half inches in diameter and two and a half inches in the bearings. The bearings are very long and arranged for thorough lubri-

cation with grease. The efficiency of the motor is 90 per cent.

For the better understanding of the flexible support and other important points, detail cuts are shown on this page.

Fig. 3 shows an end elevation of the motor with one wheel taken away. B is a cast iron, U shaped frame, the

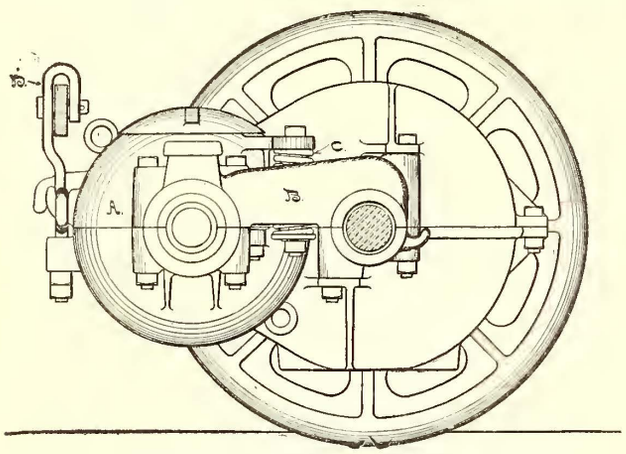


FIG. 3.—METHOD OF SUSPENSION—STEEL MOTOR.

rounded end being journaled on the car axle in the ordinary way. Swinging freely between the arms of this U is the motor, A, trunnioned by its bearings, but not touching the axle. The motor is then supported at the rear by spiral spring, C, between lugs on the frame and the arms of the U, and at the front end is supported by a swinging arm from the ordinary spring truck bar, D. It can be seen that, with this suspension, the motor rides freely on springs, readily adjusting itself to varying conditions, without bringing a strain or shock on any part. The gear centers are always maintained because of the U shaped frame.

Fig. 4 shows how the lower half of the frame is made to swing down, while the armature remains in place, one man being able to let it down and replace it after inspection and cleaning. The armature may be removed, if desired, from below; or, if the motor should not be over a pit, the upper half may be swung up and the armature removed from above.

By referring to the figures it will be seen that all the bearing caps come off from below, and all the bolts pass down from above; and, should a nut come off, no part of the motor can fall. The bolts are not made to take the weight of the motor, and the nuts are all locked with pins.

The bearings are entirely outside of the motor casing or frame, as shown by Fig. 5. They are solid shells, A, filled with the best babbitt and are supported by the bolt, B. The grease, which comes out between the end of the thrust collar and the inner end of the bearing, falls

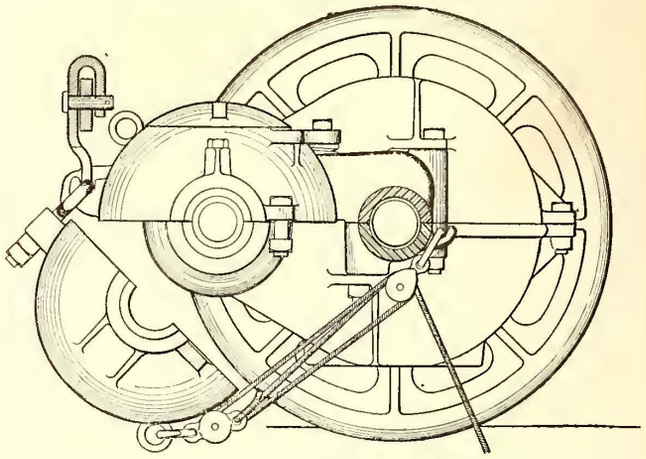


FIG. 4.—METHOD OF REACHING ARMATURE FOR INSPECTION.

to the ground through the opening, C, which is 4 × 2½ ins., and cannot be clogged. No grease can get into the motor.

Fig. 6 shows a section of the armature, the core, A, of which is built on a separate sleeve, which receives the shaft, B. This shaft, when worn out, can be replaced by removing the nut, C, drawing out the shaft and inserting a new one, thus saving the expense of tearing the armature down and rebuilding, as not even a wire connection is disturbed. The commutator is on a tapered portion of the shaft, the same as the pinion, and can be more easily drawn off for refilling. Both commutator and pinion are held in place by nuts properly locked by an ingenious lockwasher.

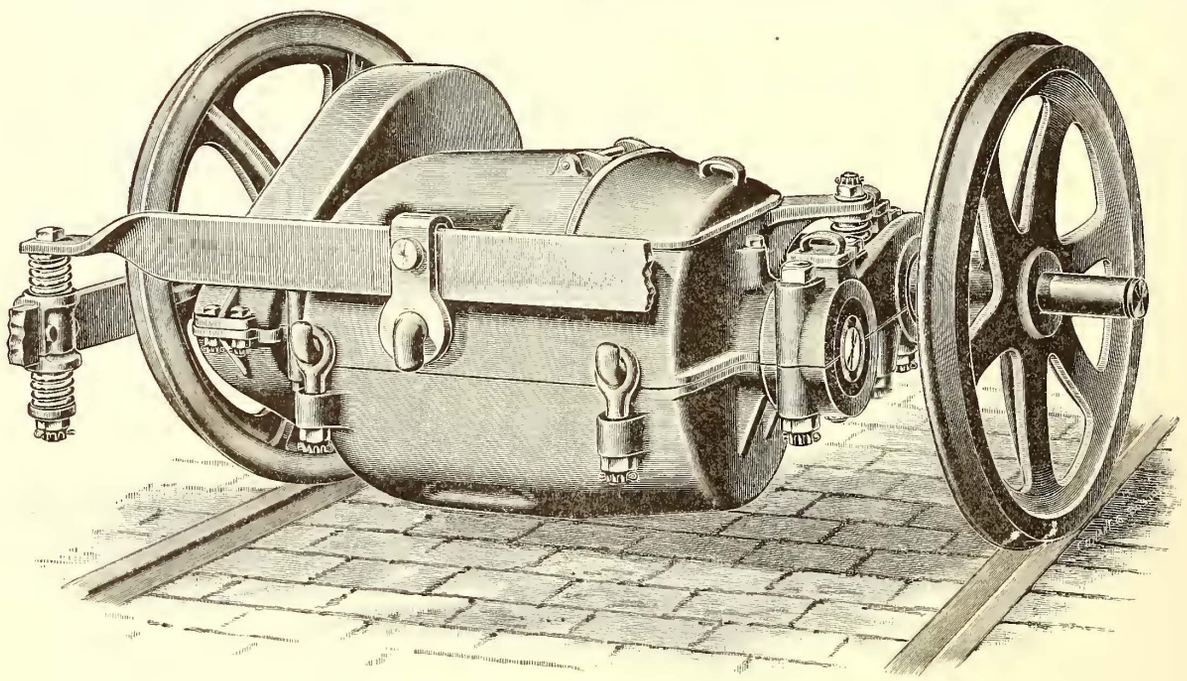


FIG. 2.—WALKER STEEL MOTOR—"SPRING MOUNTED."

This motor contains all the long tried constructional points which experience has proven to work well, and the weak points existing in other types are claimed to be eliminated. Being flexibly supported, it will remove all trouble with rail joints, as in practice the motor runs as quietly as the old horse car. Not even the gear noise is heard, as the gears are enclosed in airtight housings and run in oil. The excellent workmanship, for which the Walker Company is famous, tells greatly in this class of machinery.

The thirty-five horse power motor shown in Fig. 7 weighs 2,500 lbs., and is intended for heavy street railway work, where very large cars or trains of cars are used. It is made of cast iron, and has an efficiency of nearly 90

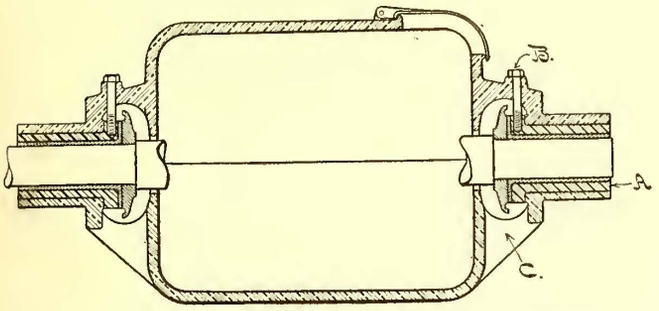


FIG. 5.—BEARINGS OF MOTOR.

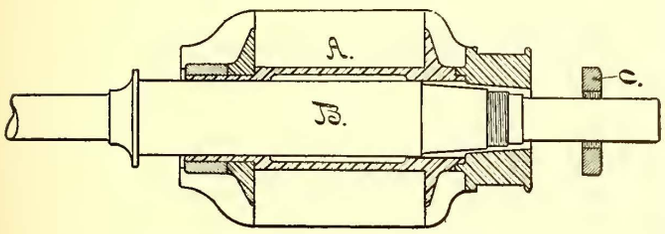


FIG. 6.—SECTION OF ARMATURE.

per cent. It is built on the same general type as the steel motor, but it is not spring mounted, being journaled on the axle like all other makes. This motor is exceedingly small and light for its output, being of about the same weight as other makes of twenty-five horse power capacity. It will operate on thirty inch wheels with plenty of clearance.

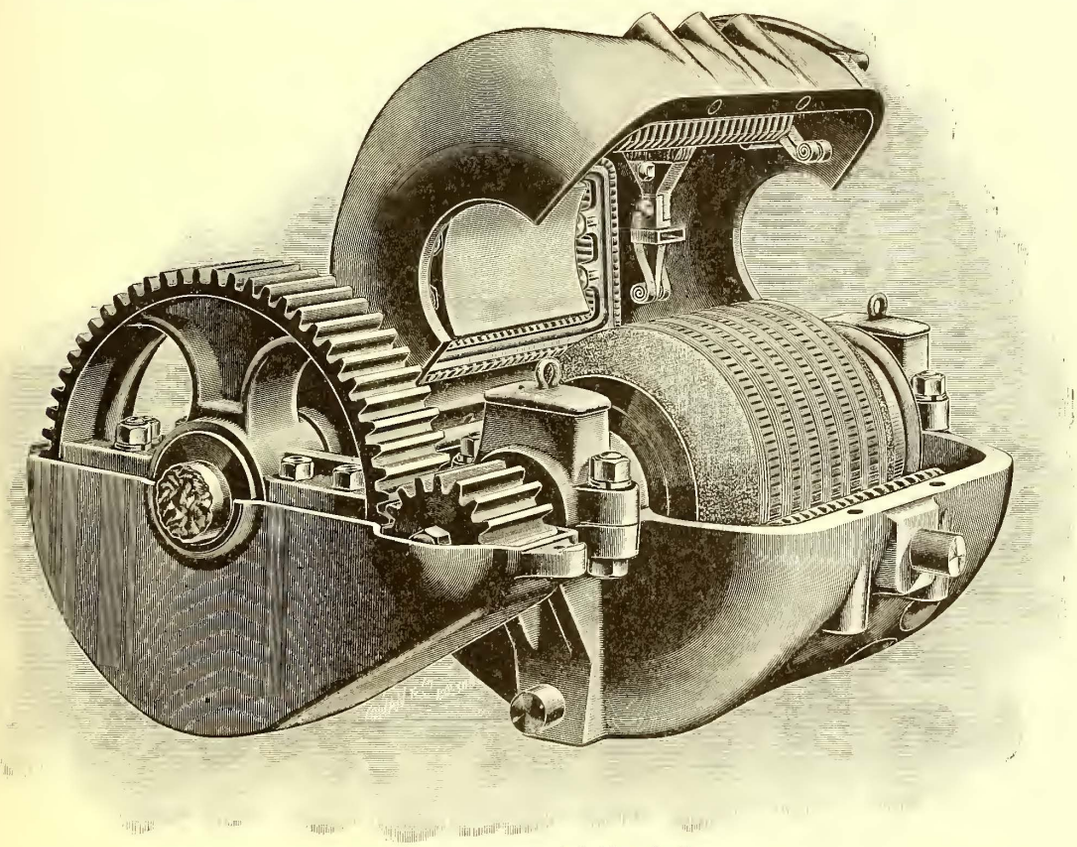


FIG. 7.—CAST IRON MOTOR OPEN.

The designs are already completed for large motors to operate elevated trains, or suburban and interurban railways which will be run at high rates of speed.

The life and activity which the Walker Company is manifesting in entering the market with every kind of electrical machinery required for the largest and most perfect work, the manufacture of apparatus under the supervision of those thoroughly familiar with the detail of electrical machinery, with consequent ability to avoid the experimental stage of the business, and the company's unsurpassed facilities, assure its great future success.

Narrow vs. Broad Gauge Electric Railways.

By E. A. Merrill.

In the discussions that have at various times taken place over the commercial value of electric railway systems radiating from towns into the surrounding country, for the purpose of supplanting the farmer's horse in the transportation of farm supplies and products, and for carrying the farmer himself to and from town, there has several times appeared the suggestion to construct a narrow gauge road, in place of the standard gauge now so universally used. If thereby we can effect an economy while performing the necessary service in an equally satisfactory manner as with the broad gauge, it will certainly be of great advantage to many communities; it is, therefore, of interest to examine the question by comparing the two systems under similar conditions.

The case most frequently met with and which would naturally be first considered, is that of a single center with radiating lines running into the surrounding country. As a fair example we may assume the following conditions, which can be duplicated in many towns with populations varying from 5,000 to 15,000:

Broad gauge to be the standard gauge of four feet eight and a half inches; narrow gauge three feet, this being about as narrow a gauge as motors of the present types can be accommodated to. Length of road twenty-one miles, consisting of three branches of seven miles each, and operated from one power house situated at a central point. Traffic of the ordinary description and distribution, and such that, based on a broad gauge standard, a total of eight thirty foot freight cars, each equipped with two thirty horse power motors, and sixteen sixteen foot passenger cars, each equipped with two twenty-five horse power motors are required, this number being sufficient for all contingencies. Single track with turnouts and sidings, side pole, bracket overhead construction, fifty-six pound T rail for the broad gauge and forty-five poundT rail for the narrow gauge road. Track located at the side of an ordinary country road and no paving required.

Of course in both cases the same traffic must be handled and with equal facilities; to accomplish this will require for the narrow gauge road, sixteen twenty foot freight cars each equipped with two twenty-five H. P. motors, and ten sixteen foot motor and eight sixteen foot trail passenger cars, each motor car being equipped with two fifteen H. P. motors.

Any advantage resulting from the substitution of the narrow gauge for the broad gauge will be found either in decreased first cost, in decreased operating expenses and maintenance, or in both. Assuming that rights of way

are granted without cost, and that preliminary expenses are distributed over the various items in proportion, we may divide the first costs as follows: Real estate, power house, car house, steam plant, electrical plant, cars and equipment, track work, overhead work.

The first five items are dependent on the variation in the sixth, as is also the eighth, while the seventh is independent of any variation in the others, and can be determined by itself alone; taking, therefore, the sixth item first, we find for the broad gauge that there is approximately 144 tons and for the narrow gauge 170 tons of dead weight to be moved with all cars in service, while the live or paying weight is the same in both cases; this difference is not enough to increase the power plant, as we should naturally install surplus power in the first instance at least 25 per cent. in excess of the usual demands; the same would be true of the feeder system if carefully figured, and therefore no increase need be made in the overhead construction account; in the operating expenses, however, the additional dead load would entail increased coal consumption, which we will take into account later. As the steam plant is unchanged, the electrical plant likewise remains constant, and therefore the costs of the first five items and also the last will be the same with either broad or narrow gauge.

The item "Cars and Equipment" will be greater for the narrow gauge road than for the broad gauge of the same capacity; this is due to the fact that the cost of cars does not diminish anywhere near in proportion to the decrease in carrying capacity; the trucks will be but slightly less for the narrow gauge, and the same is also true of the costs of car equipments, the difference in cost between a thirty horse power and fifty horse power equipment being hardly more than nominal; thus the decreased cost of each part is more than overbalanced by the increased number of parts.

In the cost of the track work is found the only source of saving. This item will be considerably less for the narrow gauge road since the number of parts is the same for both gauges, and the costs nearly in proportion to their dimensions, though nowhere near the ratio of gauges or of carrying capacity for the same number of cars. The items of saving are principally in the rails, ties, excavation, labor and freight; there will be but a nominal difference in the costs of deep cuts and fills, bridges, culverts, cleaning, ditching and the like, so that the larger the proportion of these to the total cost the less will be the relative saving.

A substantial broad gauge road of the above description, designed for economy and durability, and built in a thoroughly first class manner, can be erected, under average conditions, for $315,600, the power house and car barn being constructed of brick and iron, the steam plant compound condensing, the electrical plant of high efficiency, the cars and equipments substantial and durable, rails laid on first quality ties of ample dimensions and in a roadbed reasonably ballasted, poles of wood, iron brackets and trolley properly sectioned. The percentages of the total amount for each of the principal items, and for both broad and narrow gauge, are given in the table below, each item covering all charges properly coming under its head, while all preliminary expenses, such as surveys, legal advice, specifications, etc., are distributed over each item in proportion to its size:

RELATIVE COSTS FOR EQUIVALENT CARRYING CAPACITIES.

Part of Equipment.	Broad.	Narrow.
Real estate	.0158	.0158
Power house and car barn	.0350	.0350
Steam plant	.0684	.0684
Electrical plant	.0475	.0475
Cars and equipment	.2154	.2757
Track work	.7911	.3643
Overhead work	.1267	.1267
Total	.9999	.9334

The difference in first cost is 6.65 per cent. of the total amount or $21,000, and the interest on this at 6 per cent. is $1,260 per year, a substantial profit if not offset by increased operating or maintenance charges which we will now examine.

With the exception of "Cars and Equipments" and "Track," the maintenance will be practically the same with either system; the maintenance of cars and equipments will be greater for the narrow gauge road, and about in proportion to the number of cars, maintenance of the track may be less for the narrow gauge, but this is doubtful, as the rail is much lighter, and in any event the difference would probably be balanced by the increased cost of car and equipment maintenance.

On the side of operating expenses, all office expenses for clerk hire, etc., the attendance at the power house, and probably at the car barn, would be the same in either case; the cost of fuel, however, would be somewhat greater for the narrow gauge road, as it has a greater dead load for the same live load, and the loss in the line would also be greater for the same reason; the exact amount would be difficult to estimate, and we will simply charge it on the side of car and equipment maintenance, so as to leave no possible doubt that the latter charge is unbalanced. But it is in the operation of the cars that the greatest difference is found. In operating a system of single units, the expenses, due to conductors and motormen, must increase almost with the number of units; in the present case we have for the narrow gauge road forty cars against twenty-four for the broad gauge, and for operating this additional number at least fifteen extra men would be required, at an annual expense of $9,750, allowing each man an average of $650 per year; the difference between $9,750 and $1,260, or $8,790, represents the annual saving with the broad gauge road; this is 2.7 per cent. of its entire cost, a very substantial increase to the dividends.

For heavier traffic the advantage is still more in favor of the broad gauge, for lighter traffic less favorable, but it is difficult to conceive of a lighter traffic that would be profitable or even pay expenses. So long as we adhere to the single unit, the broad gauge will be more economical than the narrow, but when we take the case of long lines with light traffic accommodated by trains instead of single units, we find a possible field for the narrow gauge road. For example, take a road forty-two miles long, with a traffic accommodated by the cars specified in our first proposition, operated by a system requiring but one power house, and costing the same amount per mile for construction, the operating and maintenance charges will be almost identical, in fact may be less for the narrow gauge, while their respective costs will be $510,600 and $449,600, a saving in favor of the narrow gauge of $61,000. Unfortunately for electric traction, however, such roads are at present both more cheaply constructed and more economically operated by narrow gauge steam locomotives than is possible with any electric system.

Proper Rail Bonding.*

An electric current always chooses the path of least resistance. Hence, when using the earth return, if there should be along the line water pipes the current will naturally take its path along these until it meets a joint of a higher resistance than the surrounding earth, it then takes its course through the earth, but the pipe past this joint being again a continuous and good conductor, the current returns to it, and this operation repeats itself at every joint of high resistance. The water which surrounds the pipe is by this action decomposed, the oxygen going to the anode, the hydrogen being liberated at the cathode. Oxygen in the nascent state is, as we all know, a very active elemen' and, therefore, the iron in the pipes is immediately oxidized and rust, formed along the entire space where such action takes place. If there is a great deal of moisture the amount of water thus decomposed is increased, and the destructive action is greater. What is the consequence of this deviation of the current from the pipe to earth and back to the pipe? You will find that the pipe is eaten away at both places, one part being more affected than the other, but on either side of the joint the iron is speckled and bits of it removed, the appearance being very much like the zinc of a Leclanché cell that has been short circuited; this appearance being, as a rule, only along a short zone some few inches each side of the joint.

The many possible causes for damage and losses which exist when using the earth as a return, make me believe strongly in the advocacy

*Abstract of a paper read before the New Orleans Electrical Society by H. J. Malochee, electrical engineer, March 3, 1894.

of the all-metal return, not by means of supplementary wires; not by means of overhead return feeders, but by the simple use of the rails themselves. In order that this system be successful in every particular, it is necessary, of course, that the relative conductivities of the earth and rails be such as to render the amount of current going through the earth absolutely negligible.

Suppose we take, as an example, a double track road, with ninety pound rails, such as are used in all large cities. These rails, being each nine square inches in cross section, and iron and copper being as 1 to 6 in conductivity, the equivalent in copper would be one and a half square inches, and the four rails together would equal six square inches of copper in cross section. The carrying capacity of this conductor would be at least 6,000 amperes, and as compared with No. 0000 wire, in order to have the same conductivity, the number of wires of this size required would be more than twenty-eight. Just think of it! Twenty-eight No. 0000 wires bunched together! How ridiculous it does sound to hear some people speak of using one No. 0 wire, or one No. 0000, or even two of the latter size as supplementary wires, when we have as an absolutely necessary part of the equipment such a splendid path for our current.

It being admitted, therefore, that the rail is the proper thing to use, if it is possible to make it electrically continuous, the problem then resolves itself into properly bonding the joints or otherwise reducing their resistance.

The first idea was the driving of a pin in each rail, wrapping a No. 4 B & S wire around it and soldering. This was, of course, too unmechanical and temporary to be used very long, and I believe that probably not one road out of a hundred could be found thus equipped to-day. Then came the channel pin which consisted of a tapered pin with a channel in it for the reception of the wire; this pin was then driven in a hole in the web of the rail, but this, apart from the poor contact made by the wire is very objectionable on account of its liability to get loose from the constant vibration caused by the passing car wheels; it is also bad on account of the chances for moisture to get in between the iron and the copper, rust the joint out and so on.

After the channel pin came the split bushing which nearly encircles the whole of the bond wire and is better mechanically than the former joints; however, in an electrical sense it is not as good, for the reason that there are four joints between rail and rail, and the moisture can also get between the iron and copper, and by electro-chemical action injure the connection very seriously.

The welding of rail joints was next tried, and probably if this plan were carefully carried out by means of electric welding of the entire cross section of the rail, instead of joining only a portion of it, as was done, this method would be most excellent both in a mechanical and electrical sense.

Some recent devices are the solid end bond, the hollow rivet bond, the Acme bond, and the Vail bond. The solid end bond is made in two sizes eight and a half inches and thirty inches long. It consists of one single piece of from No. 0 to No. 000 wire at each end of which a rivet head and body is formed; this piece is riveted into any portion of the rail in which it is thought best to insert it. The rivet portion of the bond being larger in diameter than the wire itself, the contact with the iron is larger than in the primitive styles of bond wires; further, this contact is made still larger by the fact that the rivet head and that formed by the riveted end are pressed tightly against the side of the web by the riveting, thus forming perhaps as perfect a joint as can be made by the use of a rivet.

The hollow rivet consists in having, instead of a solid rivet at the end, a hollow wire whose outer surface is forced against the walls of the hole in the rail by a tapered iron pin which is hammered into the hollow end of the wire; this end, being split a short distance, may be turned over so as to prevent its getting loose or the pin from backing out. This is mechanically very strong, and, if the surfaces are bright, there should be a very perfect electrical joint, due to the fact that the metal is pushed outwardly at the same rate in every direction, and the two metals can be so clamped together as to form a very intimate connection inside of the hole. In this bond, the size of the outer diameter of the part which goes into the rail is necessarily much larger than the wire itself, and the electrical connection is thus made far more perfect, as will be explained later on.

A very recent addition to the number of good rail bonds is the Acme bond, which consists of a copper sleeve with a tapered end. This sleeve has a channel cut on the side, thus making the wall of the sleeve rather weak in that particular place. The hole is drilled about one-thirty-second of an inch smaller than the largest outside diameter of the sleeve, and this latter is driven over the wire, in the hole in the rail, the connection is made very solid, and the material in the sleeve shapes itself to all the inequalities in the hole and on the wire. The Vail bond has been but very recently designed by J. H. Vail, and is probably one of the best on the market. It is substantially made, and contains a number of advantages which few other bonds have. It consists of two heavy sockets of copper, one on each rail, and connecting cables of copper wires between the two. The sockets have two or more studs which are riveted into the web of the rail, and these, together with the shoulder, when the bond is in position, furnish quite a good electrical connection, provided, of course, the work is done in a thorough manner, and the surfaces are bright at the time of their connection.

Each of these bonds has its own peculiar advantages, but the special, and by far the greatest advantage of these last described bonds, is the increased area of the joint with the rail. In considering the general subject of resistance at the joint, we certainly cannot fail to remember that iron has about one sixth the conductivity of copper, and therefore the area of the junction surface should be no less than six times the area of the copper wire which we use as bonding wire.

This result can of course be reached either by increasing the diameter of the wire or by lengthening the joint. The latter is difficult to do, and it would be costly as compared to the first method. If we adopt the scheme of increasing the diameter, what would be the result of doubling the diameter of the bond wire at the point where it connects with the rail? Suppose we have No. 000 copper bonding wire connected to two rails by holes in the web, this part being three-eighths of an inch thick. The area in square mils of No. 000 B & S wire being 131,790, the area of the joint should therefore properly equal seven times 131,790 sq. mils. The joint if made with No. 000 wire three-eighths of an inch long equals the diameter (410 mils), times 3.1416, times 375 mils, equals 483,000 sq. mils. As we want an area equal to six or seven times 131,790 or 922,530 sq. mils. we can get that area immediately by doubling the area of the wire, and the joint will have an area equal two times 483,000 sq. mils equal 966,000 sq. mils, which makes the conductivity of the iron portion of the joint equal to that of the wire itself. However, what is the conductivity of this wire as compared with that of the iron rail itself? Take a seventy pound rail which is seven square inches in cross section and whose value in terms of copper is one and one-sixth square inches. This bar of copper half an inch thick and two and one third inches wide has a section equal to 1,166,000 cir. mils. And the No. 000 wire has a cross section of 167,805 cir. mils; thus it would take seven No. 000 wires to equal the conductivity of the rail and make it electrically continuous. Whether the seven wires should be used or not would have to be determined by the number of cars to be run, the distance from the power house, etc. In general, I should say that the very heaviest bonds would have to be used nearest the dynamo and the lightest at the farther end of the line. Still, each installation would have to be treated independently according to the special circumstances surrounding it.

A suggestion which was made some time ago and which should receive some attention, in my opinion, is the increase in the length of the rails; this would decrease the number of joints per mile. A number of rolling mills have declared their ability to furnish 100 ft. rails. This alone would reduce the number of joints from 176 the number now used, to fifty-three per mile, making the cost of bonding less, and also decreasing the chances for trouble caused by electrolysis, bad connections, etc.

Another suggestion which seems to be very important is one recently made by Prof. Brown Ayres, of Tulane University, viz., the electric welding of the bonds to the rails. This means of connection is most important, for certainly if we use a bond no matter how large, if we make the area of the connection large enough to counteract the lesser conductivity of the iron, still, if the real jointing of the bond with the rail is not perfect and permanently so, the above provisions for a good return circuit are of little avail. The small cost and light weight of the electric welding machines necessary for such work would make this further provision a very practical remedy for any trouble from electrolysis at the joint, rusting out of the same, and the consequent increased resistance of the bond and rail joint, which after all neutralize any other provision that may have been made to increase the conductivity of the entire return circuit. This method has the advantage over the welding of the rails themselves in so far as the flexibility of the joint is retained and yet the continuity of the metallic circuit is preserved.

Another thing to which I desire to call your special attention is the difference which exists between the various lengths of bond wires, in so far as resistance is concerned. For example: The number of eight and a half inch bonds necessary for one mile of single track have a resistance of .00885 ohm, whereas the thirty inch bonds for the same track would have a resistance of .0265 ohm; this is for No. 0 B. & S. wire. The loss in volts due to the resistance of the bonds themselves, independent of any loss in the joints, would be for that distance, with 100 amperes of current and the eight and a half inch bonds, .88 volt, and with the thirty inch, 2.65 volts.

Is the cost of a thorough bonding excessive and prohibitive? Figures will answer this question. One mile of No. 000 B & S wire weighs 3,380 lbs; at fifteen cents per pound equals $407. This is the cost of the supplementary. Now 176 bonds thirty inches long weigh 275 lbs; at fifteen cents will increase the cost $45, making a total of $452.

As a comparison I will give you the cost of the longest bonds used, say, three feet of wire, No. 0000 B & S. We have seen that in order to make the ninety pound rail electrically continuous we must have seven of these wires bunched together; this equals twenty-one feet at each joint, making for the first 176 joints in the rails a total of 3,700 ft., weighing 2,370 lbs.; at fifteen cents per pound, equals $355. Thus the cost of material is less for heavy bonding as compared to light bonding and one No. 0000 supplementary wire, but the cost of manufacture being probably higher for the special form in which this material is furnished, it is reasonable to think that the entire cost in the two cases would be very nearly the same. However, when it is considered that in one case the circuit has a conductivity of 7, and in the other a conductivity of 2 at the most, no manager would hesitate a minute to adopt the latter method, even if the cost be higher.

What are the conclusions that seem to have been reached? First, we must use our rail for a return circuit. Second, we must make this circuit of greatest conductivity and least resistance. Third, our bonding wires should be of equal carrying capacity to that of the rails. Fourth, the connecting surfaces of these bonds with the iron rail should be no less than seven times the circular milage of the bonds themselves. Fifth, the connection, electrically speaking, should be as perfect as possible, so as not to cause electrolysis at and destruction of the contact. Sixth, the connection from the rails to the dynamo should be amply large to carry the current which it is intended to carry, with practically no loss in that distance. Seventh, the entire cost of a good rail return is no more costly per mile than the return by means of a supplementary and light bond wire.

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

Address all communications to

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It is Dangerous for a street railway manager to permit himself to lapse into such satisfaction with his achievements in securing the introduction of mechanical traction, as to neglect opportunities for improvements in the many little details that please the patrons, increase the income, and place the business on a substantial financial basis. The operations of every system should be broadened so as to embrace all features which will tend to make the business popular, and to increase the income more rapidly than the expenses. Unless this is done, some rival company may, even without the advantages of location, eventually obtain control of the traffic, or else the directors will manifest a disposition to make a change in the management.

A Correspondent in this issue calls attention to the great desirability of selecting some system of accounting for street railway companies, which will be considered as standard. We are very glad to publish this plea, for we consider the call for a standard, such as that suggested by our correspondent, a most urgent one, and will be glad to give space to any suggestions which our readers have to offer towards a satisfactory solution of this question. The development of the electric railway business has been so rapid that there has been hardly time for the fixing of standards, either in the operating or accounting departments, although the need of such action has been widely felt. Valuable work in this line has been accomplished by the committee on standards of the American Street Railway Association, and we understand that the subject will be taken up carefully by the committee again, in time for the Atlanta Convention.

Boulevards, Neutral Grounds or Reservations in the middle of the streets on which street railways can operate are most desirable features of a modern city street system, and it is a wonder that this method is not followed in the laying out of all new cities, or in the extensions of older cities where the conditions are favorable. There are many advantages that result from this arrangement, both to the city and to the street railway companies. The streets are cheaper to maintain, as it is necessary to pave only a comparatively narrow roadway on each side; the neutral ground can be kept in grass or transformed into a park and bordered with shade trees, so that it always presents an attractive appearance. In the matter of safety to the public it is very desirable, as it admits of a high rate of speed for the cars without danger to persons or vehicles, and in the matter of boarding or leaving a car the passenger is in less danger from passing vehicles. Track repairs do not interfere with the street traffic, the expense of paving the track is obviated, and in addition, a cheap type of rail can be employed. In this respect the street railway companies in many of the Southern cities have an advantage over those at the North, for the operating expenses are generally reduced where these conditions prevail. An ideal street railway city would have a neutral strip on all its main thoroughfares upon which its tracks could be laid.

The Earning Power and Security of an investment are not the only factors determining its value. An important element is the ease with which the capital represented can be withdrawn according to the pleasure or need of the security holder. In other words, the convertibility of any property is the most important consideration affecting its value, and often commands for certain stock or bond issues a relatively higher price than they would otherwise possess. It is for this reason that some steam railroad shares, listed and largely dealt in on the New York and other city exchanges, show quotations much higher than stock in corresponding industrial or mercantile enterprises of the same reliability and earning power, whose shares change hands only at private sale. The securities of street railway companies, except those situated in important cities, have never been largely traded in on stock exchanges, and the general investing public, until recently, has not given this class of securities a great deal of attention. The amount of capital required for the equipment of electric lines, however, has lately given street railway properties financial prominence, and they now form, among many, a favorite investment. The peculiar advantages which they present to capitalists should give them wide sale, and this can be done by listing them on the exchanges and by published reports of the returns at stated times. The value of properties will become generally known in this way, and the convertibility of the stock will give it an added value.

The Importance of Adequate Rail Bonding is a matter that is being brought very prominently to the attention of electric railroad managers all over the country through the agitation on the subject of the damage by electrolysis, of water and gas pipes and metallic subway conduits. Recent investigations in a number of the larger cities where electric roads are being operated show that the electrolytic action has been greater than was supposed, and has been an active agent in the deterioration of the different underground systems. According to well known laws the return current will pass from the car wheels to the station by as many paths as may be

presented, dividing itself among them according to the conductivity presented by each. One remedy then is to provide a metallic return which shall not only have a greater conductivity than that through the earth and pipes, but so much greater that the amount passing by the latter circuit shall be so small as to be practically negligible. If the electrical carrying capacity of the rails is sufficient for this purpose, the problem is one simply of bonding, care being taken to make all parts of the return circuit of equally high conductivity.

"I Am Shriveling Up" said a street railway manager to us recently; "I have been in the employ of this company in various positions for nearly thirty years, and during that time have never traveled outside of this immediate neighborhood for the purpose of studying street railways. I am a casual reader of street railway literature, but having had experience with only animal traction I find it difficult to comprehend what is written regarding other methods. I have had a strong desire to attend the meetings of the American Street Railway Association, and hope to be present at the Atlanta meeting in October, but the directors of this company have never been willing to grant me the time or means." This was from a man whose lines in every particular rank favorably with the half dozen other lines in the same city, yet he feels, as stated above, that his powers are being dwarfed and that his work comes far short of what it might be, had he the opportunities for studying the operations of other lines and of meeting with his fellows engaged in a like occupation. This is one of the many evidences that we find that street railway managers and superintendents, as a general thing, appreciate the advantages to be had from a membership in the American Street Railway Association, but are deprived of its benefits through lack of appreciation on the part of the managing directors. Those who find themselves in this condition would doubtless be able to effect a change and secure more consideration from their employers were they to occasionally place before them the articles that are constantly appearing in this publication regarding special advantages of a membership in the Association.

In the Progress of Electric Traction the South has played an important role and stands to-day with heavy invested interests, not only in railways, but also in the lighting field. Although electricity has had to win its way slowly, it is now being generally introduced and is coming into such favor that it must soon supplant the mule in nearly every Southern city. The first steps have been taken, and well taken, by the introduction of excellent systems in the principal cities, but to stop with present developments would be folly. Electric traction must necessarily advance until all the lines in all the large cities and many of those in smaller cities shall have been equipped after the most improved plans of construction and management. There are many advantages which Southern street railways, especially those in the coast cities, possess over those of the North and West; the routes are generally level; there is no expense for removing snow, and the winters are so mild that the patronage is good all the year; labor is cheap, and where the service is reasonably good the patronage is liberal. Coming as it has, electricity marks an epoch in the material advancement of the South. So great an achievement in this line by and among a people who have been since the war conservative almost to a fault, cannot fail to attract the attention of the financial world, nor to infuse and re-encourage the people of the South themselves to even greater endeavors to utilize their abundant natural resources in other directions. The resulting benefits to Southern cities from the introduction of electric traction cannot be measured by the advancement of this industry alone; the influence radiates into other channels of enterprise. Capital will come from the North and from Europe, and home capital will be unlocked for local and other enterprises. But the process of transformation from animal to electric traction is as yet barely inaugurated. The number of lines already equipped does not even approximate the number invited by the needs of the present or the early future. Naturally the South has shared in the industrial depression which the entire country has experienced during the last few months, but Southern street railways have weathered the storm well and have shown, during this ordeal, that they had behind them as a reserve power unequaled natural advantages. This fact having been demonstrated, Southern street railway investments will attract the confidence and respect of the outer world. Capital must also soon recognize these advantages, and the surplus which is now comparatively idle will begin to move; in fact, it is already peeping forth from the hiding places it has occupied during the period of business depression. Unless all signs fail, the South is entering upon a period of the broadest and most profitable activity which it has ever known, and which will be fully manifest when the clouds that have lowered over the financial horizon of the entire country for the past few years shall have rolled away.

Directors are not usually as careful students of street railway problems as are the superintendents or other executive officers. This fact is frequently accountable for faulty construction and poor discipline for which the manager himself, unfortunately, bears the censure of the public. We have in mind an electric system on which the construction is first class in every particular, except the roadbed, but this is in a most deplorable condition. On inquiry it was found that in the original construction the judgment and advice of the superintendent were ignored, and now he is blamed to a certain degree by the directors. The same is sometimes true of discipline, in cases, for instance, where the selection and discharge of employes is in the hands of a committee or of an officer who is influenced more or less by political motives rather than the best good of the service. It may be stated, as an axiom, that in order to secure good discipline, and consequently good service, the management of the men should be entirely in the hands of an officer whose duties bring him in contact with the employes, and through him all orders should be issued. In the street railway service this work generally belongs to the superintendent or manager, who should be allowed the largest liberty and then held strictly responsible for the results. If he proves incompetent, the services of another should be secured, but a two headed or mixed management will never succeed. The employes will learn to disobey one or the other and form a contempt for both. The financial head of the street railway system should not undertake to control the operating department, because in the multitude of duties which devolve upon him he can rarely give sufficient attention to important questions of operation or to the selection of motormen and conductors who

will efficiently and honestly perform their dutes. It should be the aim of every street railway company to employ good men and then keep them as long as possible in the service. In the matter of accidents, no company, however prosperous, can ignore the safety of its patrons. If heavy damages are not sufficient inducements for solicitude in this respect, it is still true that one life is worth more than all the railways in the city, and a sense of danger on the part of a community from reckless running will soon result in hostile local legislation, which will tend to injure the street railway business at large, for what is done in one city in the way of municipal regulations is likely to be adopted in other cities. No street railway company, however poor or prosperous, has a right to ignore general practice in methods of discipline or management. There is an invisible bond uniting the companies of the entire country, so that the acts of one affect all the others for good or evil. This bond can be strengthened by a membership in the American Street Railway Association, which is designed to give to all the results of others' practice, and assist in defending their local rights, while it tends to lift the entire service to a higher standard of excellence. There is a science in street railway business, in so far as management is concerned, whatever may be said regarding the mechanical department, and every one in the business is bound to study it, or failure will be the result.

An Extensive New Electric Railway System in Brooklyn.

Contracts which called for about 100 miles of electric railway track to be laid in Brooklyn, were let last month, and construction on the road will be begun promptly. The company interested is the Nassau Electric Railway Company, which was organized some time ago, by P. H. Flynn, of Brooklyn. Franchises were secured at that time, but work was not commenced. Among those interested at present are A. L. Johnson, of Cleveland, R. T. Wilson the New York banker, and others. A number of erroneous statements have been published in the daily papers in regard to this road, so that the following facts will be of interest:

The rail used will be the heaviest which has ever been laid for street railway purposes in Brooklyn, and will be a nine inch, ninety-three pound Johnson girder rail. The electric welding process will be used, and several portable electric welders, similar to those used on the West End Railway, of Boston, have been ordered for this work. The special work will be about the only part of the track which will be bolted. The rails will be laid on ties measuring 5 × 8 ins. × 7 ft. They will be of yellow pine and laid two and a half feet between centers.

Construction is to be commenced on two routes, one extending from 39th Street, South Brooklyn, to the Broadway Ferry, through a number of the principal thoroughfares of Brooklyn, a distance of about eight and a half miles. The second line will extend from Broadway to Canarsie. Probably only from thirty to forty miles of track will be laid this summer.

The plans for the road contemplate the ultimate erection of two or more power stations, but at present only one will be built. The site of this will be at the foot of 39th Street, Brooklyn, where it will be located on New York Bay, and will have the best of facilities for the receipt of fuel, etc., and plenty of salt water for condensing purposes.

The station to be built will measure 120 × 157 ft., and will have an ultimate capacity of 5,000 H. P. The Babcox & Wilcox boilers will be used, and an independent stack will be built for each battery of boilers. No automatic stokers will be used and no force draught apparatus will be installed. The engines will be of the Corliss type, and three of 750 H. P. each will be employed until the needs of the traffic are such that a larger capacity in steam power is needed. The engines will be direct connected to the generators which will be of the Westinghouse type.

The rolling stock will be supplied by the John Stephenson Company, Ltd., of New York, which has the order for sixty closed cars, and will be extremely tasteful and handsome. The cars will be equipped with Westinghouse motors.

Legal.

Electric Street Railway—Injunction. 1. The use of a street for an electric railway will not be enjoined because the construction of the track will prevent an abutting owner from loading his drays by standing them at right angles to the sidewalk, such a method of obstructing the use of the streets being in violation of a city ordinance.

2. The operation of an electric street railway by the overhead wire system is not so dangerous to those who reside or do business on a public street as to authorize its restraint by injunction.

Louisville Bagging Man'f'g. v. *Cent. Pass. Ry. Co.*, Ky. Ct. of App., October 24, 1893.

Elevated Railway—Consent of Property Owners to Construct. Where, by a written instrument, not under seal, owners of land bounded on certain streets, to whom they had no title, gave unconditional "consent to the construction and operation of an elevated railroad over and through and along such streets," by a designated company, which, with others, afterwards built and operated the road.

Held, that such consent, after being acted on by the company, operated as an abandonment by such owners of their easement in the street, so far as was reasonably necessary for the construction and operation of such road, and that they or their successors in title could not revoke such consent, and recover damages already sustained, and enjoin the further operation of such road.

White et al. v. *Manhattan Ry. Co. et al*, N. Y. C. A., October 3, 1893.

Street Railways—Negligence—Contributory Negligence—Expert Testimony—Pleadings. In an action by plaintiff against the defendant company in which the latter appeals from an adverse judgment it is

Held, 1. That the jury are warranted in finding that an electric street railway company was negligent in sounding the gong, and not slacking the speed of a car which was coming up behind an obviously frightened team.

2. Whether a woman who drove from a cross street into a street on which was an electric railway without looking to see if a car was approaching, and who was injured by the horse becoming frightened at a car, was guilty of contributory negligence, is a question for the jury.

3. Whether it was contributory negligence for a woman to drive a horse on a street on which there was an electric railway, and where the horse became frightened and injured her, is a question for the jury.

4. A general averment of negligence on the part of a street railway company in running its car is sufficient to include negligence in sounding the gong on approaching a frightened team.

5. In an action for injuries claimed to have resulted in a miscarriage, a physician may be asked whether an accident would, under certain circumstances, cause a miscarriage, and the effect of such an accident on a pregnant woman. Exception to plaintiff's judgment overruled.

Benjamin v. *Holyoke St. Ry. Co.*, Mass. S. J. C., November 20, 1893.

The Belgian Consul at Adrianople writes that a street railway will be built in that city. Engineers are already engaged upon the plans.

EDITORIAL CORRESPONDENCE.

MONTGOMERY, MOBILE, NEW ORLEANS—PART I.

Montgomery.

What was said of Charleston in our last issue, as being the spot where the first scenes of our civil war were laid, is partially true of Montgomery, for this city was also prominently identified with the "Lost Cause," and is aptly styled the "Cradle of the Confederacy," for here on the front steps of the State Capitol, on February 4, 1861, the first assembly of the delegates of the six seceding states was held, and here was organized the Government of the Confederate States of America. On the front steps of the Capitol, Jefferson Davis was inaugurated President, on February 18, 1861, with A. H. Stevens as Vice-President. One of the most interesting relics of the early days of the Confederacy is the bible on which Mr. Davis took the oath of office, and which is carefully preserved in the Treasurer's office in the Capitol. The fly leaf bears the following record: "The oath of office as First President of the Provincial Government of the Confederate States of America was administered to Jefferson Davis upon this bible by Howell Cobb, President of the Provincial Congress, at the front portico of the Capitol at Montgomery, on the 18th day of February, 1861."

The Confederate White House, as it is still known, is also a relic of the "Lost Cause," it being the home of Mr. Davis after his inauguration until the removal of the Capitol to Richmond.

Montgomery is not only prominently identified with the early days of a civil power which has passed from the

FIG. 1.—VIEW ON DEXTER AVENUE—MONTGOMERY, ALA.

nations of the earth forever, but is also inseparably connected with a mechanical power which is rapidly revolutionizing transit methods, not only in this country, but throughout the world, and which doubtless will be as durable as civilization itself. We refer to electricity as a motive power, and the early experiment, in its application to street railway purposes, made by Charles J. Van Depoele, in 1887, by the equipping of nine miles of track in Montgomery with the overhead trolley system.

Although the experiment in this particular case proved a failure, because of several unfortunate accidents, including the killing of a horse of Governor Seay, from coming in contact with a fallen wire, and later the burning of the car station, yet it paved the way for the final success of the system which is now so general, and which is being successfully employed on the principal

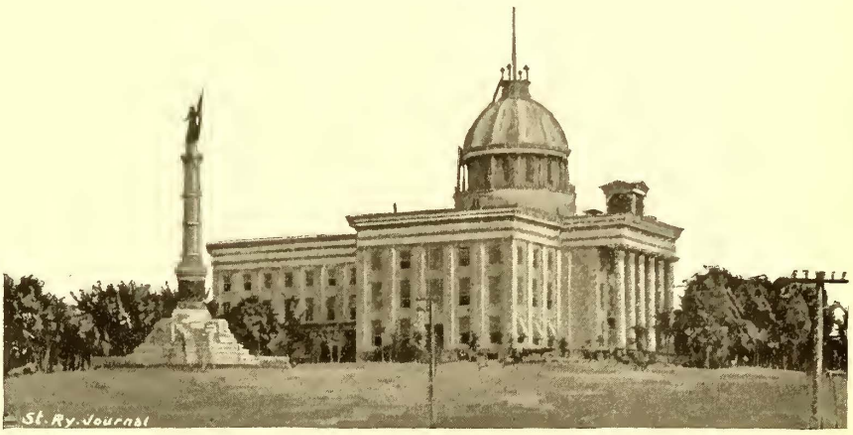


FIG. 2.—STATE CAPITOL AND CONFEDERATE MONUMENT—MONTGOMERY, ALA.

railway lines of Montgomery; although it was later installed here in the face of strong prejudice and protest on the part of the citizens, all of which is now forgotten, while every facility is offered for the development of new lines.

Montgomery, a city of about 30,000 inhabitants, is delightfully located in the basin formed by a row of hills which rise to the height of 100 ft. or more above the bluffs of the Alabama River, on the south or east bank of which it is located. The city is forty miles below the union of the Coosa and Tallapoosa rivers, and 400 miles above Mobile. The river is navigable all the year, and has recently been improved, so that boats now enter the Coosa River for a considerable distance, from which direct shipments are made to the Gulf of Mexico. Added to the facilities of river transportation, Montgomery has excellent railroad connection with all parts of the state and neighboring states, and being surrounded by a region embracing one of the richest agricultural districts of the state, the soil of which is composed of black prairie and river bottom lands; it has all of the important factors for becoming a large and prosperous city.

The elevation of the city provides for splendid natural drainage, which is supplemented by an improved plan of sanitary sewers, and it is claimed to be one of the healthiest cities in the world, the annual death rate for a long period, including both races, being only thirteen per 1,000 of population. The mean annual temperature for a period of fifteen years was 64 degs. and the average rainfall, fifty-five inches. The city is supplied with exceptionally pure water from artesian wells, and the water works system is very complete, consisting of duplex pumping engines, which draw their supplies from reservoirs, into

which the water flows from the wells, and by which it is forced into a stand pipe twenty-six feet in diameter and 105 ft. high, located on one of the highest ridges back of the city, and which gives in the mains an average pressure of 110 lbs. per square inch. Connected with the water works system is a beautful fountain located in Court Square at the foot of Dexter Avenue. The fountain is in the center of a large artificial basin and is of bronze, twenty-five feet high and has twenty-five water jets. The decorative work consists of four female figures and four storks of life size, with a swan at the apex, riding the waves and supporting a female figure holding a child in her arms.

Dexter Avenue is the principal street of the city, and extends in an easterly direction from the fountain on a gentle slope to the crest of the highest hill in the vicinity, where is located the State Capitol, one of the most striking and symmetrical public buildings in the country. (Fig. 1.) The material is of brick covered with white plaster, giving it the appearance at a distance of marble. From the dome of the Capitol is had a fine view of the city and surrounding country and near by stands the Confederate Monument (Fig. 2) of attractive design; and

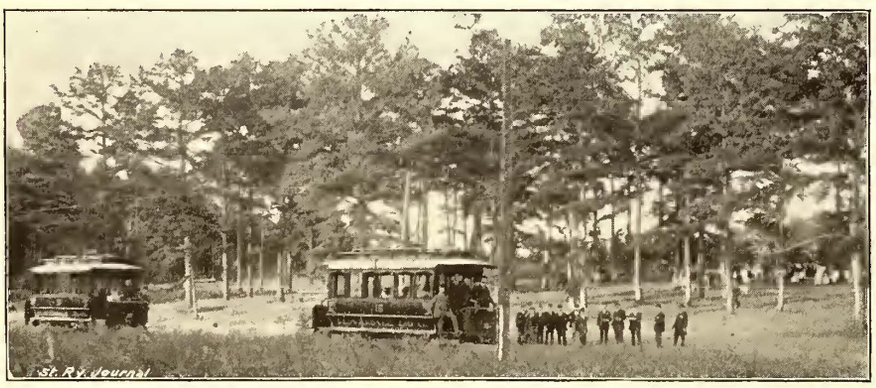


FIG. 3.—CLOVERDALE PARK—MONTGOMERY STREET RAILWAY.

on the eastern slope, which is back of the Capitol grounds, is one of the finest public school buildings of the state.

Only a portion of the business streets are paved, so that the streets become very muddy during wet weather. A scheme is on foot for increasing the area of paving, and we know of no city where it will be better appreciated.

THE STREET RAILWAY LINES

are controlled by two companies, the principal one of which is the Montgomery Street Railway, of which J. W. Dimmick is president, and Ed. L. Coolahan general manager. The cars are operated both by electricity and animal power. The work of electrifying the entire system is, however, in progress, when some of the routes now operated by animal power will be changed and the lines straightened, so as to avoid some of the troublesome curves and grades. The tracks will be extended into new territory and a much more satisfactory service than now provided. No other Southern city, in our opinion, affords better inducements for street railway development than this. Although a large proportion of the population is of the colored race, a liberal patronage is awarded the street railway lines, and in the extension of the lines the routes are being planned to accommodate the settlements of colored people in different parts of the city.

The Montgomery Street Railway is a consolidation of the Montgomery Terminal Street Railway Company and the Montgomery & Cloverdale Electric Railway Company. The electric equipment consists of seven fourteen foot motor cars built by the New Castle Car Company, mounted on McGuire trucks and provided with a double equipment of W. P. 30 Thomson-Houston motors. The electric lines operate over two routes which center at the basin, foot of Dexter Avenue, one of which extends to Cloverdale Park, on which the cars are run on an eighteen minute headway and the other to Highland Park with a headway of twenty minutes. The latter line runs for a short distance on Dexter Avenue, where the overhead construction is supported on center poles, the avenue being very wide, so that the tracks occupy a reservation in the middle of the street.

Considerable attention is given to park attractions as a means of increasing traffic, and in the summer season music is provided at the parks by the street railway company.

Preparations are being made to open a new base ball park, and an extension of one of the lines will be laid to connect with it.

The cars are run without conductors or trolley boys, fare boxes being employed, and registers which the motorman operates as the passengers board the car. At one time trolley boys were employed, but proved so inefficient that they were taken off. Frequently they would allow other boys to congregate on the rear platforms of the cars, and were generally indifferent to the interests of the passengers who seem to be quite reconciled to the use of cars without conductors. Very little trouble is experienced from the trolley wheel leaving the wire at crossings or curves, the motorman being naturally more cautious than when some one else is looking after the trolley. The cars are provided with bullseyes of different colored glass at both ends and in the middle of the side deck lights to indicate the routes. These are provided with slides of different colored glass, so that the colors can be changed when the car is transferred from one route to another.

The motormen are paid ten cents an hour, and work sixteen hours and forty minutes a day, with time off for meals. The first car starts out at six o'clock in the morning, and all are in at eleven o'clock at night, except on special occasions, when a later run is made.

Formerly the power was generated in the company's own station, which was located at Cloverdale Park, but this has been abandoned, as being too far from the city, and the generators have been transferred to the Montgomery Light Company's station in the city, where space is rented and steam for operating them is provided by the Light Company. The two engines formerly employed in the company's station are for sale. They are of 125 H. P. each, of the high speed, tandem compound type, and were manufactured by Dick & Church, at Meadville, Pa.

One line of about two miles is still operated by mule power, and for this purpose sixteen mules are now employed. The animals are very small, weighing not over 500 or 600 lbs. each, and are driven double to the cars. In connection with the re-equipping of the system for mechanical traction, the present car barns and stables, which are located on a large lot on the heights near the Capitol, will be remodeled for car storage and repairs. Pits will be provided and the barn trackage will be on a grade sufficient for running out the cars by hand in case of fire.

West End & Riverside Park Electric Railway Company.

This system, which is principally owned by Dr. Samuel D. Seelye, operates four miles of line with four cars at present. The cars were built by Brill, and are equipped with Westinghouse motors. This company has also followed the example of the Montgomery Electric Railway, and has abandoned its power station and removed its generators to the plant of the Montgomery Light Company, as it was found too expensive to operate so small a plant. The station equipment consists of one Westinghouse high speed, compound engine of 125 H. P., and a Westinghouse W. P. generator of 150 H. P.

Montgomery Light Company.

This company, which is under the supervision of W. B. Barrett, supplies both arc and incandescent lights for city purposes and power for stationary motors, and also rents space for the generators employed in furnishing power for the street railways, as noted above. The sta-

tion occupies a very plain building on the banks of the Montgomery River on the north side of the city. The power equipment of the station, besides the railway generators, consists of one Atlas-Corliss engine of 250 H. P., and one Armington & Sims high speed engine of 80 H. P. and one 90 H. P. Cummer engine, made by the Kibby

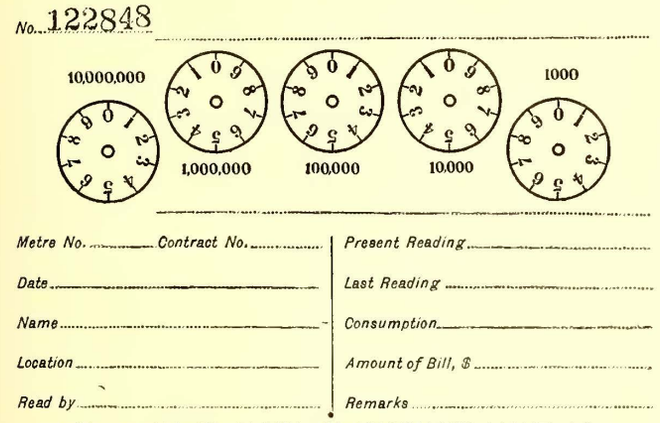


FIG. 4.—METER BLANK—MONTGOMERY LIGHT CO.

Manufacturing Company of Cleveland. There are four Thomson-Houston fifty light, arc machines, and two Westinghouse incandescent light machines, which supply power for 1,750 lights. The fuel consists of Mildale run-of-mine coal, costing $2.30 a ton delivered. The street railway companies pay a certain price per horse power hour for power, and for measuring the amount consumed

FIG. 5.—STREET SCENE—MOBILE STREET RAILWAY.

meters are provided, and a representative of the railway company takes the record of the meters twice a day, and keeps the records of the readings on blanks provided for the purpose. These blanks are printed in sets of three on perforated sheets, and are bound in book form, each blank having five meter dials printed on the face, so that in addition to the printed record the position of the register hands is indicated on the dials with pencil, thus providing a durable record. (Fig. 4.)

HOW TO REACH MONTGOMERY.

Visitors to the Atlanta Convention in October will fiud that it will amply pay them to make a trip to Montgomery over the lines of the Atlanta, West Point & Western Railway of Alabama, the distance being 175 miles. The route is through one of the most pleasant portions of the states of Georgia and Alabama, along the principal cotton belt. Many of the houses along the line fifty miles out from Atlanta are very fine, and there is a general air of prosperity superior to that found along the route of any other Southern road over which we have traveled. The line is one of the oldest railways in the country, the first section having been built in 1836; it now forms a part of the Great Trunk Line of the Richmond & Danville system, from New York to New Orleans, and is known as the model railway of the South. The roadbed is in excellent condition, and the trains are run at a high rate of speed, making the trip a most enjoyable one.

Mobile.

"Great Expectations" may be said to be the characteristic state of mind of the people of most of the Southern cities, and they have been the food on which the inhabitants have fed for a number of years. This is strikingly true of Mobile, but the indications are that these expectations regarding future greatness and prosperity are to be more quickly realized by this city than by any of her sister coast cities, for the natural advantages of her location, which give her unsurpassed inland and ocean shipping facilities, together with a healthy and delightful climate, insure her rapid growth and development. It only remains for the merchants and manufacturers of the middle West, or the great empire dominated by Kansas City, St. Louis and Cincinnati, to appreciate the importance of distributing the products of this vast region to the people of the world through this Southern port, and of receiving through this same channel foreign fruits and products for home consumption. Nature doubtless designed that Mobile should be the principal outlet for this region, as it is considerably nearer to the cities mentioned than any other Southern port, but the artificial influences of trade have heretofore diverted the products of this region to New York and the New England ports. The conditions are now changing, because the people of the South and West are acting together with a new companionship that must produce the anticipated results.

Mobile is located on the west bank of the Alabama River, about three-quarters of a mile from the head of Mobile Bay, and twenty-eight miles from the Gulf of Mexico. It is the largest city in the state of Alabama, and the only seaport in the state. Mobile Bay is about twelve miles wide, and is bounded on the east by high bluffs. There is a wide channel of sufficient depth for the largest vessel plying in the Gulf of Mexico, and this channel is now being improved by the general government, and it is expected that it will soon be open for the reception of the largest sea going vessels. The city owes its great importance to its location at the mouth of the Alabama River system, which is composed of the Alabama and three or four other rivers which enter the bay at near the same point, and which have a navigable mileage of over 1,000 miles. The location is a sandy plateau almost on a level with the water in the river, but which gradually rises and terminates in a range of hills about seven miles west of the city, which have an elevation of about 200 ft. There are six or seven miles of well improved river frontage, with sufficient depth for loading and unloading large vessels. Owing to the presence of water near the surface, as noted above, a system of surface sewers prevails. A complete underground system is about to be installed, however, when the streets will be more generally paved. The paving consists quite generally of brick and cedar blocks.

The city is bountifully supplied with almost chemic-

ally pure water, which is obtained from boiling springs in the heights about eleven miles west of the city. The Holley system of supply is employed, there being two pumps with a daily capacity of 6,000,000 gals each. A storage reservoir is located at a distance of seven and a half miles from the city, which has an elevation above the city of 208 ft. During the day the supply is direct from the pumps, but at night it is drawn from the reservoirs, and the pumps are idle.

The cotton export business has increased slowly but steadily during the last few years. There has been a large increase in lumber and coal shipments, and in the tropical fruit trade, which has been diverted from New Orleans on account of more direct shipping facilities to the interior and because of lower port charges. On the completion of the harbor improvements it is expected that the port will become a prominent coaling station for sea going vessels, as the price of steam coal delivered in the vessel's bunkers will be as low as $1.25 per ton, making it the cheapest coaling point in the world. The city is not only important from a commercial standpoint, but as a winter health resort it is taking rank with the heretofore more prominent coast cities.

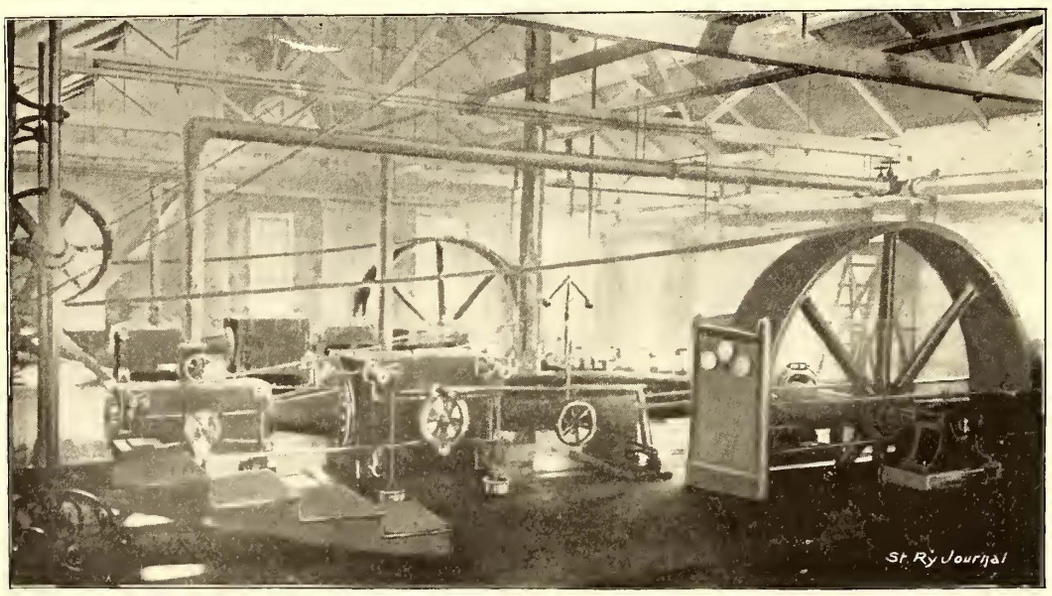


FIG. 6.—ENGINE ROOM—MOBILE LIGHT & RAILWAY CO.

It is quite natural that a stranger visiting the city should look for the first evidence of the internal growth, and we find it strikingly illustrated in her admirable system of

ELECTRIC RAILWAYS.

These are controlled by three companies, and the two principal systems are as well built and as ably managed as almost any other lines in the country.

Mobile Light & Railway Company.

This company operates one of the street railway systems and also furnishes light and power for city and house purposes. John Wilson, of Leavenworth, Kan., is president; J. H. Wilson is vice-president and general manager; A. J. Peaper is secretary. The railway system embraces eight and one-half miles of single track line, which was electrically equipped in April, 1893, and which is now being considerably extended. The rolling stock consists of thirteen motor cars and thirteen open trail cars. The average number daily run in winter is eight. The electrical equipment embraces both Thomson-Houston and Westinghouse motors, single equipments of twenty-five horse power each. The closed cars are of Brill manufacture and the open cars were made by Stephenson and Pullman and have trucks by the same makers. The cars are provided with a narrow sheet iron false dash, which is lettered to indicate the route, and which is supported across the top of the main dash by means of hooks. These adjustable signs or dashes are provided so that they can be changed when cars are transferred from one route to another. Steel wire brushes are also provided for cleaning the sand off the rails. Men are constantly employed to keep the rails free from sand.

The tracks are laid with forty-five pound T rail, and in some cases oyster shells and gravel are employed as ballast. The rails are cross bonded at every third rail and the return is grounded every 1,000 ft. The lines extend through some of the most populous districts of the city and connect with a number of parks and run in the neighborhood of the principal cemeteries. The pleasure riding in Mobile is an important factor in the street railway business and all the companies cater to this traffic to a greater or less extent. The Light & Railway Company owns Monroe Park and provides music and other attractions. One of the routes also terminates at Frascata Park, which is located on the Bay just south of the city. On the north side of the park is a base ball ground with a large grand stand. The park proper is shaded with numerous large, moss draped, live oaks, magnolias and other evergreen trees. There is a music stand, and seats are provided all about for the comfort of visitors. This park is protected on the shore side by a substantial wall, and between the wall and the river is the famous shell road which skirts the bay on the west shore for a distance of about seven miles, being shaded by venerable oaks, and is pronounced by all to be one of the loveliest drives to be found in the country. Adjoining the park is an extensive tract where is held the annual encampment of the state militia, the location being one of the most desirable parade grounds to be found anywhere. The Light & Railway Company is improving Monroe Park on the side of the bay, and during the coming season proposes to construct a new pier extending 1,200 ft. from the shore, which will be provided with pavilion and other accommodations.

POWER STATION.

The light and power stations occupy the same building, which is located just out of the business center of the city, and within a block or two from the river. The building is of brick with double gables, and the ground dimensions are 130×95 ft., with a boiler house 30×60 ft. The smokestack is of iron 100 ft. in height with an ornamental top. This is the only smokestack in the city that stood the fury of the October cyclone.

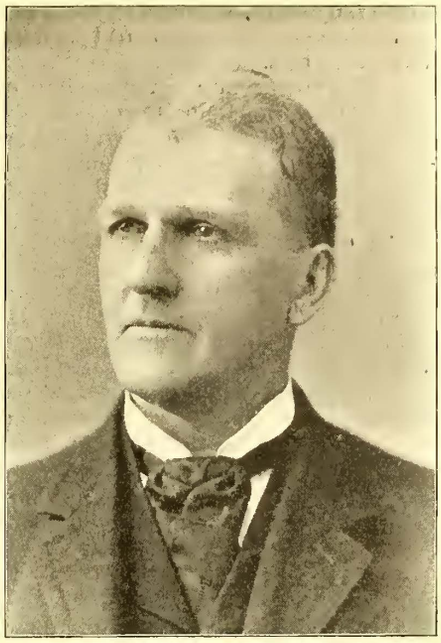
The present steam equipment consists of three Stirling boilers of 300, 200 and 150 H. P. respectively. Alabama coal is employed for fuel, but it is proposed soon to burn slab wood, which can be purchased from the neighboring saw mills at a cost of about forty-five cents per cord. The feedwater is taken from the city mains, but for condensing purposes water from three inch driven wells is employed, there being eight wells, which are from forty to fifty feet in depth, supplying 100 gals. per minute each.

The power is supplied by two compound Hamilton Corliss engines of 300 and 200 H. P., with condensing apparatus. The power is transmitted by leather belts to a countershaft, which is supported some distance above the floor by timber pedestals. Adjustable idler pulleys are employed as belt tighteners with the engine belts, which are mounted in sliding frames provided with a crank and gear mechanism for raising and lowering the pulleys.

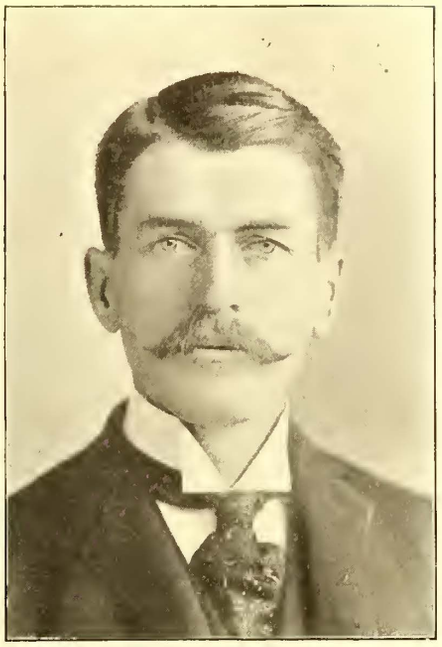
The railway and lighting generators are driven from

the countershaft. Those for the railway plant are one General Electric M. P. 100, and one Westinghouse 150 H. P. type, and the latter three Westinghouse 60 K. W. alternaters. The lighting equipment is also soon to be increased by the addition of new generators.

Employes are paid the same as the employes of the other roads described above. The fare is five cents, with twenty-two tickets for $1. School tickets are sold forty for $1, or $1 a month, which are used only on school days.



J. WILSON,
PRESIDENT MOBILE LIGHT & RAILWAY CO.



J. H. WILSON,
GEN. MAN. MOBILE LIGHT & RAILWAY CO.

The Mobile Street Railway Company,

operates twenty-one miles of track, and the system is under the management of Raphael Semmes, a gentleman well known to the street railway fraternity. Mr. Semmes is the only executive officer of the company residing in Mobile, and under his direction the lines were changed from animal to electric traction, the work having been begun in May last, and completed and put in operation on the 16th of August. The rolling stock consists of twenty closed and twenty open cars; the former were built by Stephenson, and the latter in the company's shops. The open cars are not yet electrically equipped. The closed cars are painted white, and look clean and inviting. They are mounted on Baltimore trucks, with wheels by the same makers, and are equipped with Thomson-Houston twenty-five horse power motors.

Attached to the front of the trucks are adjustable wire brushes for removing the sand from the rails. These are raised or lowered by the motorman by means of an adjustable rod, supported against the dash. The soil being exceedingly sandy, the brushes are essential as track cleaners. At some crossings and at curves on unpaved streets where the street traffic is heavy, men are employed for cleaning the sand from the rails The side steps of the open cars are hinged so that they may be turned up against the side of the car and fastened with a chain, when by putting a bar through the post hand rails the passengers are compelled to get on and off the cars on one side only, a very desirable arrangement.

The track construction on paved streets consists of the sixty pound, five inch girder rail, resting on bulb chairs with ties two and a half feet apart. Ten miles of the construction consists of forty-five pound T rail. Oyster shells and cinders are employed to a considerable extent as ballast, as is also sand and gravel, which are brought into the port as ship ballast. Cobble stones are employed to a limited extent as paving, having been brought as ballast to the port. The principal paving, however, consists of juniper blocks. Three or four squares have recently been paved with vitrified brick, as an experiment.

FIG. 8.—INTERIOR OF DYNAMO ROOM—MOBILE LIGHT & RAILWAY CO.

The turnouts on the line, as a general thing, are located at the curves, so that approaching cars can be seen in both directions. There are no grades on the line of the Mobile Street Railway Company greater then 1 per cent., and this for only a short distance. There is quite a complicated special construction at the corner of Government and Royal Streets, made necessary for passing each side of the Semmes Monument which stands at the intersection of these streets, near the City Hall. The monument is being erected to the memory of Commodore Semmes, but is yet in an unfinished condition. The overhead construction is supported on wooden poles which are of sufficient height to support a guard wire, but guard wires have not been employed to a very great extent. A movement has recently been started, however, by the city authorities to compel the railway companies to provide guard wires. It is a question, however, whether there is any advantage in their use, many cities where they have been employed having discarded them.

The car barn and power station are located at the corner of Royal and Canal Streets, just south of the business center of the city. The building is of brick, 319 × 50 ft., and the car station in the rear of the car barn is separated from it by fireproof walls and doors. The engine room is 53 × 69 ft., and the boiler room, 40 × 69 ft. The car barn is a one story building, and the power station a story and a half. The office and store room are located in a wing which extends in front of the building towards the street, and the repair shops are partitioned off from the side of the car sheds. The smokestack is of iron, six feet in diameter and seventy-five feet in height,

resting on a brick base twenty feet in height. The stack was blown over during the severe cyclone of October 2, but has been replaced and repaired. The car barn contains five storage tracks, with capacity for fifty cars. The

FIG. 8.—TOWER WAGON—MOBILE STREET RAILWAY.

repair pit extends across all the tracks near the front of the building, and owing to the presence of water in the soil near the surface, the walls of the pit are sealed with cypress planking and made watertight. The conductors' room is in the rear of the office, and is furnished with

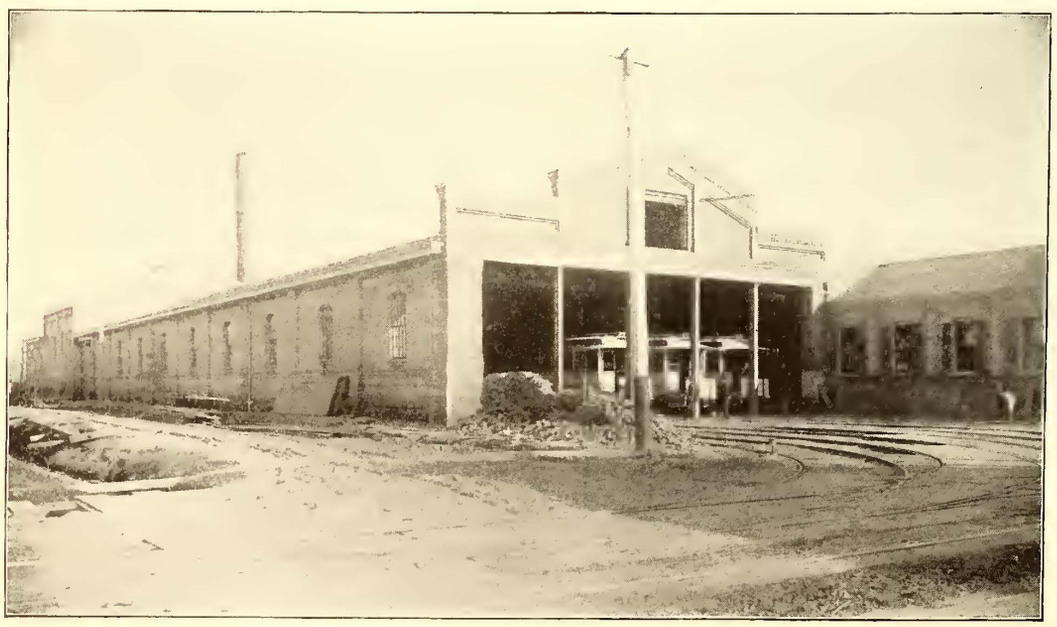


FIG. 9.—POWER STATION AND CAR HOUSE—MOBILE STREET RAILWAY.

lockers and tables and chairs for the convenience of the employes. The transfer table extends across the barn at the lower end.

The engine foundations are raised to seven feet above the surface of the ground, because of the presence of water in the soil, and to provide against high water. The brick piers for supporting the engine frame rest on concrete foundations, which in turn rest on a bed of cypress timbers placed crosswise in two tiers some distance below the water line.

The power equipment consists of three 100 H. P. Ranton water tube boilers, manufactured at Auburn, N. Y. These are horizontal boilers, but have short vertical water tubes and are said to be excellent steamers. The fuel consists of run-of-mine coal, costing $2.75 per ton delivered and slack coal costing $2.25. The coal is mixed in firing during the day, but in the busy hours the better quality is employed. The evaporation is from eight to nine pounds of water to one pound of coal. Arrangements are being perfected for burning slab wood, which can be purchased from neighboring saw mills for about forty-five cents per cord. City water is employed in the boilers, but for condensing purposes water from local artesian wells is used. These wells are about 730 ft. in depth and the water rises to the surface; it being brackish and impure, however, it is not suitable for boiler purposes. The water of condensation is discharged into the street gutters, the city being provided with surface drainage only. Worthington condensers and pumps are employed.

Three 150 H. P. McIntosh & Seymour heavy type railway engines drive, each, by means of Shultz belting, an M. P., 100 K. W., Thomson-Houston generator, the shafts being twenty-six feet apart. A new switchboard composed of slate and mica has recently been substituted for one of wood as a precaution against fire.

The tools of the repair shop are operated by a vertical, eight horse power engine, and the equipment consists of an iron lathe, jig saw, a drill press, wheel press and a good equipment of small tools. A skillful master mechanic is employed to superintend the building and repairing of cars and motor repairs. Some of the assistants in the shop are colored men who are found to be quite skillful and efficient workmen. In connection with the repair shop is a fireproof vault; in fact, a regular bank vault with brick walls and double iron doors, which is utilized for the storage of paints and oils. A similar vault is also provided in the office for the safekeeping of books and records.

EMPLOYES AND FARES.

Sixty-three men are employed, and the pay is fourteen cents an hour for twelve hours' work. Car men are uniformed, except the extras. In engaging men for this service city bred men with families are preferred. The track laborers are colored men under white foremen, the pay being $1 per day. The chief engineers of the power station receive $3 and their assistants $2.25 per day.

The fare is five cents. School tickets are sold forty for $1, which are good on school days only. Transfer tickets are issued at six different points over the lines of the company. The colored people are liberal patrons of the street railways, generally riding whenever they have a nickel.

Separate parks are provided for white and colored picnic parties. The colored picnics are usually held at night, moonlight dances being the favorite amusement. The street railway company furnishes music on certain days at the parks. Saturday and Sunday are the best days for traffic. The cars are run on a reasonably short headway and are fairly well patronized, the entire population being carried about seventy-eight times a year by the united lines.

The motormen are required to signal the conductor

with two bells at all crossings and curves, as a warning to watch the trolley. The cars on all of the lines of the city are required to come to a full stop at other street railway crossings and at some of the principal driving streets. Mobile is an old French town, and as a general thing the streets are very narrow, Government Street, which is 100 ft. wide, being the principal exception. The principal line of the Mobile Street Railway Company is laid on this avenue, which is the finest residence street in the city. The car tracks occupy a reservation in the middle of the street, the overhead construction being supported by center poles. The street is shaded by beautiful live oaks and water oaks. Most of the houses are modern in their architecture, and many of them are very fine, while the lawns are shaded and ornamented by magnolias, live oaks and flowering shrubs, making the route an attractive one for pleasure riders.

Mobile & Spring Hill Railway Company.

This company operates seven miles of single track which extends from near the river wharf to Spring Hill, situated upon a high range west of the city. This was formerly a dummy line, but began running electrically in June, 1893. The steam trains are still run over the same tracks for carrying freight which consists principally of vegetables from the neighboring truck farms which abound all about Mobile. The motor cars were built by the St. Louis Car Company. There are five motors and five trailers which are mounted on Peckham and St. Louis trucks, there being four of the former. The electrical equipment consists of Winkler motors, manufactured by the United Electric Columbia Company, of Kingston, N. Y.

The power for operating the lines is rented from the Electric Light Company, of Mobile, which employs General Electric generators. Wendel Goodwin is president of the railway company, Ferdinand Smith, vice-president, and J. H. Bleoo, general manager.

FIGS. 10 AND 11.—VIEWS NEAR LAKE PONTCHARTRAIN, NEW ORLEANS.

New Orleans.

This is the second visit that the writer has paid to New Orleans. The first was in October, 1861, when, with 500 comrades (prisoners of war from the first Bull Run battle), the city was reached after a ten days' journey from Richmond, Va. This visit covered a period of four months, during which time the writer was quartered in the east wing of the old Parish Prison at the corner of Orleans and Treme Streets, sixteen men being confined in each cell, the dimensions of which are 10 × 12 ft. But while the reception accorded at that time was more demonstrative, the second visit has been more cordial, and notwithstanding the unpleasant memories of the first visit, we have now learned to love the city and its people.

This is said to be a quaint old town, but this term is applicable to only a part of the city which includes that portion lying north of Canal Street, known as the French Section, but the newer portion of the city is not behind in many respects the more Northern cities of the country. The topography of the city conforms nearly to a great bend of the Mississippi River, in which it is embraced, giving it the cognomen "Crescent City." The shore line is about thirteen miles, and the average depth of the built up portion is one and a quarter miles, although the entire region between it and the shores of Lake Pontchartrain, five miles distant to the west, is plotted into streets and building lots. Lake Pontchartrain is really a salt water bayou, being about twenty miles in width, and forty miles in length, and connected with the Gulf of Mexico, or rather Mississippi Bay, by two narrow channels.

The city of Algiers is located opposite New Orleans, and skirts the river for a distance of about seventeen miles. New Orleans is about 110 miles from the Gulf of Mexico, and at this point the river is about 3,000 ft. wide, and has a depth of from 90 to 208 ft., the current at high tide being very swift, and the extreme variation between high and low water being about sixteen feet. The tide pulsations are about six inches at this point. The water is extremely muddy at all times, giving it a yellow color which is the characteristic color of most Southern rivers. The river is confined to its present channel by means of levees on both sides, which extend a number of miles up the river. On the river front, through the city, the levees are supplemented by wide platforms, supported on piles, which provide wharfage and storage room for the immense quantities of cotton, sugar, rice and other products which are here transferred from the river boats and railroads to seagoing vessels. A great number of vessels of all classes loading and unloading at the wharves present a picturesque scene, perhaps unequaled for variety at any other port in the world.

The level of the water in the river is at all times above the adjoining streets, the height varying from a few inches to fourteen feet. The surface of the city is almost flat, with a slope away from the river towards Lake Pontchartrain. For a few hundred feet the fall from the river is three or four inches to the 100 ft., but for the remaining distance it is only about one inch to the hundred, the lowest point being known as the basin, which is from sixteen to seventeen feet below high water. West of the basin is Metarie Ridge, which runs parallel with the lake, and which is about four feet higher than the basin, so that it becomes necessary to pump the drainage water over the ridge, from which it flows to the lake. The soil being an alluvial deposit and below the river, it is very wet, standing water being found within a few inches of the surface in all parts of the city, and all the region between the city and the lake being more or less swampy, the old fashioned method of surface drainage is employed, and there has been no material change in the drainage system for the last thirty-five or forty years. To a stranger visiting the city, the gutters filled with dirty, sluggish water present an offensive appearance, but one soon gets used to it. All the house drainage except that from the closets is direct into the gutters; from the closets it is led into cesspools, from which it is pumped and carted away in closed casks, first being deodorized. One would think from the filthy appearance and the con-

dition of the unimproved streets that the city would be unhealthy, but it ranks favorably with New York and many other Northern cities in the health reports. Surveys have recently been completed and tests made to estimate the amount of surface water to be removed, with a view of introducing an improved system of sanitary sewerage. The proposed plan is to dig drainage canals from the city to the basin with a sufficient fall to carry off the surface water, when it is to be pumped over the ridge by improved machinery, the present pumping system consisting of paddle wheels with a capacity for lifting water only three or four feet. The conditions of soil prevent the digging of wells, so that the water supply is necessarily obtained either from the river or from cisterns; the latter method prevails for household purposes, and the cisterns are usually circular wooden tanks, elevated in proportion to the height of the house, into which the water is led from the roof. There is a water works system which supplies river water for flushing and fire purposes. This is an excellent drinking water after it becomes settled. A system of filters has been tried in connection with the water works, but has not yet proved successful.

PAVING.

The business streets are generally paved, and for this purpose very large granite blocks have heretofore been employed; these are usually from twelve to sixteen inches wide and from fourteen to twenty inches long and eight inches deep. These blocks are brought from Quincy, Mass. and Rockport, Me. More recent supplies have been received from the Lithonia quarries in Georgia. These large blocks are generally laid in rows diagonally across the street with a slight crown, the spaces next to the curb line and street car tracks being filled with triangular blocks cut to fit the spaces. Notwithstanding the fact that the blocks were laid without other foundation than the natural soil, some of the pavements are still in fair condition after forty years of service without repair, but near the levees and on streets subject to heavy traffic the blocks have worn unevenly and in places settled below the grade. This type of paving is objectionable, chiefly because the blocks become smooth from wear and provide an uncertain footing for the animals. This method of paving has been discontinued by the city authorities, and the prevailing method of stone paving is the employment of the ordinary granite or Belgian blocks which are laid on a bed of concrete. Several other methods of paving are employed, depending upon the location and condition of the streets. Wood block paving has been tried, but discarded owing to the tendency of the blocks to float away when the streets became flushed from heavy rains, a not uncommon occurrence, as the annual rainfall in this locality is about sixty-four inches, and the water frequently falls in such quantities as to fill the gutters and flood the streets.

Considerable asphalt is being employed on some of the business streets and for a considerable distance on the driveways of St. Charles Avenue. It has not, however, proved durable, on account of the extreme moisture or faulty mixing of the material. Different methods of compounding the asphalt are being employed and the experiment is to be continued. Cypress planking is also being employed to a considerable extent in the residence districts, and especially on the street car lines to provide a footing for the animals. The street is planked both between the rails and tracks. Vitrified brick is also being tried, which is laid on a foundation of concrete.

The favorite paving, however, for carriage roads and residence streets is Rosetta gravel, a comparatively new material. This gravel is mined by the Rosetta Gravel Company, near Rosetta, Miss., about 140 miles from New Orleans, where it is found in great quantities in strata ninety feet in thickness. The deposit is on a line of a branch of the Illinois Central Railway, and is brought to the city on cars, where it is sold for from $2 to $2.75 per cubic yard. This gravel differs materially from other gravels in that it is composed not only of small pebbles and fragments of broken stone, but carries with it a red cement (red hematite), which causes it to form a concrete mass when exposed to the moisture and air, the materials being united by what machinists call "rust joints." In the process of laying this material the street is excavated to a sufficient depth, when the surface is covered with one inch cypress planking, upon which the gravel is placed to the depth of a foot or more, being put down in three successive layers, each layer being firmly packed by the passage of a ten ton steam roller. The cost per square yard, including the foundation, is about $1.67. The surface of the gravel streets washes considerably from heavy rains, but is readily repaired by the deposit of additional gravel. The material is being employed by the street car companies in their new construction as a foundation and ballast for the ties.

The attention of a stranger, upon reaching the city, is attracted to a series of steel towers on some of the streets, which are placed at the corners and connected by a suspension foot bridge, being designed to carry the electric wires. These towers are 125 ft. high, with the corner posts anchored at the street crossings and connected by arched girders and cross braces. Owing to the refusal of the electric companies to replace their wires on these towers, the project was abandoned after fifteen of them were constructed. The original proposition was to erect 250.

In New Orleans, excepting a place in what is called the Ridge, it is necessary to bury the dead in vaults above ground. These vaults are generally from eight to ten feet high, with an end entrance, and divided into shelves on each side just large enough to hold a single casket, which when in position is walled away from the rest of the vaults and the door sealed with a marble slab, which can be removed without disturbing the dust of the interred. These vaults are constructed, in some cases, of brick plastered over on the outside, but many of them are of granite or other building stone, and some of them are of very handsome design and finish, costing from $10,000 to $25,000. There are also in the large cemeteries what are called oven vaults, which are constructed with chambers in four or five tiers, and which close with a single slab or with brick filling. The interments in the Potter's Field and in the Jewish cemeteries are in ordinary graves.

The street railway lines of the city are controlled by five corporations, and embrace 175 miles of track. The cars are nearly all operated by animal power, there being only one system operated by electricity, and one line operated by steam dummies. All the lines terminate at, cross, or run down Canal Street. Several lines terminate at the Clay Station on Canal Street, and in this neighborhood are the starters' booths. Turntables of a primitive type are employed, and each one is operated by an attendant, assisted by the mule. Five tracks occupy the neutral strip on the level portion of Canal Street. The principal system is being equipped for electric traction, and the other companies are considering the question of adopting the same power. The companies operating by animal power employ both horses and mules, the number of the latter predominating, and in all cases the animals are driven single to bob-tail, fourteen foot closed cars. No open cars are employed in the city, except on the dummy line. The cars are equipped with fare boxes, and no conductors are employed, except on the electric and dummy lines. The street cars are well patronized, the entire population having been carried about 145 times last year.

New Orleans Traction Company,

controls the largest mileage, embracing 120 miles of track, and operates the Crescent City Railway Company and the New Orleans City & Lake Railroad, together with the new lines built under the Judah Hart franchises, but which have not yet been operated.

H. M. Littell is the resident manager of the Traction Company and is president of both the other companies. A. H. Ford is secretary and treasurer, and B. B. Gilman, superintendent. Mr. Littell is well known to the street railway fraternity, having formerly been general manager of the Cincinnati Inclined Plane Railroad, and last year a member of the Executive Committee of the American

Street Railway Association. Mr. Ford and Mr. Gilman are from Louisville, the latter having for many years been connected with the street railway lines of Louisville, Ky. The new construction is being done under the supervision

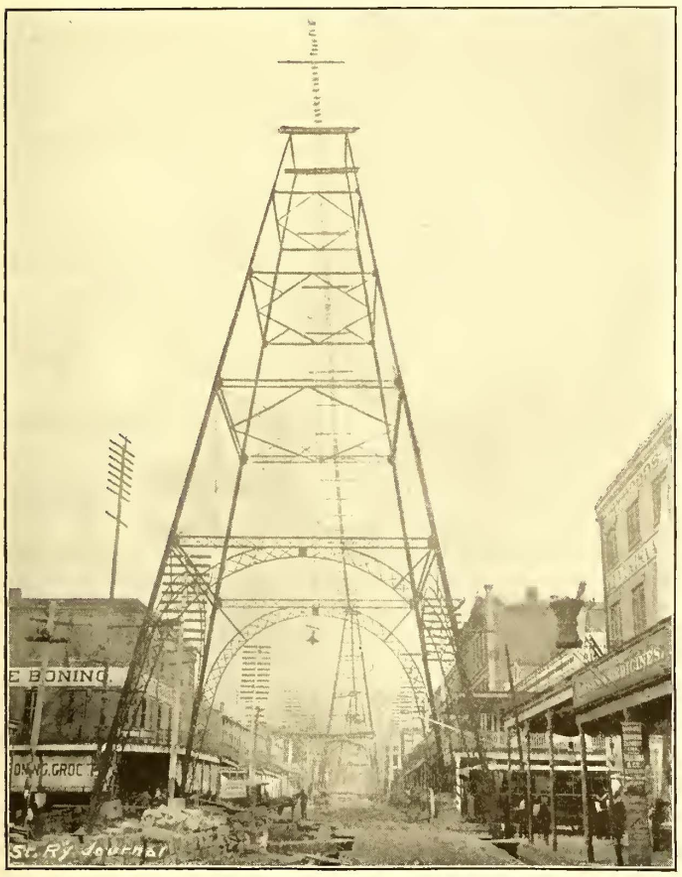


FIG. 13.—TOWERS ERECTED FOR ELECTRIC LIGHTING—NEW ORLEANS.

of G. A. Hopkins, chief engineer of the company, and B. Willard, electrician.

The work of equipping the lines for electric traction is already advanced. The Judah Hart lines have been finished and the work on Prytania and Canal Streets is well under way. In the track construction very heavy rails are employed, and the foundations are being prepared in the best manner suggested by local conditions. Three types of rails are employed. On the neutral ground which embraces about 25 per cent. of the mileage, a sixty pound T rail is used, and on about 55 per cent. of the remaining mileage a side bearing, eight and nine-sixteenths inch deep, Johnson girder rail is employed, and on the remaining 20 per cent. a center bearing rail of the same type, the weight ranging from 93 to 100 lbs. per yard. The joints are united by deep, twelve bolt fish plates, the bolts being one inch in diameter. The character of the soil and other conditions differ in many respects from those found in any other city in the country, and to meet these conditions, a peculiar method of track construction has been adopted. The location being low and the soil exceedingly wet and spongy, it cannot be relied upon to hold the ties in position. In the new construction, both on the neutral ground and in the roadways, the surface is excavated to a depth of about twenty-three inches; then as a foundation a covering of one inch cypress plank is placed in the bottom of the trench, and upon the planking is placed a layer of Rosetta gravel from six to eight inches in thickness, and on this gravel bed the ties are placed two feet centers. Cypress hewn or sawed ties 6×8 ins.×8 ft. are employed, and cost delivered about thirty-nine cents each. The rails are spiked directly to the ties, when the space between and over the ties is filled with the excavated material, except where block paving is employed. On the unimproved streets the surface between the rails and tracks is covered by two inch cypress planks laid crosswise. On the neutral ground the surface is sodded and kept in grass. The experiment is to be tried in some cases of first placing a stringer or mud sill in position on which to place the ties, after which the street material is to be returned to place.

Cypress timber, owing to its lasting qualities, is employed to a large extent in street railway construction in this locality. In the old construction some of the stringers are found in good condition after more than forty years of service. Cypress timber placed in moist ground, either as stringers, foundations or ties, or foundations for the gravel, is practically indestructible, the timber having a peculiarity of lasting if kept constantly wet or dry, but if exposed to the wind and weather it soon decays.

In the early stages of the new track work on the Judah Hart lines, a contract was made with the Duplex Rail Company for the construction of seventeen miles with the Duplex rail. After completing about eleven miles of track the contracting company failed, and although there is a large amount of material still on hand, the Traction Company will not lay any more track with this type of rail, owing to the failure of this construction on another road in the city, as will be noted later. In this duplex construction the chairs rest on ties, with a gravel foundation similar to that described above for the girder rails.

The rails are being connected with No. 0 rail bonds, with nine-sixteenths inch channel pins, the rail holes being first reamed before the bonds are applied. In the neighborhood of the power station, and on sections where excessive current will be required, double or triple bonds will be employed. No ground plates are employed, except at points where the lightning arresters are placed.

The overhead construction is supported on side poles, and in the business portion and on lower Canal Street,

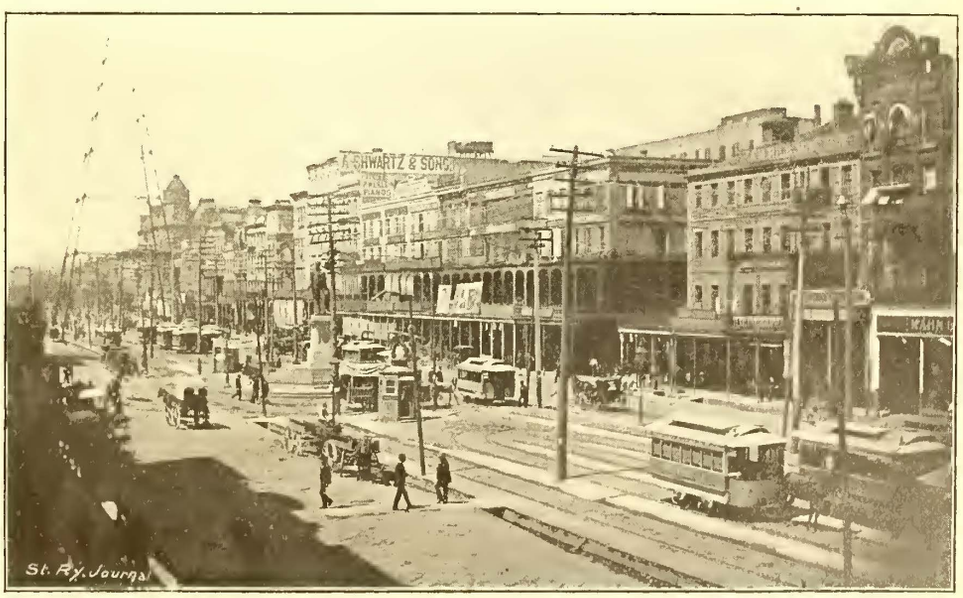


FIG. 14.—VIEW ON CANAL STREET, FROM OFFICES OF NEW ORLEANS TRACTION CO.

tubular iron poles are employed, but on most of the lines wooden poles of heart pine are used. These poles are 12 × 12 ins. at the base, and are left square for the first twelve feet, but are dressed octagonal for the remaining length, and taper to 7 × 7 ins. at the top. The base of the pole, before setting, is treated with a dressing of carbo-

H. M. LITTELL,

GENERAL MANAGER NEW ORLEANS TRACTION CO.

lineum to protect the wood from the action of moisture. The wooden poles are set with a rake of two and a half feet, but are expected to assume a rake of only ten inches when span wires are in place, the soil being very yielding. The iron poles are set in a concrete foundation, and have a rake of only twelve inches. On one side of the street the poles are provided with double wooden cross arms, with two top grooved insulators for carrying the feed wires.

Instead of ending the wires on the ordinary cross arm, a special frame is made of angle iron, and firmly bolted to the top of the pole. Each feed wire is then ended and anchored to this frame by means of an eyebolt, to which is attached a steam insulator. For connecting the several wires together, a solid conductor is run near the outside edge, and a little above the iron frame, and supported by top groove insulators, to which is attached the several short cable connections which are fastened to the several feed wires. Should it be necesssary to disconnect any one wire, it can be done by disconnecting the short cable connection, and throwing out the switch corresponding to that section. The joints of the short cables are not soldered, but simply connected by means of a tee provided with set screws. Thirty foot poles of heart pine, prepared for setting, cost $4.50 each, and thirty-five foot poles cost $6.

ROLLING STOCK.

Eight wheel cars are to be chiefly employed. Those for the first equipment are all manufactured by Brill, and have twenty foot bodies, inside measurement. The cars are mounted on Brill maximum traction trucks which are equipped with Thomson Houston G. E. 800 motors, there being two equipments to each car. There will also be forty open and ten closed cars, manufactured by the St. Louis Car Company. These have a single equipment of W. P. 50 G. E. motors, and are mounted on McGuire Columbian trucks. The cars are equipped with the Crawford fender. The eight wheel cars have been adopted on the theory that they will prove less severe on the tracks, and also, in case of low joints, they will ride more smoothly than four wheel cars. The latter claim is doubtless correct, but the practice so far, on other lines, does not sustain the claim that the eight wheel cars are any easier on the tracks and joints than others. The cars have several novel features, including the use of electric push buttons which are placed on the inside of each post, by means of which passengers can signal the conductor when they wish to have him stop the car. The window blinds are also of special design, and the doors are double. The contrast between the bob-tail cars at present employed and the new equipment is very striking.

A new car barn has been erected at the corner of Arabella and Magazine Streets, on the south side of the city, near Audubon Park. The ground dimensions of the structure are 240 × 260 ft., and the monitor roof is sixty-five feet high. The posts are sixty feet apart in the width, and twenty feet apart in the length. One tier of posts running across the barn in the line of the transfer track is omitted, the roof being supported at this point by plate girders which span the track space about twenty feet above the rails. The structure is of steel, with corrugated sheeting, and covered with improved composition ready roofing, manufactured by I. D. Fletcher & Company, of New York, and was designed by L. W. Brown, city engineer of New Orleans, and built by the Youngstown Bridge Company. There are nineteen storage tracks, aggregating about a mile, with capacity for 190 cars. The transfer car crosses near the back end, communicating with each of the tracks. Five tracks are provided with repair pits, the sides of which are supported by cypress planking, tongued, grooved, treated with carbolineum, and made watertight to prevent the water from draining into the pit. The side posts of the pits are anchored by braces to mud sills which extend two or three feet beyond the line of the pits. The repair shop occupies a large space on one side of the building, and will be equipped with working tools.

The power will be rented from the Louisiana Electric Light Company, on the basis of a car mile rate, whose plant will be described later on, by the addition of four M. P. generators, manufactured by the General Electric Company.

PRESENT OPERATIONS.

The two systems controlled by the Traction Company are at present operated by animal and steam power, for which purposes 2,343 head of mules and horses are employed. The system embraces eleven routes, nearly all of which run on streets parallel with the river. The steam dummy line, however, enters the city on Canal Street and extends past the principal cemeteries and athletic grounds to West End, a popular summer resort on Lake Pontchartrain, seven miles west of the city. The route beyond the city proper is along the bank of the new basin and ship canal, which connects the city with the lake. The buildings at West End consist of a hotel, pavilions and club houses with a large platform, which is built partly over the water and partly on a wide levee which shuts out the water of the lake from the city. A portion of the levee has been transformed into a pleasure ground, and is ornamented by a rustic fountain, shade trees, palms, yuccas and other tropical plants, together with a labyrinth formed by the intertwining branches of an evergreen shrub. There are numerous small houses and rustic seats provided all about for the accommodation of pleasure seekers, and on one side is a shell road, making a very smooth carriage way. Music is provided on all pleasant evenings, and there is boating and the usual attractions of a summer resort. The location is reached from the depot and carriage road by two drawbridges which span the canal and basin. The temperature is said to be about 10 degs. lower at the lake than in the city. Old Spanish Fort, another popular resort on the lake, is located a few miles east of West End, and is reached by steam line and carriage road. The dummy cars, which now communicate with West End, will soon be operated by electrically propelled cars.

A. H FORD,

SECRETARY NEW ORLEANS CITY & LAKE AND CRESCENT CITY RAILWAYS.

Several of the

lines extend to Aubudon Park, and one passes across it and beyond. This park was the site of the New Orleans Exposition held in 1884–5. This tract has been donated to the city as a public park. The only remaining building of the Exposition is Horticultural Hall in which are still preserved the palms, plants, trees and shrubs which composed the exhibit in this department. The grounds are unimproved except there is a fine gravel driveway. Near the river are avenues of fine old live oak trees covered with Spanish moss, whose overhanging branches form a perfect arch and now and then there is an isolated tree whose leaves cover a circular space nearly 300 ft. in diameter. On the back part of the tract are forty acres devoted to an experimental sugar plantation, where young men go to study the art of growing and making sugar. The buildings are equipped with the latest and most approved machinery for refining sugar and preparing it for the market. The station is in charge of Professor W. C. Stubbs, an expert in sugar making.

STABLES.

The 1343 mules are housed in seven stables which are each in charge of a foreman, and all are under the direction of E. H. Starks, assistant superintendent. The stables are of one story structure with ample ventilation and ground yard, in which the animals are quartered during the night in hot weather. Wide stalls are provided and the stables are kept in an exceptionally clean condition, the animals being all trained to attend to nature's calls at certain times and at a certain place provided in the yards.

The feed consists of Arkansas prairie hay, costing $8.50 per ton, which is fed long, and dry oats and corn which are unground. The daily ration consists of twelve and a half pounds of hay and fifteen pounds of grain. The water for the use of the animals is obtained in most cases from artesian wells, which are from 700 to 900 ft. in depth, and the water flows naturally into tanks from which it is led to the watering troughs. The average daily mileage of the animals is eighteen, long and short trips being made on alternate days. The tracks of the old construction are composed of tram rails laid on wooden stringers, 5×10 ins. At the present time they are in rather bad condition, repairs having been neglected on account of the proposed reconstruction.

EMPLOYES AND FARES.

Drivers are paid $1.65 for a twelve hour day; conductors on the dummy line receive $2.50 per day. Engineers and firemen $75 and $45 per month respectively. On the dummy lines the conductors use the Beadle bell punch, and all the other cars are provided with Beadle and Slawson fare boxes of the old type. The fare is five cents, except on the dummy line to West End, where it is ten cents, with a round trip ticket for fifteen cents, and on the owl cars, where it is ten cents after 12 o'clock midnight. Tickets are sold to mail carriers for four and a half cents each. Employes are provided with tickets with which they ride when on duty.

COUNTING RECEIPTS.

The fare boxes are stripped daily, and returns are carried in bags to the receiving station which occupies the third floor of the Germania National Bank Building, where are also the company's offices. Here a force of clerks is employed for counting the money and putting up change in envelopes for the use of drivers. This department is in charge of Joseph Bein, and all details of the work are carefully systematized. To save time in counting the nickels, of which about $2,000 worth are received daily, a pair of specially constructed Fairbanks scales is provided on which the nickels are weighed, the scales being so constructed that a proper allowance is made for the worn coin.

Strippers are provided with canvas bags numbered to correspond with the car to the number of 219, the usual number run; into this the contents of the fare boxes are emptied when they are taken to the receivers' station, the hour for stripping the boxes being 12:30 P. M. to 5:30 P. M. each day. The work of counting the receipts is begun in the morning and is conducted by three persons. The contents of the bags are emptied upon the table, when the silver pieces are selected out and counted, and the amount of silver called out to a lady clerk who records the same opposite the car number in a book ruled for the purpose. The employes' tickets are also selected when the nickels are transferred to the hopper of the scales, which is provided with weights and also a beam register. The amount in dollars and cents is then reported to the clerk, and is recorded opposite the car number; the footings of the daily receipts are then reported to the secretary. The entire amount is usually counted by two persons in about an hour, the total receipts being from $2,500 to $3,000 a day. Formerly, before the present method of weighing the nickels was adopted, it took over five hours to count the daily receipts.

The nickels are then again weighed and placed in small wooden boxes in amounts of $100 each, and are then given to lady clerks who place them in change envelopes in sums of fifty, twenty-five and ten cents. Change envelopes are provided and the nickels are placed in them in echelon and the envelope is folded twice and sealed, making a solid packet. Some of the young ladies become very expert in putting up change in envelopes, frequently putting up $50 in twenty-five cent packets and tying them in bundles of $5 each in about eighteen minutes. A tally is kept of the amounts delivered to the packers, and when the bundles are completed and returned to the receiver they are checked up so that a careful tally is kept on each step of the operation. The bundles are then enclosed in bags of $50 each and placed in the receiver's office, which is fenced off from the main office by a high wire screen. The bundles are then sold to the starters who come to the receiver's office for them who in turn sell them to the drivers, each driver being required to carry $10 in change, which is carried in a belt provided for the purpose. The entire amount of nickels received each day is returned to the drivers as change packets.

PAY WAGON.

For paying the employes a pay wagon is employed, which is an ordinary one horse, covered express wagon, the cover being supported by a wire frame, which is enclosed front and rear and provided with a safe. These wagons are driven to the different pay stations, and as the employe receives his wages he stands upon a rear step and signs a receipt on a shelf provided for the purpose.

C. B. F.

(*To be Continued.*)

Correspondence.

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

New York, March 9, 1894.

Editors Street Railway Journal:

In your February number we find an article, entitled "An Excellent Cable Record," which, as it stands, seems to indicate a high degree of perfection in the work turned out by the English manufacturers named. The beautiful illustration makes one feel real sorry for the cable railway which threw away so perfect a cable prematurely. It may be, however that portions of the cable were in a very bad condition; would it not have been better to have shown samples of worn cable, as it is easy to find plenty of good samples carefully prepared on an emery wheel? Apparently, the article casts discredit on the cables of American manufacture, and probably it was intended to do this, otherwise, cables of the same manufacture which lasted less than half the time of the one good one in the same place, might have been mentioned in the article. Records of American made cables, showing services of 485, 550, 579, 602, 679 and 1,258 days, each on different railways, can be mentioned and referred to and pointed out as being of extraordinary quality and perfection. These records are all of them very high; at the same time, the elements of chance and good luck had much to do with their long life. Under conditions in which cables are

worn out in from thirty to ninety-eight days, quality plays a secondary part, and freedom from accidents the principal part. Taken as a whole, the records of foreign made cables used here are a very ridiculous affair, and it requires considerable assurance to claim great things on one chance record. As practically the entire revenue of street railways is derived from citizens of the United States, it would seem proper that they should have preference as to trade. Experience and records will certainly show that American made cables are far superior to any foreign ones.

Respectfully submitted by
An American Manufacturer.

TWIN CITY RAPID TRANSIT COMPANY.

AUDITING DEPARTMENT.

Minneapolis, Minn., March 22, 1894.

Editors Steret Railway Journal:

Though often said, yet true: "No knowledge is more indispensable to the successful management of any business than a thorough and concise system of accounts." It is related of Talleyrand that he has defined the science of language to be "for the purpose of concealing one's thoughts and opinions," and the same idea is often carried out in the application of the principles of book-keeping—to bewilder, to confuse and obscure the financial conditions of a business or corporation. While it is true that "figures won't lie," yet there are those individuals and corporations who, either through ignorance or for a purpose, make certain combinations of figures or statements that are misleading and false.

From my personal experience and observation I am fairly of the opinion that there is no business where the opportunities are so diversified, and chances for leakage so great, as in the operation of an electrical street railway, and this condition is greatly aggravated where transfers are issued. I might state, without fear of contradiction, that there is no class of business, to-day, where the system of records is so crude and unsatisfactory as that now in vogue in very many of our street railway systems. This existing condition is accounted for as follows:

1. Many roads have tried to adapt the "old horse car methods" to the accounting of an electric system, and without success.

2. The transition from a horse car system to an electric system has been so recent that the mechanical transformation and development has been, so far, the prime and only consideration.

3. The conditions are so diversified and intricate that the installation of an economical, accurate and harmonious system is imperative; such a system, however, has not been found, and if found, not successfully installed.

Now that the mechanical principles of our electrical street railway systems are fairly well settled, the time has arrived for the careful consideration of all those conditions that lead to an economical management and a fair remuneration to those who have invested their money. These conditions can only be arrived at through a concise and practical system of accounting and record.

The American Street Railway Association will accomplish a great deal of good by taking some definite action toward adopting a uniform standard of accounts. By the adoption of such a standard the management of the various roads throughout the country could make comparisons of the cost of operation, which would be mutually beneficial. The adoption of a standard system would also be of great benefit and security to the investor, as he could then tell something, from the statements rendered, about the condition of the various companies.

For the mutual benefit of all concerned, and with your kind permission, I should like to introduce or have introduced by others more competent than I, in the subsequent issues of your valuable journal, for general discussion and mutual benefit, a few specific ideas on those fundamental principles which could be generally adopted by all electric street railways. Yours truly,

J. H. Calderwood.

Cleveland, March 24, 1894.

Editors Street Railway Journal:

I wish to make a suggestion to the American Street Railway Association through the columns of your valuable journal with reference to the yearly conventions, to remedy in the future what has, in my judgment, been an error in the past. It has been the custom heretofore to throw the doors of the exhibition hall open to everyone and anyone, and the halls have been crowded to their utmost capacity, usually with the residents of the city, and the fair sex have been represented to a great extent (to which I, of course, have no objection). As I have been connected with street railway work for a great many years before my interest in the manufacturing business, I am inclined to look on both sides of the question, and by doing so I am enabled to arrive at a fair conclusion. It is my belief that the conventions have been made interesting and successful largely from the fact that the supply men have turned out so liberally and spent a great deal of time and money in preparing their exhibits. The men in charge of the exhibits have been obliged to remain at their posts some fourteen or fifteen hours a day during the three days that the convention is in session, and are usually busily engaged in explaining their various devices to those who make inquiry; very frequently after spending a long time and a great deal of patience with some gentleman who appears to be thoroughly interested, he will find when he comes to go with the usual "many thanks for your courtesy," that the gentleman is running a dry goods store or a shoe store on the same street a few blocks away. I would suggest that the Association adopt a resolution setting aside one day, or even half a day if thought best, when all the members present may meet at the convention parlors and from these visit the exhibition hall in a body, and at this time the doors be closed against every one excepting the street railway men and their friends and the supply men. This would afford them an opportunity to examine the exhibits which the supply men have taken such pains to prepare, and would also be a cue to the supply man that the gentleman with whom he is talking to is directly interested in street railway work. After the street railway men had made a tour of the exhibition hall the doors could again be thrown open to the public, and the supply men would not then be obliged to keep so constantly at their posts.

I do not wish to convey the idea that I am at all dissatisfied with the treatment I have received at the street railway conventions that I have had the pleasure of attending; on the other hand, it has been one of the greatest pleasures of the whole year to me to be present at the American Street Railway conventions, and it has encouraged me not a little in getting up a nice line of exhibits of new and improved devices, and I trust that we shall be represented at a great many conventions yet to come.

I hope this suggestion will be received by the Association in the spirit in which it is intended, and that it will receive their favorable consideration.

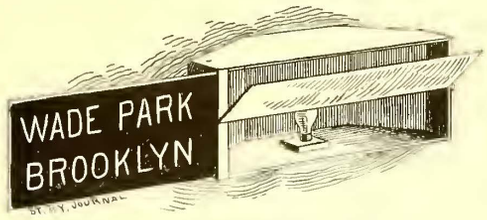
Yours truly,
W. E. Haycox, President and Manager,
The Fulton Truck & Foundry Company

Illuminated Car Sign.

The illuminated sign here illustrated has recently been put into use on a number of the cars of the Cleveland Electric Railway, and seems to possess the advantage of being easily read at considerable distances, as well as being simple in construction and comparatively inexpensive. This sign was designed by John J. Stanley, general superintendent of the company, and those in use have been made at the company's shops.

The sign is intended to be attached to the dash of the vestibule, and consists of a galvanized iron box twenty-one inches long, eleven inches wide and four inches deep. The back is beveled off toward the ends as shown, to allow space for the hooks whereby it is attached to the dash,

and at the same time increase the reflective effect on the sign, which forms the front. The front is furnished with a glass slide which bears the name of the line. A double sign may be used and a folding tin cover attached to the



ILLUMINATED CAR SIGN.

front of the box that may be folded either up or down, thus exhibiting the destination of the car. The illumination is furnished by a single incandescent lamp.

These signs may be readily and cheaply constructed at any well equipped car shop, and have been shown by practice to be readable at a distance of from 200 to 300 ft. If desired, the front slide of the box may be constructed of tin with perforations for the letters.

An Electric Brake.

An ingenious electric brake, for which a number of advantages are claimed, has recently been invented by E. B. Skinner, of the Ogden City Street Railway, of Ogden, Utah. An important feature of the invention is that to set the brake the electric current is only used

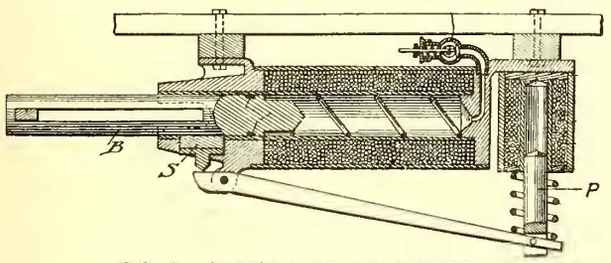


FIG. 1.—SECTION OF SOLENOIDS.

momentarily, instead of continuously, as in most devices of this character.

Fig. 1 shows a section of the electrical portion of the device. The horizontal plunger, B, which is so connected o the brake beams that a movement to the left sets the brake shoes, moves inside of a solenoid wound on a brass or copper tube with heads of the same material. Within this solenoid is a spring which normally holds the plunger outside the solenoid. A smaller, vertical solenoid, with plunger, is also provided, as shown. The end of this plunger is directly connected to a long lever operating or pressing against a shoe, shown at S, which bears against the plunger, N, with such force as to hold it rigidly in

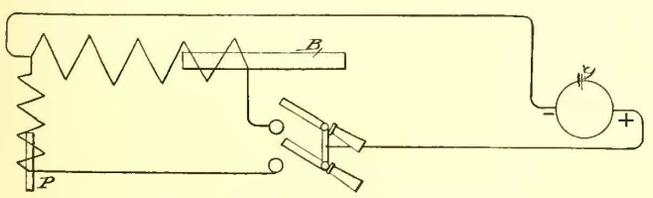


FIG. 2.—DIAGRAM OF CONNECTIONS.

place when there is no current passing through the vertical coil.

The method of electrical connection of the brake apparatus will be seen from the diagram (Fig. 2). The dynamo is shown at y, and the outgoing circuit leads to two switches, shown in the diagram, controlled by one lever. These are so arranged that the movement of the lever first closes the lower switch, and afterwards the upper switch.

The action of the brake is then as follows: In its normal position the horizontal plunger, B, is extended, and kept so by the pressure of the brake shoe operated by the vertical plunger, P, which itself is kept extended from its solenoid by the action of the spring shown. The result of moving the double lever is first to close the lower contact (Fig. 2) so as to pass the current through the vertical solenoid, drawing in plunger, P, and causing the shoe to drop away from plunger, B. The upper contact, or that making the circuit through the horizontal solenoid, is then made, drawing the horizontal plunger into its solenoid, and setting the brakes. The switch is then thrown open, stopping the electric current from passing through the release coil, when the plunger, B, is held in position by means of the shoe. Then the current may be stopped from passing through the horizontal coil, and the pressure of S against B will hold the brake shoes tight. To release the brake, the current is passed through the release coil, thereby releasing plunger, B, from the pressure of the shoe, when it will be pushed out by its spring.

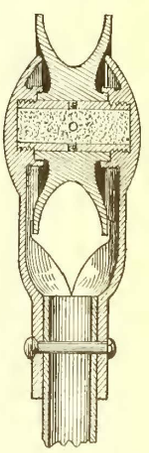
To guard against any sudden action or jar when the brake is released, an air valve, as shown, is provided at the back end of the horizontal cylinder. When plunger, B, moves into its cylinder, the air will be forced through this valve, but when the brakes are released, B will be held back against the action of its spring, sufficiently to prevent jar by the partial vacuum formed as it moves out of the tube. The vacuum can be controlled by the air valve, allowing more or less air to re-enter.

By an ingenious arrangement the brake is made adaptable to train use, so that not only can all the brakes be set from one point, but in case the train should break in two, the brakes on each portion would be automatically set. The device does not interfere with the ordinary hand brake attachment, so that that can be used, if, in the case of a trolley car, there should be a failure of current for any cause.

A Simple Trolley Head.

A trolley head, consisting of but four parts, has recently been invented by I. B. Walker, superintendent of the Sioux City Railway Company, Sioux City, Ia. The device has been in operation for some time on that road, and seems to give good satisfaction. The chief claim for this device is its simplicity, there being no cotter pins, nuts, springs, rivets or other loose parts. The four pieces comprise the pin, wheel and the two sides of the harp. The engraving herewith shows the method of construction.

The head is perfectly self-contained, and needs no attention whatever from the time it is put on until it is worn out. The wheel can be made of any durable metal, such as copper, bronze, aluminum or cast iron. The harp can also be made of any suitable metal, aluminum, brass, and malleable iron having been employed. The latter is the cheapest, and the aluminum weighs about one-fourth that of the brass harp. Owing to the peculiar shape of the harp there is no wear upon it, while the shape allows the greatest possible strength.



TROLLEY HEAD.

The pin is made of steel and case hardened, and during the five months' use of this device on the Sioux City Railway no pins have yet worn out. The pin is secured into bosses on the harp, and is filled with dry lubricating graphite, sold by the Graphite Lubricating Company, of Bound Brook, N. J. It has a three-quarter inch hole through its entire length, and four and one-eighth inch holes are bored into the pin in its center. The graphite can escape only through these holes, and as graphite is a conductor there is perfect lubrication, while the wheel runs perfectly cool. There is no need for side springs, as the one-inch pin gives more surface than is really needed for carrying off the current.

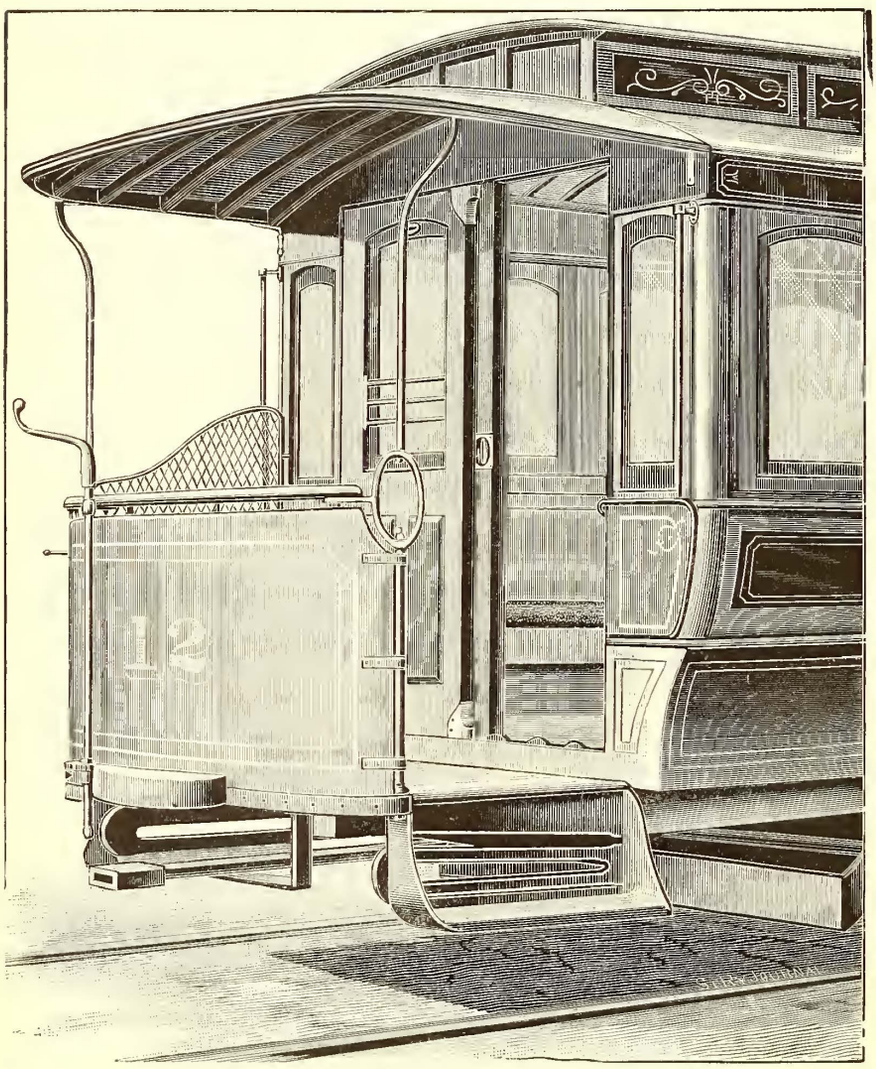
In another form of head, graphite in the form of paste is used, and this is fed to the bearing by a screw fitting into the end of the pin which is set up as required.

New Easy Exit Car.

Since the advent of electricity and cable as motive powers for street railways, and the consequent increase of passengers carried, it has been found that the old method of constructing street cars must be improved on, and passengers handled easily and rapidly.

The crowding of platforms, and consequent difficulty of entering and leaving a car, has troubled many managers. A new type of car, the invention of Wm. Sutton, president of the American Car Company, of St. Louis, has been put upon the market with the object of overcoming the above difficulty. It is shown in the accompanying engraving.

The car is provided with double doors, one of which is of the ordinary sliding type, but made to move from one side of the opening to the other. The other is pivoted in the center of the opening, swings out towards the platform, and is made to close and lock on either side of the opening. This pivoted door is only used at the end of the route, when changing from one track to the other, and is locked on the side of the platform closed by the gate. This arrangement makes the pivoted door tight, and prevents rattling, and allows three-fourths of the platform for passengers to stand on, without interfering with those getting in and out.



NEW EASY EXIT CAR.

One seat at the entrance is sacrificed, and this is made adjustable, the motion being the opposite of a theatre seat, turning in instead of up when the sliding door is used, and utilized on the side that the pivoted door is locked. This invention has only recently been patented.

The American Car Company built a trial order of this type of car, the results of which were so satisfactory that it is now completing an order for ten more.

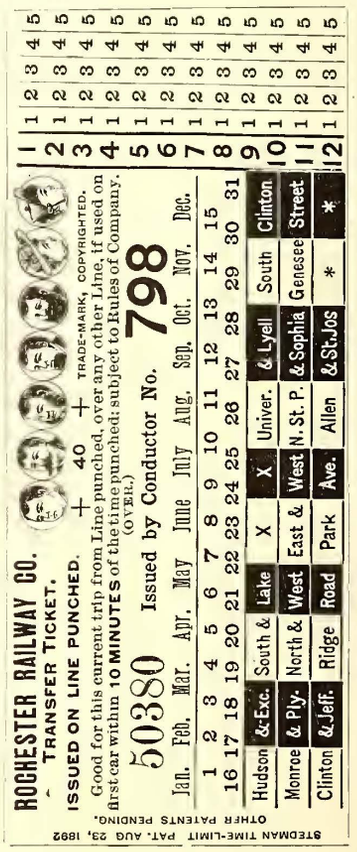
An electric railway, sixteen miles in length, will be built at Klampenborg, Denmark.

New Transfer Ticket.

We present herewith a reproduction of a new transfer ticket, designed by J. H. Stedman, of Rochester, N. Y., and embodying the Stedman system now used by over eighty street railways. The protection from abuse by passengers, and the prevention of frauds of conductors is the vital point of this system, and it has proved highly efficient.

The ticket shown illustrates a new method devised to confine the use of the transfer ticket to the original passenger. Besides showing the route, direction, time and date of issue, the conductor indicates on the ticket the appearance of the person to whom the ticket is issued. This is done by indicating that likeness making up the trade mark which most resembles the original holder. This ticket need be put into use only once in a while and intermittently, perhaps, but it will prevent, it is thought, much of the fraudulent use of the transfer, as its moral influence will be considerable.

As will be seen, the ticket is most compact and convenient for punching.



The back can be used for advertisements if desired. Among the cities in which the Stedman tickets are in use are New York City, Indianapolis, St. Louis, Brooklyn, Baltimore, Buffalo, Rochester, Milwaukee, Pittsburgh, Newark, Hoboken, etc.

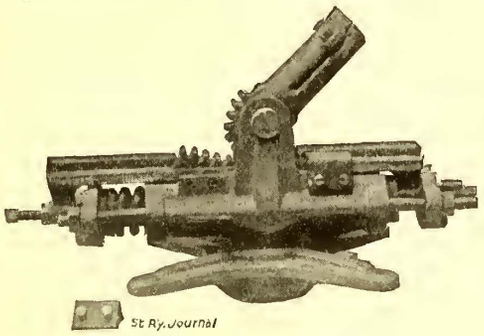
The Union Traction Company, of Providence, has purchased the mortgage of the Attleboro, North Attleboro & Wrentham Street Railroad. It is stated that the road will be in operation by April 1. It stopped doing business last fall after the burning of the power house in North Attleboro.

The Fair Haven & Westville Horse Railroad Company, of New Haven, Conn., signed a contract last month with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, to electrically equip its road.

Clay, Moore & Company, of Philadelphia, have purchased the New Haven & Centerville Horse Railroad from Cornelius Pierpont for a syndicate of that city. The price agreed upon, it is said, was $225,000. The road will be electrically equipped.

A New Type of Trolley.

The illustration shown herewith gives a view of a new trolley, the invention of J. R. Griffiths, of Chicago, and sold by the Yeats Engineering Company, Monadnock Block, that city. The important claims made for this trolley are its simplicity and durable construction.



A NEW TYPE OF TROLLEY.

One of its special features is its few parts, which are all interchangeable. Any part can be removed in a very few minutes and a new part replaced.

This trolley is claimed to be especially good for bridge work, as it has a low base, and as no chains or side springs are used, can be carried down level with the top of the car. It has only one spiral spring encased in a cast iron frame, making it very firm and rigid, and as the pole works on sprockets in conjunction with a half sprocket wheel attached to the spiral spring, it will be seen that the tension must be even, and the pressure on the wire is the same whether the pole is at an angle of 40 degs. or at 2 degs. The trolley swivels on its base and pulls in both directions. The bearing surfaces are all designed for strength and durability, with provision for taking up the wear.

The trolleys are now doing service on the Calumet Electric Street Railway, where they are giving excellent satisfaction.

Smoking cars are to be tried by the Philadelphia Traction Company on the 13th and 15th Streets electric line.

The Foster Fender.

The accompanying illustrations display a new safety guard for trolley and cable cars now placed on the market by the Foster Automatic Safety Guard Company of 150 Broadway, New York. A test of this fender on human beings has been made on the Hillside division of the North Hudson County Railway Company with gratifying results.

The advantages claimed for this safety guard over other types are as follows:

The front fender in its normal position can be made to run over the roadbed at a height above the track of three inches or less, according to the condition of the roadbed. The fender is attached to the truck of the car in such a manner that it can be made to run flush with the dashboard, thereby making it possible to trail cars without any delay or inconvenience. The safety guard when struck automatically releases a cradle which instantaneously drops from beneath the platform of the car and runs forward on wheels on the crown of the track, three feet in front of the car, and prevents any possibility of the crushing or maiming of the person struck.

This fender is also claimed to be the only one which is capable of running three inches or less above the ground where the forward wheels of the truck are more than seven feet in the rear of the bumper.

The general arrangement of the fender can be seen from the engravings shown herewith.

The front fenders are attached to rails extending from the truck of the car, thereby avoiding all oscillation.

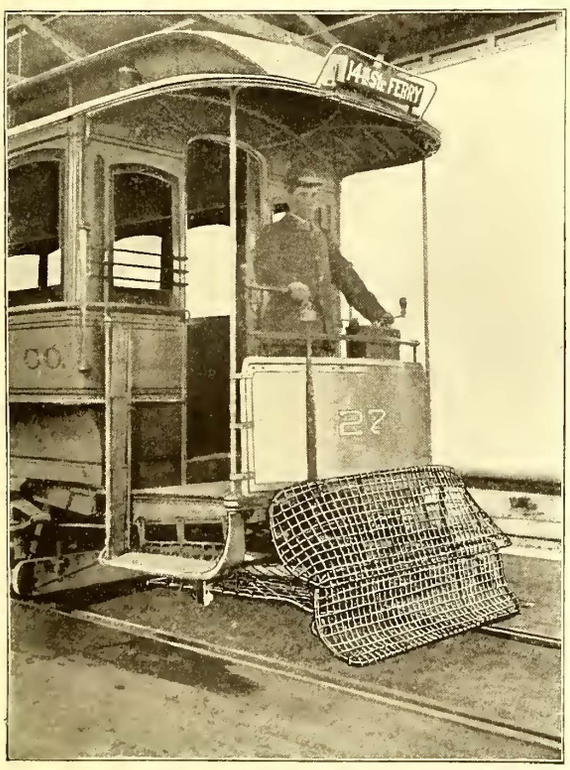


FIG. 1.—THE FOSTER FENDER READY FOR OPERATION.

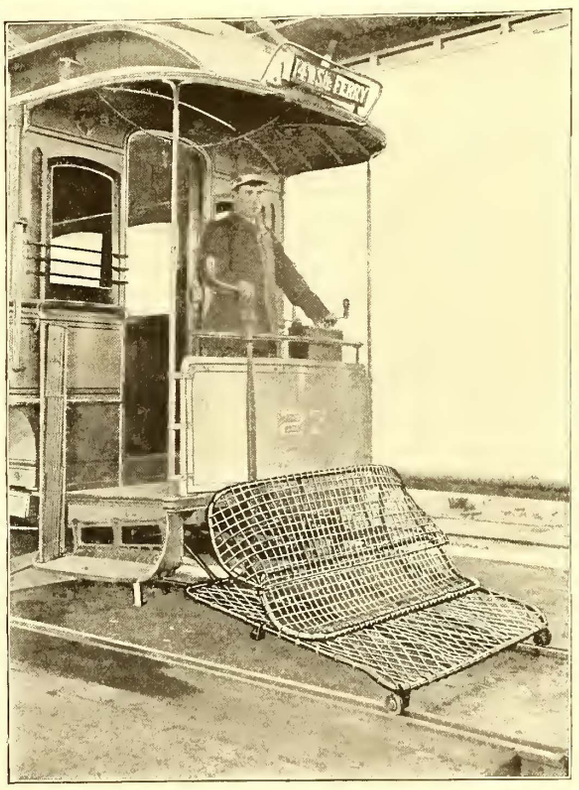


FIG. 2.—THE FOSTER FENDER IN OPERATION.

The cradle is suspended from beneath the platform of the car and is held in position by two arms, and is actuated by the impact of any collision with the fender, and runs out from its position beneath the car.

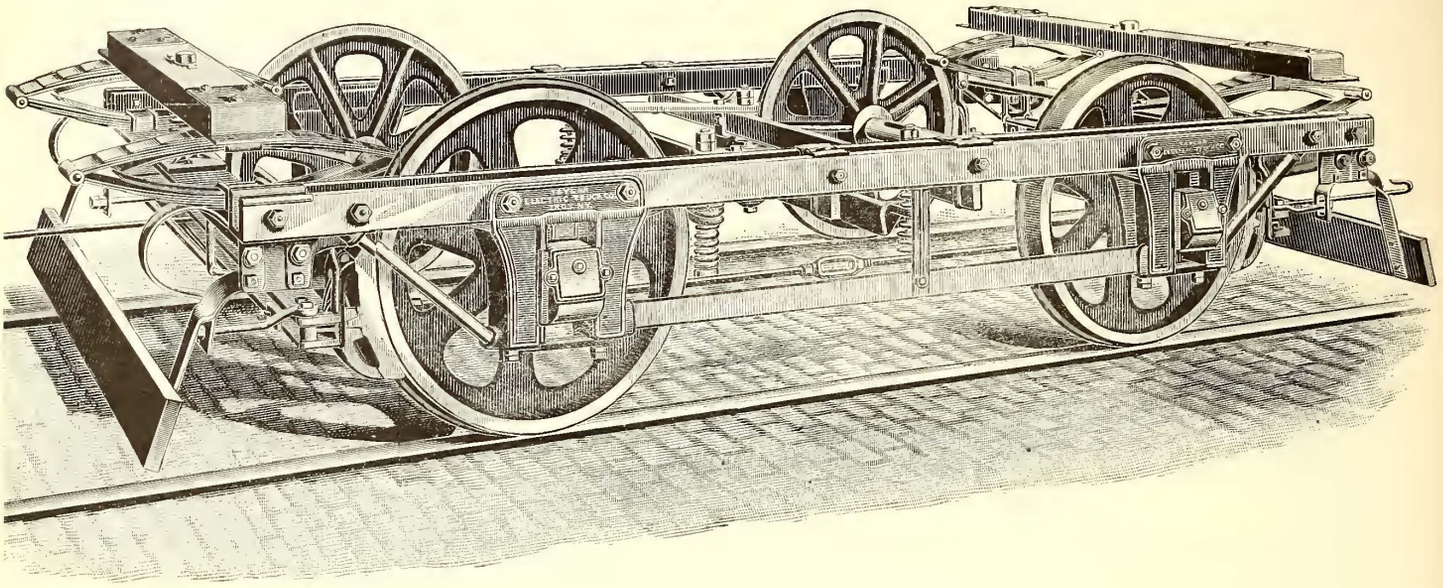
The cradle can also be locked from the platform, and prevented from acting by the motorman in order to avoid the destruction of the safety guard in case of any collision with vehicles.

The line of the Brooklyn City Railway of Brooklyn, N. Y., has been extended to Newtown and Corona. Before long cars will be running to Bowery Bay Beach and Flushing.

Electric Motor Trucks.

The wear upon the running equipment of an electric street railway is certainly equal to, if not greater than, that upon a steam railway. The constant stopping and starting of an electric car on tracks covered with snow, slush, mud and dust alternately, the strain in rounding short curves, &c., all sum up a total of wear, which the more rapid speed of the steam railway does not counterbalance.

That this independent truck frame accomplishes more than one result is evident. The car body is not depended on to keep the frame square, and does not receive the tremendous racking and straining inevitable when the frame of the truck is bolted to side sills of the car body. Then again the axles can be made and held parallel to each other in the Taylor construction, and as a result uneven wear on the flanges of wheels is unknown, while the motor and truck journals are worn evenly and truly. The Taylor Electric Truck Company is convinced from its past experience, and from the facts as presented above,



TAYLOR ELECTRIC MOTOR TRUCK.

That these facts are recognized by practical men is evidenced by the adoption by electric street railways as basic principles, the ones tried and found true by steam railways.

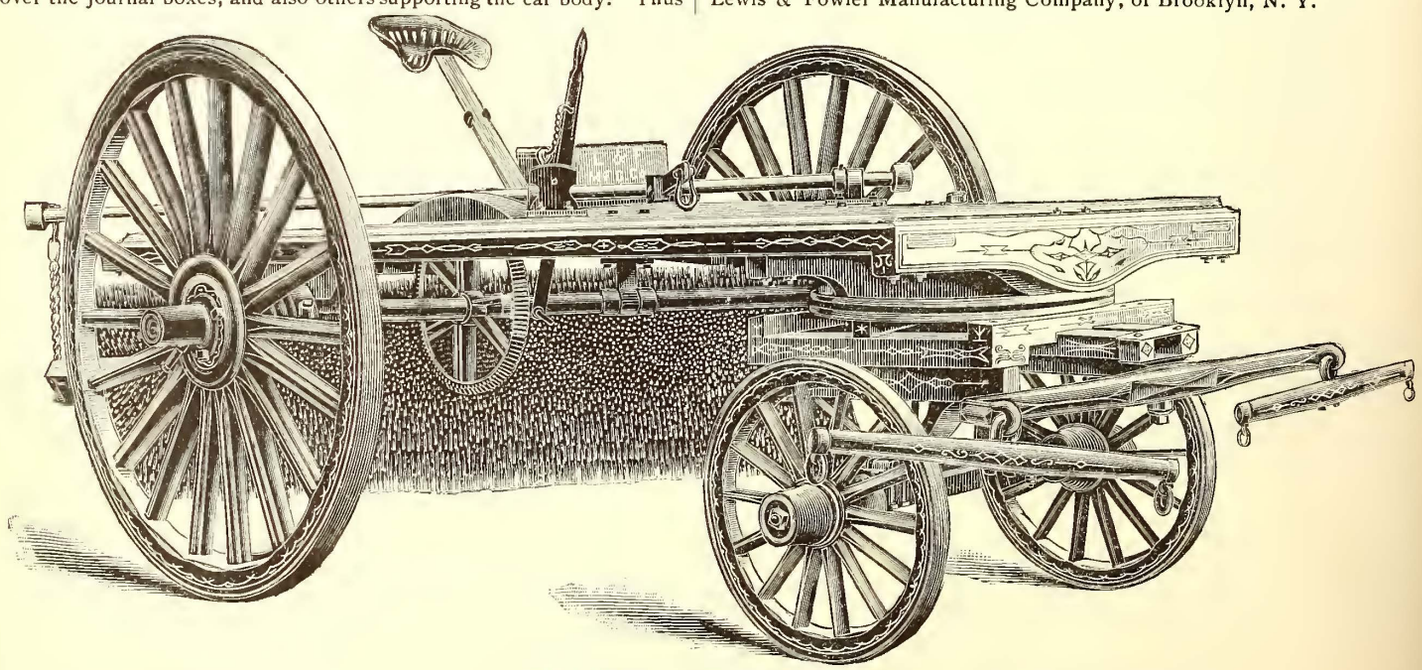
The Taylor Electric Truck Company believes that practical experience should prevail in motor truck construction; and acting on this belief, has incorporated in its trucks the fact long ago found out in governing steam railway construction, that the elliptic spring was the only form with elastic and easy action, suitable for use under passenger coaches.

The Taylor Electric Truck Company makes a strong point on the use of the elliptic springs in its construction. The latest pattern single truck made by the company, as shown in the cut, has elliptic springs over the journal boxes, and also others supporting the car body. Thus the car body is entirely supported on elliptic springs, which by their elastic action carry it with the ease of a Pullman or Wagner palace car. The frame of the truck is in the form of a simple truss, so strong and substantial that it is able to support the utmost weight that can be placed on it, without having recourse to coil springs placed intermediate to the supporting elliptic springs. An interesting experiment proving the strength of the side frame of a Taylor improved electric truck was made recently, when a single side frame supported at the journal boxes was loaded with 10,260 lbs. at each end without distortion. The Taylor trucks, both single and double, are designed so that each truck is an independent and complete construction, and is connected to the car body by king bolts, precisely as in steam railway construction.

that it is working in the right direction as regards the proper motor truck construction, and feels assured that a cordial recognition of the validity of the claims made will be accorded.

The Eureka Street Sweeper.

It is universally admitted that a well cleaned track means a great saving of power. Sweepers, therefore, are economy producers, and the better the sweeper the greater the saving. The accompanying engraving shows the improved Eureka sweeper, manufactured by the Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y.

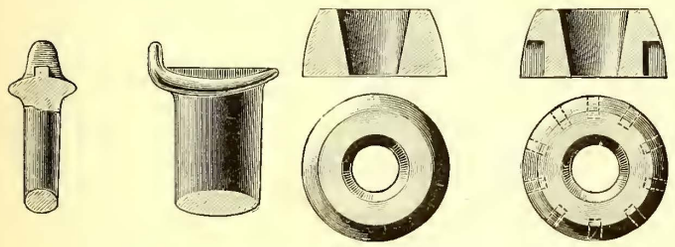


THE EUREKA STREET SWEEPER.

One especially desirable feature of this sweeper is the patent box hub. This encloses the axle and effectually protects all the working parts from dust and dirt, preventing clogging and insuring constant and free working. By means of a triple ratchet the axle is always held in the direct center and is prevented from wobbling and damage. This sweeper, it is claimed, lasts longer, performs better work in less time than any other sweeper, and is less wearing upon horses. The Eureka is made of the best material, and is so simple that inexperienced hands can operate it successfully from the start without damage to any part, it simply being required that the oil wells be filled once a week. Another and very important feature of this machine is that the broom can be thrown in and out of action while in motion.

Wrought Iron Wheel Centers.

The use of forged, wrought iron center, steel tired wheels in street railway practice is comparatively unknown in this country, the one-piece, cast iron, chilled wheel being the standard. European tramway practice is different, however, in this respect, the forged center, steel tired wheel being used almost entirely. The possibilities of building up a market for the forged center wheel was brought to the attention of M. Pierre Arbel, of the Arbel Establishments, Rive-de-Gier (Loire), France, while at the Columbian Exposition. Believing the wheel manufactured by that company to have a future in the American street railway world, it has been decided to establish an American office for the sale of the wrought iron, forged wheel centers manufactured under the Arbel process. This, as already mentioned in this publication, is in the Havemeyer Building, New York, and is in charge of Wm. Hazleton 3d.



FIGS. 1 AND 2.—SECTIONS OF SPOKES AND HUBS.

In the great developement which has taken place in the manufacture of all varieties of street railway equipment, the wheels have not been appreciably altered except by increasing the weight from the old style used on the first horse cars, although with the large and heavy cars and the equipments used now on many street railway lines the wheel load is considerably heavier than that allowed in steam railway service. It is a well known fact, also, that cable and electric traction is much more severe on wheels than steam road service, the former having to operate on the surface where the rails are often covered with a coating of mud or dirt. Besides this, the wheels are subjected to much more frequent and severe brake action than on steam roads. Surface roads must also follow the lines of streets, necessitating many sharp curves and heavy grades.

The severity of this service upon the life of wheels is well known, and the average cast iron, chilled rim wheel is not guaranteed for over 40,000 miles of service. Numerous experiments have been made with compound, or built up wheels; that is, wheels having a cast or wrought iron steel center and steel tire, which, however, have not led to the adoption of this class of wheel to any extent. Cast steel wheels have also been tried experimentally and have been found to be superior to cast iron wheels in that they are lighter, wear less from the action of the track and brake, and give better traction and quicker brake action; the cost of steel castings, however, is quite high. With the wrought iron center, steel tired wheel, the advantages of the steel tread are all retained with the ability to replace the steel tire when worn, at a slight

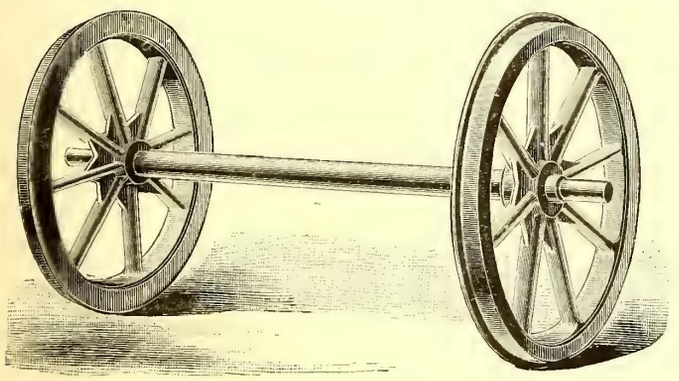


FIG. 3.—PAIR OF ARBEL WHEELS.

expense. This pattern of wheel, it is also claimed, makes less noise while running and wears the rails very much less than the cast iron wheel.

The Couzon Works of the Arbel Company are located at Rive-de-Gier, France, and have been established since 1870, being the largest works of their kind in Europe for the manufacture of wheels for street railway use. The process of manufacture has been steadily improved since starting the factory, and as the result of a number of special processes employed, they claim superior excellence for their product, which claim is borne out by a large number of awards received at different National Expositions.

The manufacture of wrought iron wheels as carried on at the Arbel Works is divided into three processes; first, preparation of the different parts of the wheel; second, mounting or assembling; third, forging. The rims, which are made from flat bar iron of special section, are rolled into circular form by a special machine and welded at the ends. The rim is then grooved to receive the spokes; the spokes are elliptic in section and are drop forged at their outer ends to the shape shown in Fig. 1, to facilitate welding to the rim. The hub is composed of two halves of the form shown in Fig. 2, each half being forged from a bar of rectangular section, bent around a mandrel. The grooves receive the inner ends of the spokes and are formed by dies under a steam hammer. The different parts are then assembled into the form of a complete wheel, their construction being such as to let the wheel thus set up be transferred to the heating furnaces without falling apart. In this state the wheel has a greater dish to the spokes than in its completed form, the extra amount of metal being necessary to obtain perfect welds.

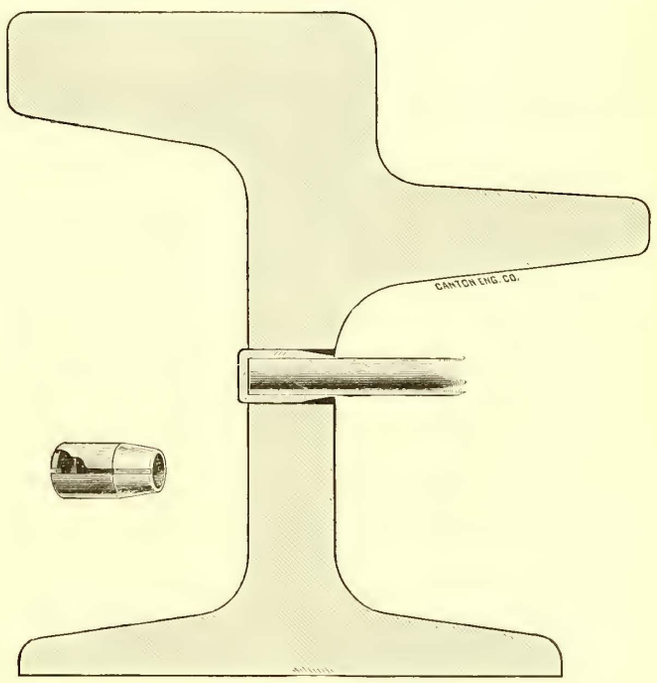
The heating is done in reverberatory furnaces of special form, so constructed that the maximum intensity of the heat comes at the hub of the wheel where the metal is heaviest, gradually decreasing to the rim, which is much lighter. After the whole wheel has reached a white heat it is placed between two dies on the anvil of a steam hammer, one die being fastened to the anvil and the other to the hammer. A few blows of a fifteen ton steam hammer are sufficient to weld all the parts perfectly into one homogeneous whole. The webs uniting the spokes, shown in Fig. 3, are formed by this last process. The wheels are then finished, hubs bored and rims turned and are ready to be placed on the axles and receive the steel tires.

Owing to the facility with which steel tires of standard street railway sizes may be obtained in this country, the Arbel Company is only importing at present its forged wheel centers, but is prepared, upon the receipt of large orders, to manufacture the wheels complete at its French establishment, in accordance with any desired specification. So far as the question of durability is concerned, there seems to be no doubt but that the steel tired wheel is superior to the standard cast iron wheel, leaving out of the question the facility with which new tires can be placed upon the wrought iron centers as fast as worn out. In railway service, steel tired wheels have made over 500,000 miles, and should, in street railway service, make at least 200,000 miles, or practically equivalent to five years' maximum service. The forged centers are guaranteed for five years' service, but are practically indestructible.

The Arbel Company has large numbers of its wheels in use on all the principal tramway lines throughout Europe, and has a number of flattering testimonials testifying to the satisfaction given during the periods of service, covering, in several cases, as much as seven years.

Steel Bonding Caps.

The accompanying cut shows views of the new track bonding device recently brought out by the Ohio Brass Company, of Mansfield, O. The steel bonding cap, as its name signifies, is a steel cap which fits snugly over the end of the bonding wire and into the web or flange of the rail. The method of bonding tracks with this device is as follows: The end of the wire is passed through the hole in the rail



RAIL WITH BONDING CAP.

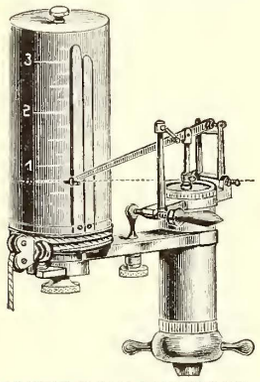
which is drilled one thirty-second of an inch smaller than the outside diameter of the cap. The cap is then placed on the bonding wire and entered into the rail. A few blows from a hammer fasten it in place. The crimp, extending the full length of the cap, allows the shell to compress firmly over the wire and into the rail, making a perfect air and moisture proof joint.

It can be used equally well with iron or copper wires of different sizes. The facility and quickness of bonding combined with the low selling price will no doubt bring it into speedy favor.

AT a recent meeting of the stockholders of the Northampton (Mass.) Street Railway Company, it was voted to increase the capital stock to pay for ten miles of track extension, enlarge the power house, and increase the equipments.

The Robertson-Thompson Indicator.

Our illustration shows a new form of indicator manufacted by the New York Indicator & Specialty Company. This indicator has been but recently put on the market, and seems to contain a number of valuable features. The parallel motion employed is of a new design, and is secured by a controlling lever attached to the pencil arm governing it direct. By this arrangement any wear on the pivots that should appear in course of continued use, only affects the accuracy of the pencil movement an amount equal to the wear, and does not multiply the error, as in some other forms of parallel motions.

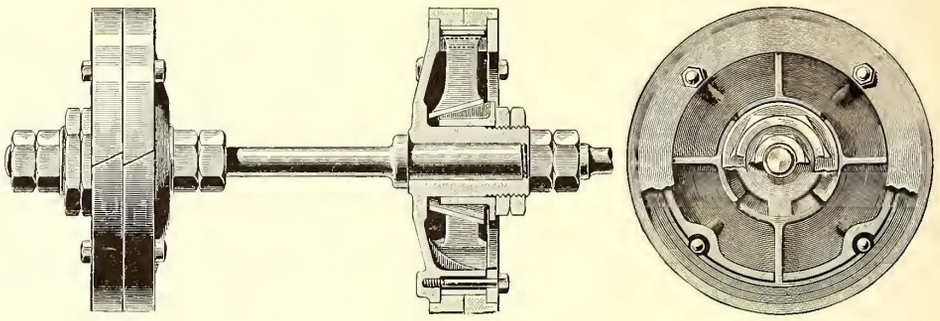


THE ROBERTSON-THOMPSON INDICATOR.

It will be noticed by reference to the cut that the two links are parallel with each other at all points of the stroke, and that the lower pivots are always in a straight line with the pencil point. This arrangement does not depend on the piton rod for a guide, and gives a very exact pantograph effect. The indicator is made almost entirely of brass heavily nickeled, but for use on ammonia machines it may be constructed entirely of steel. The piston rod is of steel, hollow and threaded on the inside, permitting the adjustment of the pencil point to any height on the drum. The drum is one and three-quarters inches in diameter and is provided with a bearing one a half inches long at the bottom and half an inch long at the top, as well as cone bearings to take up the end play. The guide pulley admits of the cord being led in every possible direction without the use of carrying pulleys. The indicator can be readily adjusted for either right or left hand use, and on account of its light moving parts is especially adapted for high speed service.

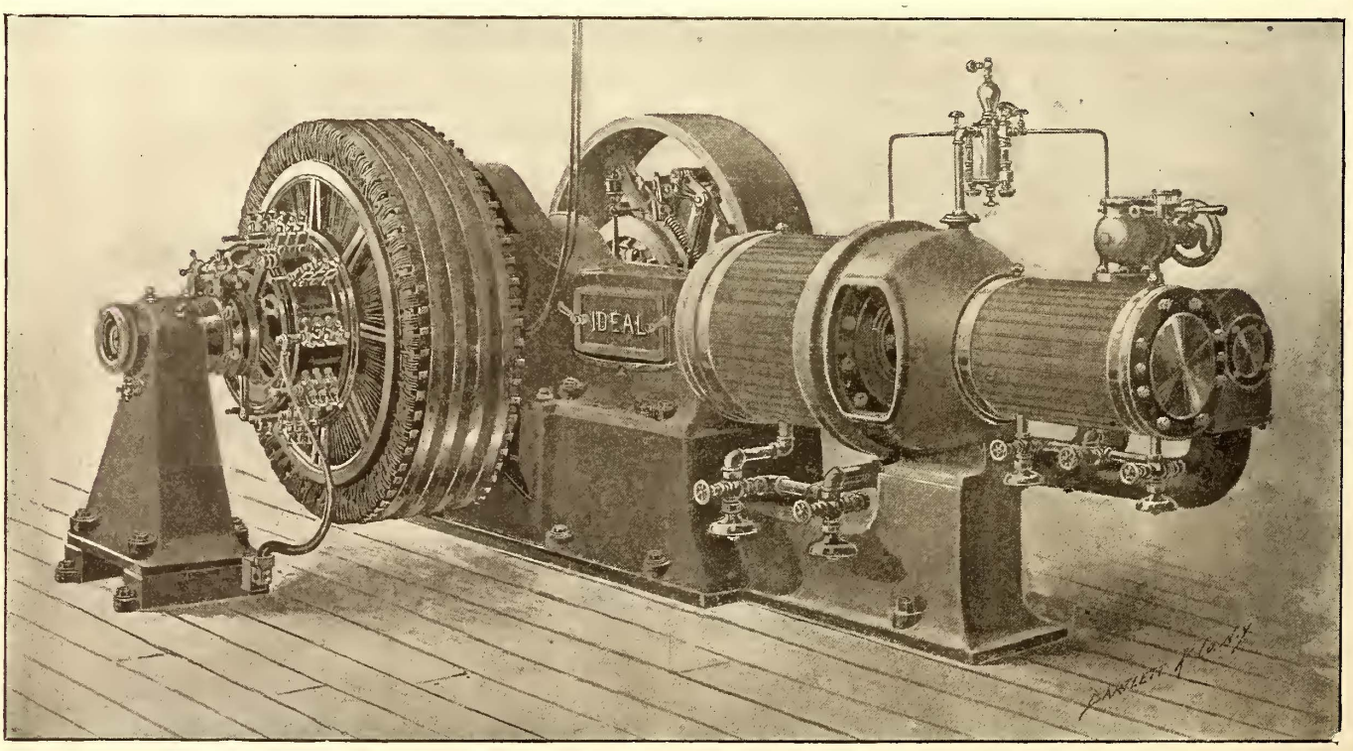
Direct Connected "Ideal" Engines.

The direct connected combination of engine and dynamo of to-day is demonstrating, by an increasing number of plants, its practicability, efficiency and sound principles. We illustrate one of the latest of these combinations. This comprises a multipolar dynamo of the Waddell-Entz type, driven by a Harrisburg tandem compound, Ideal, self-oiling engine. The dynamo is 80 K. W. capacity, and the Ideal engine, cylinders 10 and 17 × 22 ins., is built for running, in this instance, non-condensing. The speed of the combination is 260 revolutions per minute, and it operates under a pressure of 115 to 125 lbs.



DIFFERENTIAL EXPANSION PISTON VALVE—IDEAL ENGINE.

The Ideal engine has several strong points of improvement. The self-oiling feature is shown to be a highly efficient device, all the bearing surfaces being by its use supplied with continuous streams of oil, by which the following very apparent advantages are obtained: First, perfect circulation of oil without the care and attention dependent on drop feed and other devices for oiling. Second, important bearing surfaces are dustproof. Third, there is freedom from all splashing and unsightly dripping of oil on the floor and dynamos. In direct connected work of this character, it is extremely important that the dynamos should be kept as free from oil as possible, for it has been proved that short circuits of dynamos are most frequently traced to the throwing or conveying of oil from the engine to the dynamo.



IDEAL ENGINE DIRECTLY CONNECTED TO DYNAMO.

Another point is the improved adjustable piston valve shown. In this valve the sectional spider that governs the pressure of the packing rings is made of composition metal or brass, having a greater ratio of expansion than the metal in the valve proper or its seat. The adjustment is made when the engine is tested at the works, steam being let in between the flanges of the valve, and the adjustment made while hot; when the parts cool, the greater contraction of the brass spider releases the rings, thus preventing sticking and consequent damage to the surfaces when the engine is started after a period of rest. As soon as the valve becomes heated the adjustment of the rings perfects itself.

These engines are remarkable for the simplicity and heaviness of their design, the method of support under the cylinders being original.

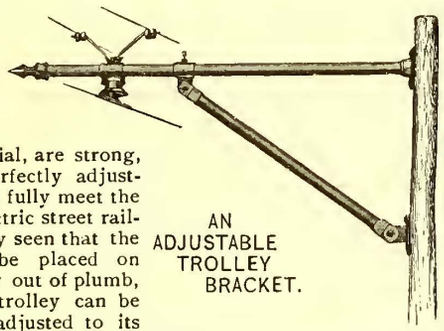
Stern & Silverman, railway contractors, of Philadelphia, Pa., have taken the contract for the reconstructing of the Brigantine (N. J.) Beach Electric Railway. This road was built a year ago directly upon the sand, and was swept away during the storm of October, 1893. It is to be rebuilt upon trestle construction, and bulkheads and jetties projecting into the ocean. The road is to be in operation June 1.

The economy of this combination is quite remarkable, since a water consumption is obtained in service of twenty-three pounds per horse power non-condensing.

The Ideal engine illustrated was manufactured by the Harrisburg Foundry & Machine Works, of Harrisburg, Pa., and was installed at the Bridgeport Copper Company, of Bridgeport, Conn., by the manufacturer's representatives for New York and Boston, W. R. Fleming & Company, 203 Broadway, New York, and 620 Atlantic Avenue, Boston.

Adjustable Trolley Wire Brackets.

The use of adjustable trolley wire brackets is often most convenient, and they have proved most popular with line contractors and constructors. We show herewith a convenient bracket of this kind which is manufactured under the patents of the Burnham & Duggan Railway Appliance Company, of Boston, Mass.



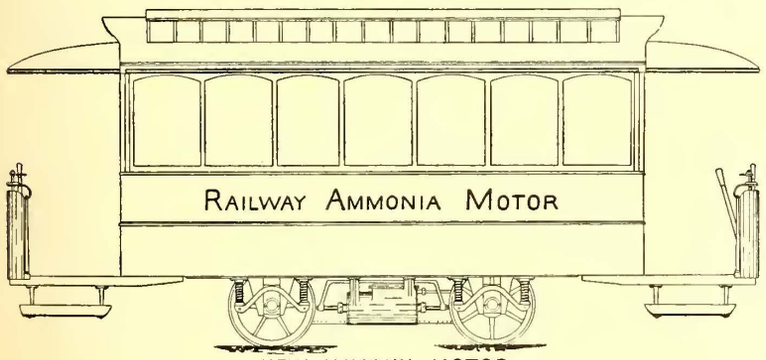
AN ADJUSTABLE TROLLEY BRACKET.

The brackets are made of first class material, are strong, neat in appearance, perfectly adjustable, and, it is claimed, fully meet the requirements of the electric street railways. It can be readily seen that the Duggan brackets can be placed on poles that are crooked or out of plumb, and when required the trolley can be quickly and accurately adjusted to its proper position. All of this can be accomplished without disturbing the pole or the fastenings of the bracket to the pole.

Duggan brackets are extensively used on the principal railways of this country, and in some cases have been substituted for rigid brackets, where experience has shown that adjustable brackets are not only necessary in use but economical in maintenance of line.

The Railway Ammonia Motor.

Our readers will remember that some months ago we published an engraving and description of an ammonia motor that was operated on the 28th Street line, New York City. The motor, as its name implies, was operated by ammoniacal gas, which was used to work a small engine placed under the car. The motor was withdrawn from service some time ago, and its manufacturers, the Railway Ammonia Motor Company, have made some changes in its mechanical construction. Two motors of an improved type are now in course of construction at the works of the De La Vergne Refrigerating Machine Company, 138th Street, New York, the large manufacturers of artificial ice machinery. One of these motors will be ready for exhibition on a New York line about the middle of April.



NEW AMMONIA MOTOR.

The motor car body was built by the John Stephenson Company, Ltd., of New York. The motor is of fifty horse power, and the reservoir can be charged in two minutes to run a distance of thirty miles. The motor is designed to attain a speed of twenty miles per hour, and can climb a grade of 8 per cent. at a speed of six miles, hauling two trailers loaded, or a weight of nine tons.

The principle upon which the ammonia motor operates is the expansion of anhydrous ammonia gas. Anhydrous ammonia can only be kept in a liquid form under atmospheric pressure at 40 degs. below zero, or under greater pressure corresponding with the increased temperature. At about 60 degs. F. it will evaporate with sufficient force to give a pressure of 100 lbs. per square inch on the cylinder of an engine; at 80 degs. F. it gives 150 lbs., and at 115 degs. F., 225 lbs. pressure.

The anhydrous ammonia is charged into a sort of tubular boiler, and surrounding this is an outer tank filled with water at a temperature of 80 degs. This gives an initial pressure of 150 lbs. of ammonia gas, which is passed through the engines shown. The exhaust gas from the engine is discharged into the water tank and is completely absorbed, water being able to absorb 727 times its volume of ammonia gas. The union of these elements also increases the temperature of the water, and consequently the pressure.

Anhydrous ammonia is a cheap product, and is obtained by distilling aqua ammonia. One cent's worth of coal is sufficient to produce six gallons of ammonia, or all that is required, it is said, to operate a car for two miles. As none of the ammonia is allowed to escape, but all is absorbed by the water in the outer tank of the motor car, the material can be used over again practically indefinitely, the only process required being the redistilling, as described above.

The question has often been asked if there is any liability of explosion or ignition of ammonia gas, and has been settled by the best authority that it is not ignitible, and under the conditions in which it is used in the ammonia motor there is no possibility of explosion.

Large Consolidation at Allentown, Pa.

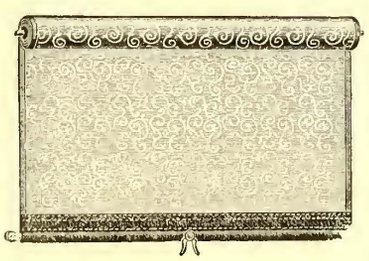
A consolidation of the street railway interests of Allentown Pa., was made last month by a number of capitalists, among which were A. L. Johnson, of Cleveland, and R. T. Wilson, of New York.

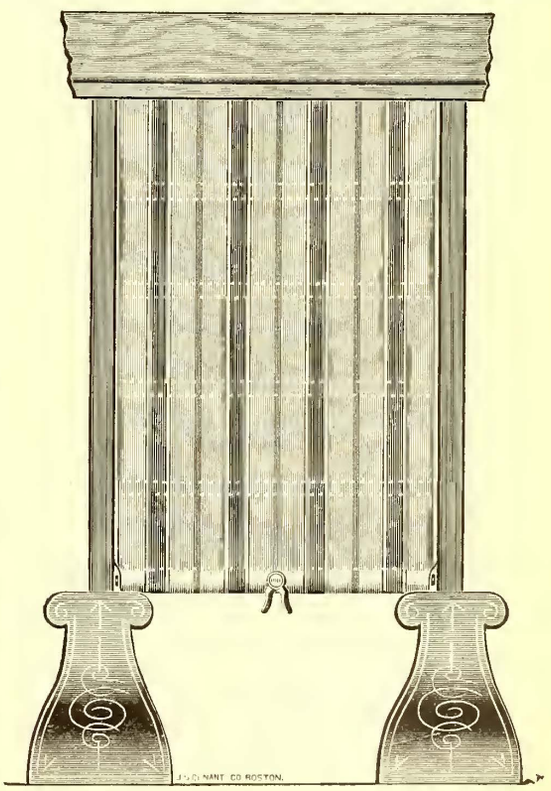
The old company was known as the Rapid Transit Company, and was largely owned by the Industrial Improvement Company, of Boston. In addition to this property, the syndicate has secured a baseball ground, shooting park, picnic grounds, etc., as well as the common stock of the Allentown Power Company, which had a contract for lighting Allentown. A. L. Johnson has been elected president of the new company.

Curtains for Street Cars.

The substitution of curtains for wooden blinds, which is a noticeable feature on many of the new steam and street cars, has been brought about in the interests of health, convenience and economy. The space for receiving lowered blinds in street cars is a receptacle for all sorts of filth. Hence, the employment of blinds has many opponents. On the other hand curtains can be dusted or washed, the cloth can be cheaply replaced, using the same old fixtures, and the convenience in use is beyond comparison. A curtain that will run easily, stop at any point, which cannot be run up on the fly when released, is strong, durable, cheap and convenient, is greatly to be desired. By a new process, open car shades are rendered mildewproof and waterproof, thus lasting much longer.

Two styles of curtains, manufactured by the Davis Car Shade Company, of Portland, Me., are shown herewith. The holding device employed with these shades has been described in former issues. Among the recent orders closed by this company is one for shades for 250 cars with the People's Traction Company, Philadelphia.





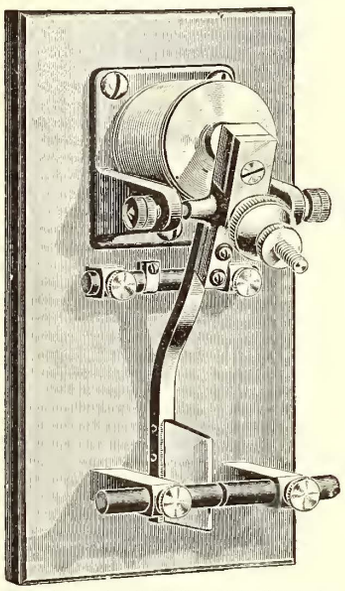
CURTAINS FOR STREET CARS.

THE Newburgh (N. Y.) Electric Railway Company was incorporated February 28; capital, $150,000. Directors: George L. Nichols, George M. Huyett, William M. Tobias, Henry R. Newkirk, of Brooklyn; Harry C. Norton, of Newburgh, and others.

A New Lightning Arrester.

The W. S. Hill Electric Company, of Boston, has put upon the market a new lightning arrester, known as the Doane arrester, which we illustrate herewith. This arrester possesses several ingenious features which should draw the attention of station managers. In it the short circuit is made through a non-inductive resistance sufficient to limit the current that will follow the lightning discharge to an amount that can do no injury. In a 500 volt circuit with a non-inductive resistance of 100 ohms in series with the arc, only five amperes can follow the discharge.

In this instrument the arcing points are carbon rods, shown in the cut, the resistance being placed in series with the line. The cutting of the arc is made by a slate block, on the end of the movable lever, and raised between the carbon points by the action of the coil, shown in the cut. No current can pass through any of the movable parts of this arrester, and as only a limited amount passes through the carbons they are practically indestructible.

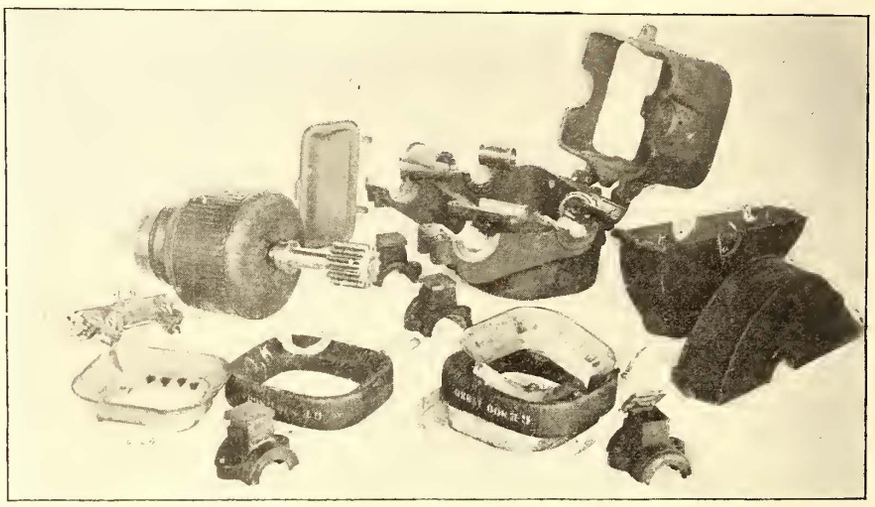


A NEW LIGHTNING ARRESTER.

A Dissected G. E. 800 Motor.

The G. E. 800 motor has gained for itself numerous testimonials from practical railway men for excellent qualities. Its light weight, in particular, appeals to the economical manager, who finds that by its use the wear on his track is necessarily reduced. The cost of the maintenance of the motor has been found very low. Some have been run for nearly a year without entailing a penny of expense for repairs.

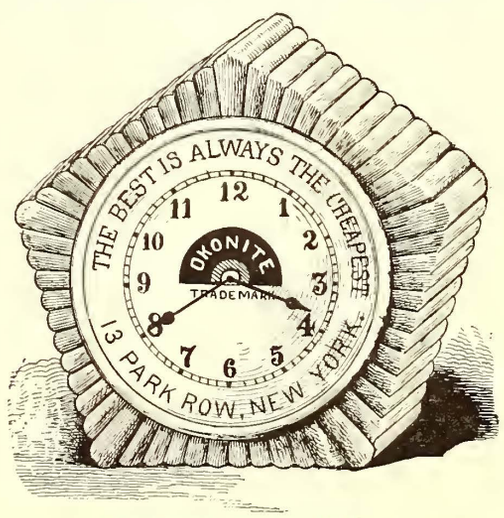
The cut shows the method of construction of this motor. The armature is of the iron clad type with embedded winding. The spools are wound and set in cup shaped field pieces, which are bolted to the upper and lower frames. The bearings are lined with the best quality anti-friction babbit, and the small door in the top frame of the motor allows of ready access to the brushes. When the motor is closed, and mounted on the car it is absolutely water and dust proof, and under the control of the equally well known type "K" controller, forms with it an excellent pair.



A DISSECTED G. E. 800 MOTOR.

A Tasteful Paper Weight.

The Okonite Company, of New York, which has the reputation of doing things up in a very handsome manner, has recently sent us a very novel and tasteful paper weight. This is of glass, in the form of a pentagonal prism, and contains a small clock which is a first rate time keeper. The face of the clock bears the familiar trade mark of the Okonite Company, and the motto of the company, "The best is always the cheapest."



A TASTEFUL PAPER WEIGHT.

The Geneva & Waterloo (N. Y.) Electric Railway enterprise has been revived again. It is averred that the road will be built this year. The right of way has been mostly secured, it is said.

The City Council of Akron, O., has passed the ordinance granting the Akron & Cuyahoga Falls Street Railway Company permission to extend its lines into the city.

New Type of Car Seat.

The accompanying engraving shows a novel type of car seat, built by the Gilbert Car Manufacturing Company, and placed in ten Kentucky and Indiana cars constructed by that company. It differs from other car seats of its kind in that the back does not turn over when reversing, but simply moves from side to side. It is claimed that in this way the seats can be placed much nearer together, and can be more easily and quickly reversed at the same time, as fast as the conductor can walk through the car. It has the tilting seat, as in all steam railway car seats, and when the back is moved in one direction the seat travels in the opposite direction, raising the front. Ends of arms are not used, so as to make the seat more convenient for entering or leaving.

Mr. Anger, of the Gilbert Company, has also devised a center lock, not shown in the engraving, for locking the back of this style of seat, and which can be used if required.

NEW TYPE OF CAR SEAT.

A Complete Line of Overhead Material.

A collection of overhead parts sold by the New York Electrical Works is shown herewith. The engraving is from a photograph taken last month of one side of this company's New York office.

The section insulator of which two views (side and bottom) are shown, has, in common with the full line of crossings and switches, the horizontal run for the trolley wheel. The further advantage claimed is the carrying the current from each end to the center by strips of metal on opposite sides of the central running piece of wood. This is an advantage in many ways and is very fully covered by the patent. There is no point on the line from which current cannot be taken by the wheel, and yet there is no possibility of a burnout. The car lights do not go out in passing over it, and it avoids shock to the motor, especially on heavy grades.

The rigid right angle crossing and the diagonal, which is adjustable to any angle, have a horizontal run for the trolley wheel. There being no dip, the sparking is greatly reduced and the tendency for the wheel to jump off the wire, so noticeable at crossings, especially when taken at any speed, is claimed to be overcome. The method of holding the wire down is by a key or wedge which is forced down on the wire by a cap screw, as shown in the cuts of crossings, switches and section insulators. The method of clamping the trolley wire in the switches to hold it against the horizontal strain or pull of the wire is similar, using a cap nut and key which bends the wire into a depression left in the body of the switch, or over a hump or projection.

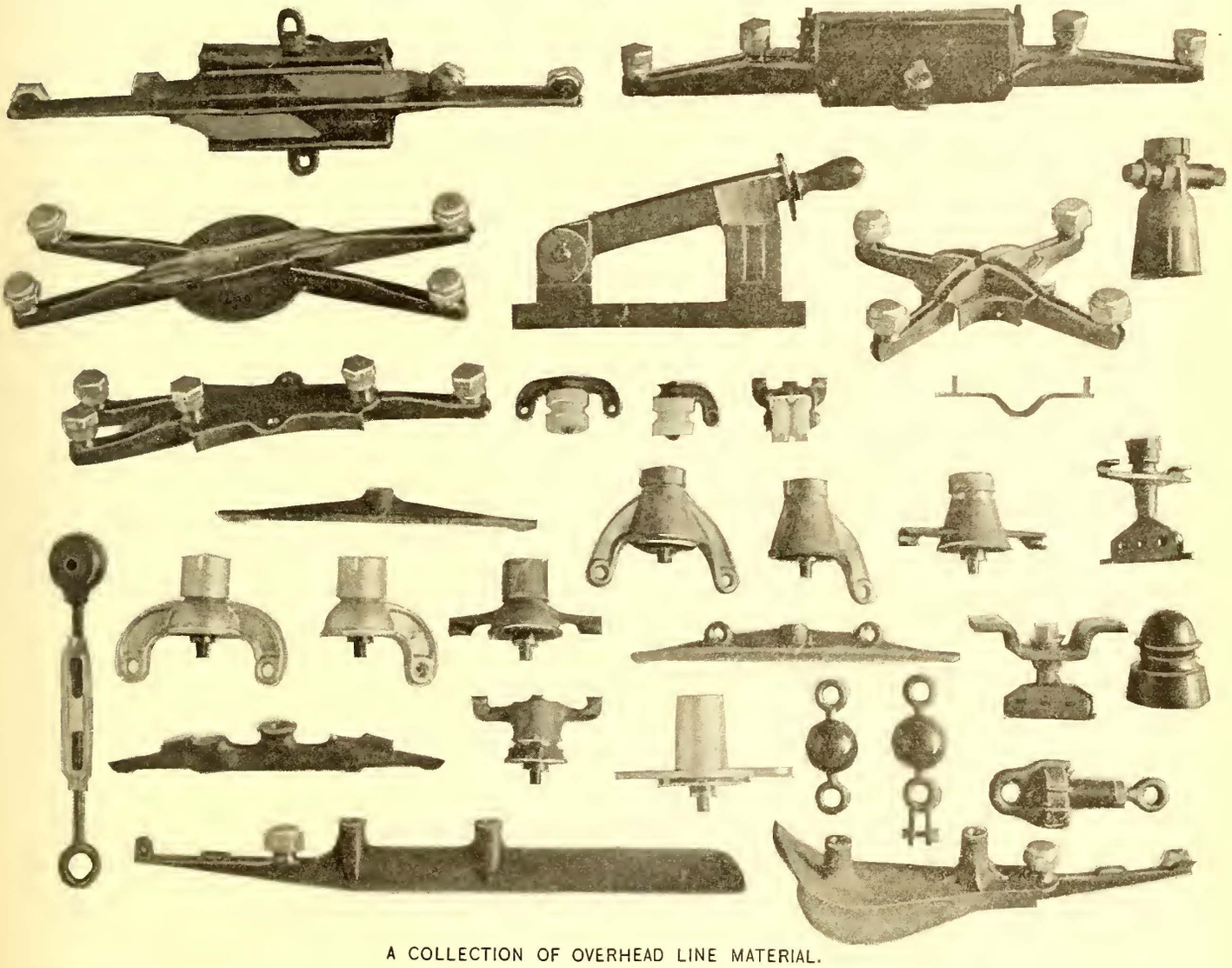
There are several kinds of straight line hangers, pull-offs, solder ears, splicing ears, anchor or strain ears, and mechanical clips also shown, as also a spring hanger for bridge work or under elevated roads, and a very simple and neat car house hanger.

The insulated turnbuckle shown in the cut is one that was tested in a Riehle testing machine, and gave way at the opposite end from the insulation at a strain of 6,085 lbs.

The mechanical clip is giving great satisfaction wherever used, and is especially valuable for emergency work.

While this company makes solder ears and material of all kinds to use with solder, its especial attention is given to mechanical devices obviating the use of solder, and it has a full line of such material.

The insulating compound used in its devices has shown wonderfully high resistance in a series of tests made at one of our foremost institutions of learning. Of a lot of hangers submitted to a breakdown test, none broke through at less than 5,000 volts, and some ran up to over 20,000.



A COLLECTION OF OVERHEAD LINE MATERIAL.

General Electric Exhibit at the Midwinter Fair, San Francisco, Cal.

The building officially called the Palace of Mechanical Arts is the one containing most of the electrical exhibits. The exhibit of the General Electric Company occupies a space less prominent in location and smaller in size in proportion than that occupied by the same firm in Electricity Building in Chicago. At present the electric field on the Pacific Coast lies chiefly in the way of transmitting power, and its employment for the propulsion of street cars, mining work, etc., owing partly to the high price of coal, and on the other hand to the abundance of water power in the higher altitudes. For this reason evidently the General Electric Company made a specialty of its mining and power transmission apparatus. The standard car equipment is also shown, consisting of a Bemis truck, having mounted upon it two G. E. 800, single reduction, iron clad motors, fitted up with the new style of suspension, allowing the larger part of the weight of the motors to be carried on springs, instead of being thrown on the axles.

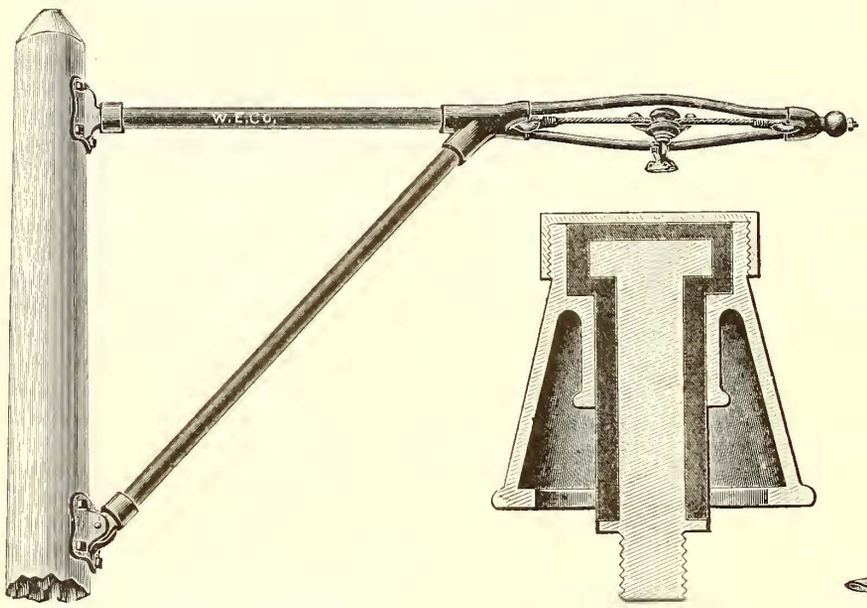
There is also exhibited a complete power transmitting plant with three-phase current. The generator is of thirty-five kilowatt capacity, and is driven by means of a thirty-five kilowatt motor. The current of the generator is led to a switchboard containing the usual set of instruments, such as indicators, recording wattmeters, switches and fuses, and the regulator for the field winding of the motor. From this switchboard the "line" is carried on oil insulators, after having been transformed in the step-up transformers from a potential of 300 volts. to one of 6,000 volts, to the switchboard of the receiving station. Step-down transformers are employed there, reducing the voltage to 300, under which pressure the current is delivered to a ten horse power, three-phase motor. This is belted to a "drill" generator, or dynamo having rotary bushes, such as required for the operation of the percussion drill. The drill exhibited is of the General Electric type. Connection is made by means of a cable armored for its better protection in usage in the mines. A ten horse power mining locomotive, portable mining outfits consisting of a diamond drill and hoist operated by the same motor, motor and pump, sinking pump, etc., are also shown.

A board filled in exposition style with railway supplies, etc., a few fan motors which attempt to make things lively by means of colored ribbons attached to their frames and floating in the air currents produced; a search light, twenty-four inch projector, four large ball clusters on poles, contaning each forty sixteen candle power lamps and two cubes of fifty-four sixteen candle power each, complete the exhibit so far as the Exposition space proper is concerned.

A 200 K. W. railway generator furnishes current for cornice lighting, the lamps being connected five in series, also for the motor of the tower elevators, and is driven by a double piston valve engine of the Joshua Hendy Machine Works, of San Francisco, cylinders 14 × 18 ins., belt connected. The cylinders are oiled by the Acme light drop lubricant. This dynamo is on the opposite side of Machinery Hall, near the boiler house, where also are found eight arc light machines of Thomson-Houston make, each of fifty light output. They are driven, four each, from a countershaft, which in turn are belted, one to a Buckeye automatic cut-off, slide valve engine of 200 H. P., 140 revolutions; cylinders 14 × 24 ins., the other one to a 150 H. P. Russell engine of 190 revolutions, cylinders 13 × 20 ins., and fitted with the Russell automatic cut-off slide valve and flywheel governor.

Combination Pole Bracket.

Superintendents and managers of electric roads have long felt the want of an improvement in bracket suspension. Among a number of new devices for bracket construction which have been placed on the market within the last few months, Wood's combination bracket stands out as one embodying all of the improvements which tend to make it a practical, simple and durable device. The pole bracket illustrated herewith was designed to overcome all of the difficulties experienced in bracket suspension, and it can be thoroughly depended upon either in single or double track work. The principal objection to bracket suspension is the rigid construction and the continual hammering effect received from the trolley wheel, which is not only detrimental to the trolley, trolley wheel and line, but tends to loosen the bracket and increase the arcing and burning.



COMBINATION POLE BRACKET.

This device entirely obviates this trouble. By reference to the above cut it will be seen that a straight line hanger is to be used for supporting the trolley wire instead of the ordinary bracket hanger. The hanger is held in place by a piece of one-quarter or five-sixteenths inch span wire about three feet long, which affords a *flexible* support for the insulator. This bracket is similar in construction to the ordinary bracket now in use, differing only in the fact that two curved arms which support the span wire extend over the brace casting. The span wire is easily adjusted by means of an eye bolt at the extreme end of the bracket. All objections to rigid construction have been overcome by the use of this bracket, and the liability of breakage is reduced to a minimum. This bracket is being placed in the market by the Wallace Electric Company, Chicago, and was designed by M. M. Wood, the company's electrical engineer.

Under the caption of "Anti-Friction Materials" *Cassier's Magazine* for March publishes an article by K. Hedges, M. Inst. C. E. The use of oil as a lubricant, says Mr. Hedges, is to separate the rubbing parts of machinery and to diminish the friction of metal upon metal by an intervening film of oil. If the oil is supplied in sufficient quantity to cause the entire separation of the metals, the friction is reduced to the measure of the viscidity of the oil. Where an insufficient quantity of oil, or a poor quality, is used, friction is caused by the interlocking of the metals forming the revolving and stationary parts of the bearings. For if the bearings are examined under a strong magnifying glass their roughness is very apparent, and the oil used, under such conditions, carries along with it particles of metal that are gradually torn from either the revolving shaft or the bearing, and these particles aid greatly in increasing the friction and causing further wear and cutting. It is a well known fact that heavy lubricants effect a better separation of the metal, and with less wear and tear, than lubricants that are more limpid. Of all the various materials tried, graphite, especially flake graphite, is proving quite successful in reducing friction and curing hot bearings. The conditions of success, so far as lubrication with graphite is concerned, are: The graphite must be soft and yielding, absolutely pure, free from grit, and the flake of uniform size.

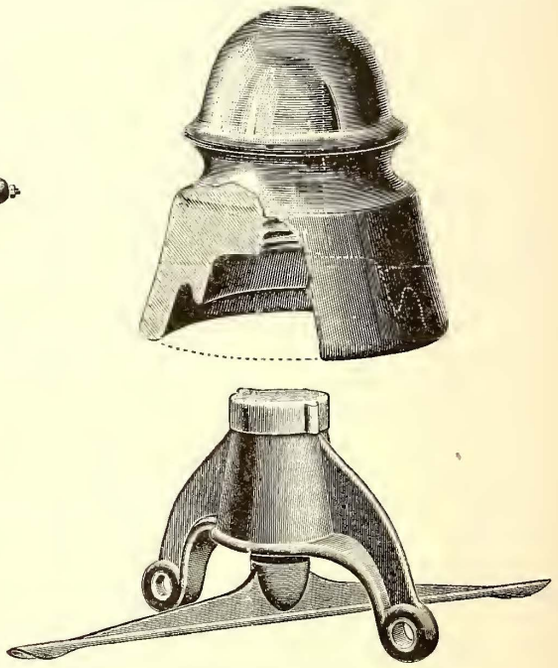
Large Motor Equipment for Brooklyn.

The Curtis Electric Manufacturing Company, of Jersey City, announces that it has closed with the Brooklyn City Railroad Company for 120 electric car equipments. The motors furnished will be its well known 30 H. P. "Box" type. These motors have been in use on the lines of the Brooklyn City Railroad Company for the past two winters, running in competition with those of the two largest electric companies. The fact that this large order went to the Curtis Company shows how highly its apparatus is esteemed by the officers of the road.

New Types of Line Appliances.

The accompanying illustrations show some line appliances sold by the Lynn Manufacturing Company, of Boston, Mass. The construction of the appliances can be easily seen from the sectional and other engravings shown herewith.

Each piece of line material supplied by this company is made of bronze or metal castings which have been thoroughly tested before leaving the factory, and is insulated with "Sinew Compound" which has achieved a reputation for its insulating qualities, toughness and durability.



SOME NEW LINE APPLIANCES IN SECTION AND READY FOR USE.

The Lynn Manufacturing Company has issued an attractive catalogue giving descriptions and illustrations of its special line and overhead electric railway material.

Improvement in Paneled Switchboards.

The disastrous results usually incident to short circuits in power stations are too well known to, and have been too vividly impressed upon, street railway managers to need further description here. A precautionary device, which could always be relied upon to give complete and independent control of each section into which the system is divided, has for years past been a real necessity in every complete station equipment. This section control is needed to avoid the disablement of the entire system by trouble on any one section which may arise from a variety of causes. Furthermore, a proper system of feeder distribution and section control serves another useful purpose, for if a short circuit on one section cut off all the current, a severe mechanical strain is placed upon the station machinery, and still another strain occurs if the load on all the sections is thrown on simultaneously. A suitable division of the system into sections, each of which is controlled at the station, is therefore desirable for every electric railway.

In order to provide for this convenient and necessary control, the General Electric Company has still further projected its feeder panels, which are made for different numbers of feeder circuits; that known as from "C" adapted for two circuits, being shown in the illustration. It is fitted with a circuit breaker, two ammeters, and two single pole switches for each feeder.

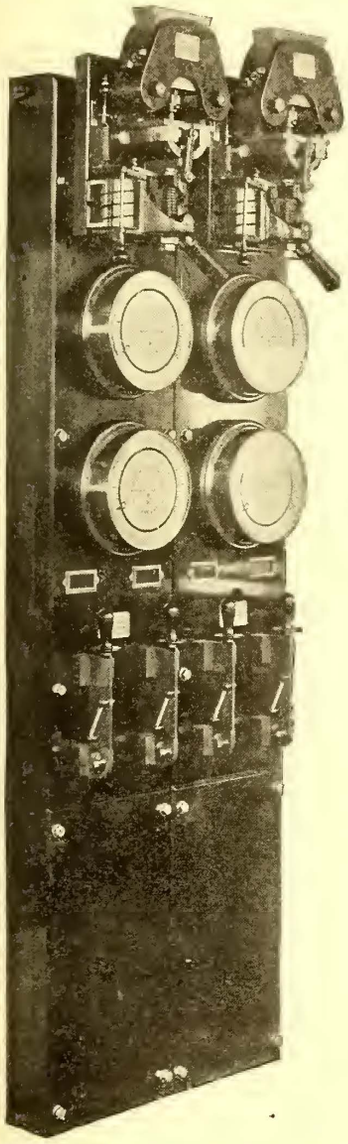
The automatic circuit breaker is known as form K, and is of the latest and most improved design. It will interrupt repeated short circuits without damage to itself, and can be instantly reset. The magnetizing coils will carry 1,200 amperes continuously, and can be adjusted to 1,800 amperes for temporary overloads. The fuses are of excellent design and can be cheaply and quickly replaced. They are of copper and are coiled to secure some electric magnetic effect and diminish the flashing when melting from overload. The terminals are made with a view to avoid the damage from any ordinary short circuit.

These panels are designed to be bolted side by side with the gen-

erator panels, and are supported by vertical angle irons, which can readily be bolted to the angle irons furnished with the generator panels. The bus bar is of the same height, so that the feeder panels can be connected in circuit, by simply extending the line bus bar of the generator panels.

Some of the forms of these panels are equipped with circuit breakers and some with fuses. The circuit breaker acts more quickly in opening the circuit and can be more quickly closed. The fuse acts more slowly, but when blown cannot be replaced as quickly as the circuit breaker can be closed; and although the first cost is less, the cost of renewing fuses is greater than that of maintaining the circuit breaker.

Feeder panels thus made will prove valuable acquisitions to every station switchboard. They have already demonstrated their indispensability and are now being made in large numbers to meet a rapidly increasing demand.



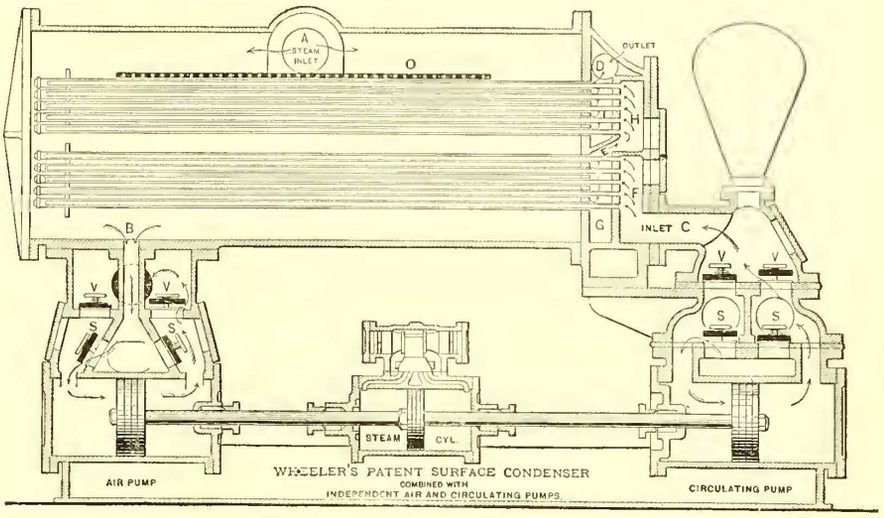
FEEDER PANEL FOR SWITCHBOARD.

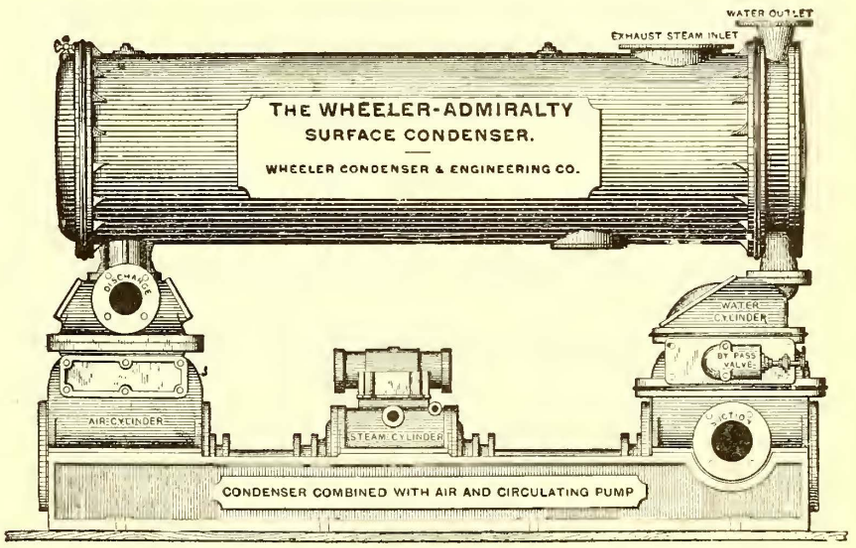
Wheeler Surface Condensers.

The use of Wheeler surface condensers is extending so rapidly in electric and cable railway power houses that an explanation of their peculiar features and method of operation will be both interesting and instructive.

The Wheeler condenser is the result of extensive and wide experience in condensing steam. The principle on which it is constructed is that of exposing as much surface as possible of the cooling medium to the exhaust steam, and producing a uniform temperature in the condenser, making one portion as efficient as another. The tubes are arranged so that they are free to expand and contract, without the use of packings of any kind. The tubes are also so arranged as to be easily removed, so that the condenser can be cleaned and kept in working order without serious delays or stoppages.

Referring to Fig. 1, the exhaust steam enters the inlet nozzle, A, and is distributed evenly throughout the chamber by the baffle plate, O. After being condensed it passes, with the vapors, to the air pump through the outlet, B. As will be noticed, there is ample room in the bottom of the condenser for the water of condensation, so that it cannot accumulate and come in contact with the lower tubes and become chilled. The cooling water enters the condenser from the circulating pump through the inlet, C, and passes into the chamber, F. From this point it enters a series of small tubes which extend inside of larger tubes to a point near the back end of the latter. In returning through the larger tubes, the water passes through the annular space between the two tubes. It is thus spread out, giving a high velocity to the inner skin or surface of the large tube, which sweeps away very rapidly the heat of the steam on the outer surface of the latter tubes. From G, the water passes to H, is again subjected to the same operation as before, and leaves the condenser through the passage nozzle, D.





FIGS. 1 AND 2.—WHEELER SURFACE CONDENSERS.

Fig. 2 shows an external view of the Wheeler "Admiralty" type of condenser, which is not only used extensively in marine service, but is very popular in connection with stationary engines. The tubes of this condenser are of the plain, single type, secured with patent brass screw gland ferules, etc. Either type of condenser can be mounted upon the air and circulating pumps, as shown in both cuts, or is furnished separately to be operated by centrifugal pumps belted to the main engine.

For railway power stations and electric light plants the surface condenser is rapidly taking the place of the jet condenser, owing to the safety and security which it adds to the engine, in addition to the value of the vacuum and the usual advantages gained by the addition of any condenser. In localities where water is unsuited for boiler purposes the surface condenser is of special value, because the water of condensation does not come in contact with the circulating water, and consequently is returned to the boiler in a pure and distilled state.

The Wheeler Condenser & Engineering Company has offices at 39 and 41 Cortlandt Street, New York, and its works at Carteret, N. J., where are the best facilities in the line of special tools, etc., for making condensers of every description.

THE Philadelphia Electric Elevated Street Railway Company was incorporated on March 13, with a capital stock of $200,000. The president of the company is Wm. D. Marks. Others interested are D. S. Lindsay, Wm. J. Hamilton and Joseph Blair, all of Philadelphia.

THE Washington, Burnt Mills & Sandy Spring Railway Company has been incorporated by George W. Cissell, Ralph L. Galt, of the District, and Asa M. Stabler, John Miller, of Maryland, and others.

The Manufacture of Veneer for Car Seats and Ceilings at Newport, Vt.

W. P. SEGUINE.

Those conversant with the manufacture of veneer are aware that there are several ways in which it is cut. For the information of those unacquainted with the several processes, the following description is given of the method of rotary cutting as practised every week day in the year at the mills of the Frost Veneer Seating Company in Newport, Vt., and Antigo, Wis. The other methods of cutting logs for the manufacture of veneer are by sawing and slicing, each of which has its advantages.

At Newport, Vt., the Frost Company has a mill 40×85 ft., three stories high, and with a saw room on the lake side 24 ft. square. This building is all occupied for the manufacture of veneer, and in connection with this building is a factory 40×100 ft., where the veneer is made up into many different forms, such as chair seats, car ceilings, settees and many other articles too numerous to mention.

But the present article has only to do with the cutting of the veneer, beginning with the logs in Canada ninety miles from the mill. These logs are shipped over the Quebec Central Railroad to Newport, in the winter time, and unloaded on top of the ice, which, for the benefit of those unacquainted with the winters of that neighborhood, it should be said, is often three feet thick. Those logs that are not cut up go to the bottom of the lake, which inside of the boom is from four to twelve feet deep. It is very essential that veneer logs be kept under water during the summer season to prevent season checking and sap stain. The logs are taken from the lake by two men in a heavy boat. This boat is provided with a windlass, and the logs are raised from the bottom with a pair of tongs. Four are attached on either side of the boat, when with the windlass the boat is pulled to the foot of the slip. Here a bull chain is attached to two or three of the logs and they are pulled into the saw room by steam power.

In the saw room the logs are cut in blocks, from four to six feet long, by means of a patent saw machine, shown in Fig. 3, and which well performs the work for which it is designed. About 2,500 ft. of logs are cut up daily and put in the steam tank, where they are steamed from six to ten hours. As there are two tanks, one is being filled while the other is being emptied. From the tank the logs are rolled to the cutting room, and the bark taken off; this process in veneer parlance is termed "rossing." They are then centered, which means that a hole is bored in each end about one-half inch deep. With a crane they are then swung into the machine illustrated in Fig. 2.

The log rotates toward the knife which is slowly but surely creeping up to the log at a rate, which can be gauged by the operator, so as to cut veneer so thin that it will take sixty layers to make an inch, or by giving it a more rapid rate, so thick that it will require only four of these sheets to make an inch. In other words, the machine can be gauged so as to cut veneer any thickness from one-sixtieth to one-fourth of an inch. After the log is rounded up it is possible to take the sheets off in a continuous piece to the core, which is six inches in diameter, but at Newport the sheets are usually pulled on to a table twenty feet long, and are broken up, running layer upon layer. Two men at the far end of the table then cut the sheets in squares, as desired for use. By the aid of little knives, called "spurs," set at right angles to the log, the veneer can be cut any desired width. The widest veneer which can be put on the machine shown is six feet, but the bulk of the veneer is cut in widths of from fourteen to twenty-one inches. It requires four men to operate the machine, two to cut the veneer at the end of the table, one to take off the bark, and two to cut up the logs and put them in the tank.

From the cutting room the veneer is taken on an elevator to the dry rooms, where girls place two sheets at a time in racks made for the purpose. The rolls are taken to another dry room, and spread out, stood on edge, or built in pyramids, as the case may be. The dry veneer is taken out by one man, and carried to the sorting room, where it is graded for the different uses to which it is best adapted. From this room it is taken to the glue room, but as the object of this article is only to describe the manufacture of veneer, we will leave the subject with one or two casual remarks.

A person standing by the veneer machine with a perfect log about twenty to twenty-six inches in diameter, and seeing the veneer roll off, is led to exclaim, what a mine of wealth there must be in cutting veneer. But reverse the thing, and get a poor log in the machine, and see armful after armful go into the fire room. The exclamation will be of a very different character. Many apparently good logs are found to be nearly worthless when cut in veneer. The logs principally used are birch, although some elm and bass are used in the work.

More might be said on the subject, but the principal points have been described and it only remains to give a short sketch of W. P. Seguine, general manager of the railroad department of the Frost Veneer Seating Company, whose portrait appears on this page.

Mr. Seguine was one of the earliest pioneers in perforated seats and veneers. While in the service of the late firm of Gardner & Company, he put into use the first veneer seating ever used by a public conveyance. This was in the old steamer "Shady Side," a trifle over twenty years ago. In this test veneer gained public favor and also began for Mr. Seguine a record as a railroad supply man. At the building of the Third Avenue L road, New York, he seated all the stations from the South Ferry to Harlem. Following this came the building of the West Shore Railroad, and he furnished all stations with seats and settees from New York to Buffalo. He has also done work for the Pennsylvania Railroad system for twenty years, and his veneers are now in all parts of the world.

Mr. Seguine is a thorough mechanic and understands his business from the log up, finding himself at home in the veneer mill, in the factory or at the setting up of his work.

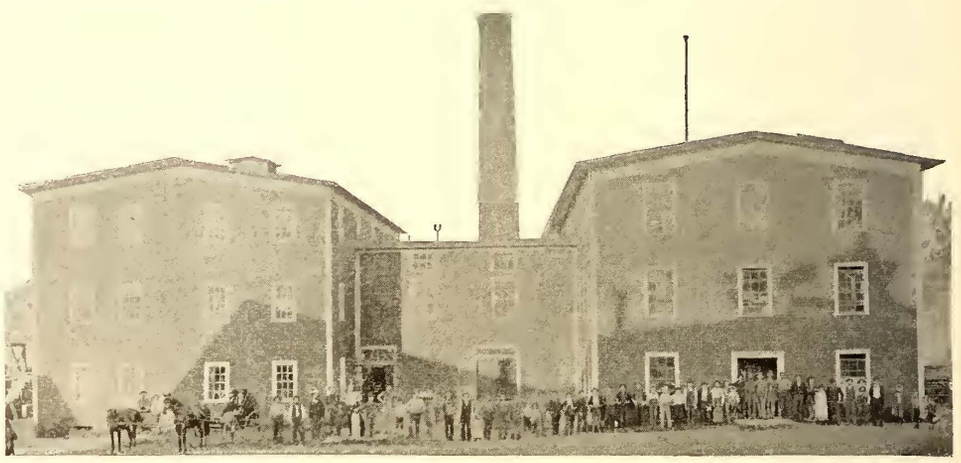


FIG. 1.—FROST VENEER SEATING CO.'S FACTORY—NEWPORT, VT.

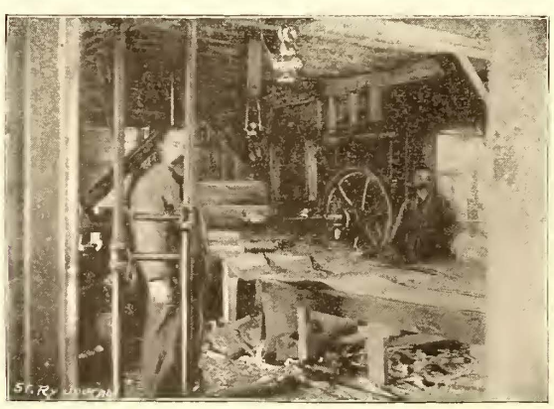


FIG. 2.—CUTTING ROOM—VENEER FACTORY, NEWPORT, VT.

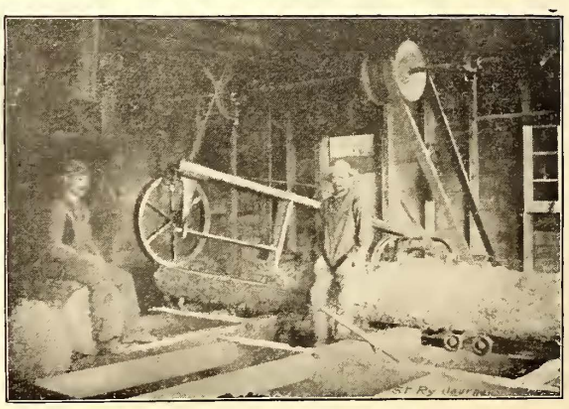
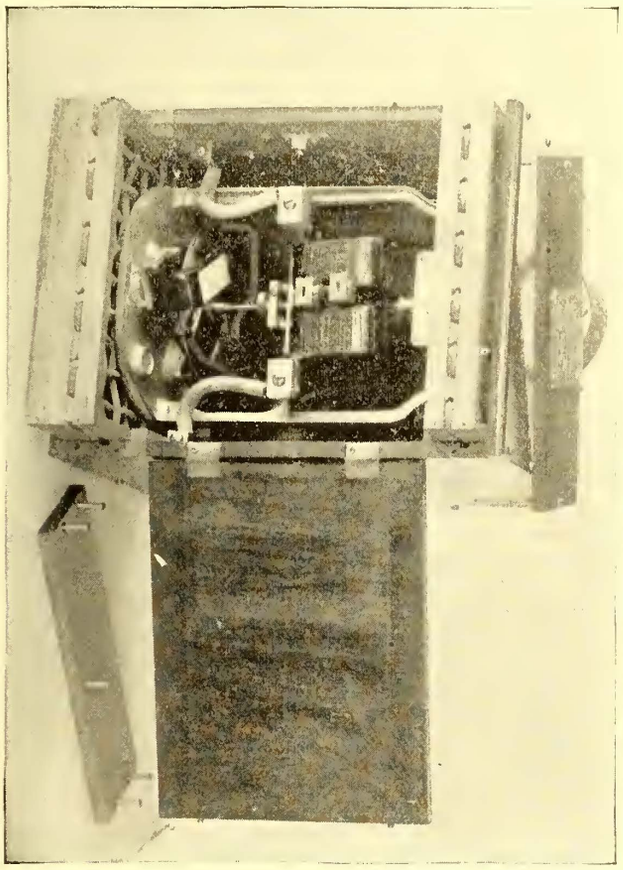


FIG. 3.—SAWING ROOM—VENEER FACTORY, NEWPORT, VT.

Portable Thomson Recording Wattmeter for Street Car Testing.

It is frequently necessary in electric street railway practice to test the power consumption of the cars, and heretofore the General Electric Company has furnished a 500 voltmeter mounted rigidly within a mahogany box for this purpose. This was, however, found not to be without faults. The mechanism being rigidly mounted, the meter was subjected to violent jars which frequently interfered with its accuracy, shortened its life and rendered it unsatisfactory. Experiments have been going on for some time past to evolve a satisfactory portable recording meter for the purpose named, and the General Electric Company now announces one which will satisfy the many requirements of street railway service.

The meter in question consists of a Thomson recording meter mounted on a skeleton metal frame, and having a capacity of twenty-five amperes at 500 volts. It is mounted within a polished wood carrying case about two-thirds the size of the former type. Instead of



PORTABLE RECORDING WATTMETER.

being rigidly mounted in the case, the meter is suspended between two networks of interlaced rubber cord, or, as it were, between two rubber hammocks. This method of suspension saves the meter from violent agitation or shocks, and renders its accuracy reliable. It is the first time that this system has been applied to the recording meter, and it is a feature that will recommend it to all street railway men. The meter may be used placed upon the floor of the car with absolute safety and convenience, and gives perfectly accurate readings.

This portable meter is normally rated at twenty-five amperes. In testing cars, however, the current will frequently, for short intervals, very greatly exceed this, as when starting, or upon heavy grades, but this meter is so constructed as to record these sudden bursts of current accurately, and enormous overloads may be carried through the meter for short intervals without detriment to the instrument or impairment of its accuracy.

The meter has been subjected to careful and severe tests with absolutely satisfactory results.

An Electric Signaling System for Cable Roads.

An electric signaling system whereby the necessary signals may be transmitted from any point on the road to the power house, has been recently put in operation on the Third Avenue cable road in this city. This system is the invention of Frederick Pearce, of New York. The signals consist of a certain number of strokes on a gong, and are sounded and registered at all the power houses. Any arbitrary arrangement of signals may be used. As employed on the Third Avenue road, one stroke of the gong means "Stop the cable"; two, "Go easy"; three, "Go ahead, O. K.", and four, "Fire." There are two gongs in each power house, the larger one of which rings for signals relating to the cables operated from the 65th Street power house, and the smaller to those operated from the Bayard Street power house. There is also an annunciator connected with the gong which shows whether the up or down cable is in trouble.

The signaling apparatus consists of devices called automatics. These are contained in small boxes covered by manholes at certain points along the line. The manholes are placed as nearly as possible on the north side of every other cross street, and where the streets are numbered, on those bearing even numbers. The boxes are also numbered, where practicable, to correspond with the number of streets they are nearest to. Every signal received at the power house is printed upon a tape and the time of receipt recorded automatically. Whenever a stop signal is received, a wrecking wagon from the nearest repair station is sent to the point from which the signal is sent. There being five of these stations along the line of the road, it can be readily seen that assistance can be rendered at any point in a very short time.

The automatic or signaling apparatus consists of a bronze cylinder nine inches long and three and a half inches in diameter, closed at one end by a diaphragm, and at the other by a solid cap. In the interior of this cylinder is the mechanism for automatically transmitting the number of the box. This mechanism is attached rigidly to the framework of the manhole and the box has a slight play about it, governed by the flexible diaphragm at one end. At the closed end of the box is attached a handle that may be swung into a vertical position, by which the box may be raised to send the signals.

When it becomes necessary to send a signal, the conductor of the car proceeds to the nearest manhole, raises the corner and lifts the handle of the automatic to a vertical position, then by raising the automatic, an electrical circuit is broken, and signals sent to the power house according to the number of times the automatic is raised. The general signal used is one stroke of the gong, meaning to stop the cable. The lifting of the automatic to send the first signal winds the interior mechanism, whereby the number of the box is transmitted. When the conductor replaces the manhole cover to return to his car the handle is pressed down against a diaphragm on the top of the box, thereby releasing the mechanism and transmitting the box number. The handle may also be depressed by hand if necessary. Electrical connections may be made at each manhole and telephones attached to communicate with the power house if required.

The automatics are by their construction air and moisture proof, and there is nothing to get out of order. As this apparatus operates on a closed circuit, any defects in the line are at once noted at the power house, and may be repaired.

Work at the Factory of the Barney & Smith Company.

This large and progressive company is more than satisfied with its advent into the street railway field. Its managers report an excellent trade. A trip through the extensive shops of the company was recently made by a representative of this paper, who saw evidences of great activity. He noticed under construction seven open cars for the Mt. Adams & Eden Park Incline Railway of Cincinnati, six of which are grip cars, with seven reversible and one stationary seats, and one trailer, with seven reversible and two stationary seats, one on the outside. These cars are all built with one bulkhead, as they are to run on a loop. They are twenty-five feet six inches over all.

The company is also building for the Mt. Adams & Eden Park Incline Railway eight open, electric motor cars, thirty feet long, with seven reversible and two stationary seat, and no seats on the platforms. These cars are built with bulkheads on both ends, and when completed will certainly present an elegant appearance.

But the pride of the shop is the lot of forty cars now under construction for the Cincinnati Street Railway Company, of Cincinnati. Part of these have been delivered, and reflect great credit upon the company. They are being built twenty-seven feet over all, and eighteen feet on the inside, and have detachable vestibules on one end. The side windows are four in number, and consequently very large, being 48×30 ins., of French plate, bevel edge glass, very highly polished. The end doors are double hung, patent rollers. The interior is finished in cherry, highly polished, and elaborately carved. The ceiling is in birdseye maple handsomely decorated with variegated leaf. The thick windows are glazed with three-sixteenths inch, polished, bevel edge plate glass, with chipped center. The strap rails are of solid bronze tubes, instead of the old-fashioned wooden rail ordinarily used. The seats are upholstered, and are covered with crimson plush. Burrowes curtains, forty-eight inches in width, are used. The Cincinnati Street Railway Company is to be congratulated on the elegant appearance of these cars.

Also complete and ready for shipment is a full equipment for the Capitol Street Railway Company, of Frankfort, Ky. These cars are all mounted on Barney & Smith new improved trucks, are sixteen feet long (inside), and make a very stylish showing. One of the cars is a twenty-two foot body, mounted on a pair of Barney & Smith's double trucks, and is intended for hauling freight. It is equipped with four twenty-five horse power motors, and will be expected to draw freight cars to and from factories located on a belt line of this road. At the factory are also ten cars for the Philadelphia Traction Company, all of which are to be open, twenty-seven feet long, with six reversible and two stationary seats. These cars will have bulkheads on each end.

The Barney & Smith Car Company has also an order from the Canton & Massillon Street Railway Company for nine open cars, twenty-six feet over platforms, with seats all reversible, and vestibules on both ends, seven of which will be mounted on Barney & Smith's new improved trucks.

Eighth Annual Meeting of the International Street Railway Association.

(*From Our Special Correspondent.*)

The programme for the eighth annual meeting of the International Street Railway Association, which will occur at Cologne, next August, is as follows:

1. TRACK CROSSINGS.

The subject of crossings appeared in the programme of the general meeting of 1893. The following request was then made: "State what proportion of the expense of the installation and maintenance of grade crossings between steam and street railway lines, such as gate-houses, gates, signals, etc , is borne by the steam railway company and by the street railway company.

Have you any new information to furnish or new observations to present in regard to this question?

2. LUBRICATION.

The programme of the general assembly of 1893 contained the following questions: "What lubricants are employed on your locomotives and cars? State the cost of lubrication per axle kilometer." Have you any new information upon this subject? What, according to your knowledge, are any local conditions which should affect the selection of lubricants? What effect does quality have?

3. SHOEING.

Have you made any trial of strap-shoes? What manner of using them did you adopt? What are the results in respect to the work and condition of the horse? What is the expense compared with the cost of the ordinary shoe?

4. RAILS.

Describe the type of rail you use. What have been the faults which you have found with it? What has been the wear, and for how long a time has the rail been in service? What is the amount of traffic on the line and what is the vehicular wear? How do the joints stand up and how do the rails keep to gauge? Is your track sufficiently solid to enable it to stand up in case a system of electric or mechanical traction should be substituted for animal power? State to what type of rail you would give the preference in a pavement of macadam, Belgian block, wood, asphalt, etc.

5. ELECTRIC TRACTION. INSTALLATION.

Describe the system of electric traction which you have adopted. What is the length of line equipped, and what is the topography of the route, especially the grades on the lines?

What is the maximum radius of your curves? Do any curves occur on the grades?

What is the horse power of your central station?

What is the number of motor cars composing your rolling stock, and what is the seating capacity of the cars.

Do you think that the ordinary type of horse car is suitable for electric traction? Do you think that the employment of double decked cars is to be recommended for this service.

What has been the total cost of the installation? Per kilometer for track? Per kilometer for overhead line? Per motor car?

What was the expense of changing over or rebuilding the roadbed.

OPERATION.

What in ordinary service is the current and voltage which you use on the line? What are the same required for maximum service?

What is the average speed of your cars per hour?

What is the average number of cars in operation and the average number of kilometers run daily by the cars? Give this information for motor cars and for trail cars.

State the maximum number of cars which you can put in operation at the same time and the total maximum daily mileage of the cars.

Give this information for motor cars and for trail cars.

State the expenses of operation per motor car kilometer. N. B.—the expense of operation should include the cost of producing the motive power, the wages of employes, and the depreciation of the plant.

State what accidents have occurred in your operation by electricity. What have been the cost and the results of these?

6. HEATING OF CARS.

Have you had any experience in the heating of your cars, and what have been the results?

What system do you employ, and what are its advantages and disadvantages? What was the original cost per car and what is the cost of maintenance per car day?

7. FEEDING HORSES.

What composes the normal rations of your horses? Especially what were the conditions that determined you to employ a greater or less quantity of hay, straw (as food), barley and corn?

From economical or local considerations should the choice of food be made to depend in any way upon climatic conditions?

APPLICATION is to be made for a charter for the Berks & Dauphin (Pa.) Traction Company, the incorporators being D. B. King, C. J. Lewis, H. G. Culp, C. Q. Guldin, S. R. Miner, H. M. Brownback and G. Reuntrow Seidel. This is understood to be the first move in the project of building a chain of trolley roads from Harrisburg to Philadelphia, via Reading and Lebanon.

The Cost of Producing Electricity.

At the meeting of the National Electric Light Association, at Washington, February 27, 28 and March 1, the Committee on Data, consisting of H. M. Swetland, T. Carpenter Smith, E. F. Peck, G. G.

TABULATED STATEMENT OF DATA.
(Where there are blanks in the table, details were not given.)

Hours.	Amperes.	Volts.	Watt-hours	Pounds Coal.	Kind.	Watt hours per lb. coal.
24	583	115	1,609,070	10,800	slack	150
15½	101	120	187,860	2,940	.....	64
14	....	....	386,385	3,755	slack	103
.....	....	....	10,989,870	64,155	slack	171
6	25 inc. / 18 arc.	1,000 / 1,500	312,000	4,200	.....	72
6	800 inc. / 6.8	52 / 2,750	361,800	8,000	slack	45
9½	20	1,100	2 090,000	39,750	Ind. block	53
24 / 22	10 / 879½	117 / 1,180	259,600	16,420	Ind. block	166
7	4¼	2,000	59,500	2,000	soft	30
10	225	110	247,500	4,400	slack	56
14½ / 7	20 / 6.8	1,046 / 1,632	381,023	7,300	soft	52
6	7	2,640	110,880	1.000	pea	110
14.6	....	....	315.360	6,930	slack	46
6.5	....	....	401,249	5,469	slack	73
24 / 8¾ / 24	39 / 9.6 / 296	1,050 / 2,068 / 500	982,800 / 172,058 / 355,200	30,852	slack	42
15	150	120	270,000	5,925	slack	46
13 / 10	400 / 10	113 / 810	587,600 / 81,000	7,000	Pekay	95
6	300 / 10	120 / 1,050	279,000	4,000	.....	70
8	19	1,000	152,000	1,404	slack	108
8 / 7	113½ / 6¾	110 / 560	99,550 / 26,460	1,584	.....	79
24	4,409	122.1	12,920,136	70,352	screenings	183
inc. 24 / arc. 24 / pwr. 24	84 / 80 / 145	1,100 / 2,000 / 550	2,217,600 / 3,840,000 / 1,914,000	38,220	hard sc'gs	208
.....	200 inc. / 24 arc. / .. pwr.	125 / 1,550 /	375,000 / 421,600 / 46,000	7,942	Cumberland and sc'gs.	106
15 / 4	234 / 6.8	50 / 500	189,100	6,000	.....	31½
7 / 12⅔	285 / 268	54¼ / 52	283,820	5,450	Pittsbg. nut and slack	52
inc. 24 / pwr. 18 / arc ..	369 / 80	110 / 500 /	974,160 / 586.740 / 720,000	12,267	soft	186
6	200 inc. / 10 arc.	110 inc. / 50 arc.	132,000 / 3,000	2,000	bit. slack	67
6	141	108	91,368	1,400	Lehigh pea	65
14½	26	1,000	377,000	4,200	buckwheat	90
15 inc. / 18 pwr.	108 / 65	1,135 / 525	1,838,700 / 614,250	18,600	.....	132
15	60	1,100	990,000	8,960	ant. bkwt.	110
inc. 11 / arc. 5½	20 / 9½	1,000 / 1,000	272,250	3,257	Ygy. lump.	83
12	28	1,000	336,000	3,500	Pardee soft	96
inc. 13 / arc. 11	400 / 9½	52 / 2,700	552,550	6,000	ant. bkwt.	92
16	46	1,070	787,520	6,500	bituminous	121
pwr. 12 / inc. 24	160 / 775	203 / 132	389.760 / 2,455 20	27,366	Y'ghiogheny	104
inc. 8 / arc. 7	240 / 8½	110 / 1.375	211,200 / 81,812	3,000	bituminous	98
inc. 15½ / arc. 6	230 / 8	104 / 45	370,760 / 2,160	3,360	slack and nut	111
inc. 15½ / arc. 13	15 / 10	52 / 4,050	12,090 / 526,500	6,100	bituminous	88
inc. 14½ / arc. 14	20 / 10	1,000 / 3,400	290,000 / 476,000	6,048	buckwheat	126
15	1,600	52	1,248,000	6,500	buckwheat	192
24	373	112	1,002.624	8,190	Pittsburg	122
14	22½	1,000	312,666	2 880	Leh. V. pea	109
7½	3'0	115	267,375	3,500	bituminous	76
inc. 6½ / arc. 6	156 / 30	120 / 120	121,680 / 21,6 0	1,681	Cumberland	85
inc. 24 / arc. 8	500 / 100	112 / 9.6	1,344,000 / 7,680	16,000	hard rice	152
pwr. 24	200	225	1,080,0 0			
16.3	33.56	1,000	547.028	4,805	buckwheat	114
inc. 12 / arc. 5	25 / 8½	1,000 / 1,000	300,000 / 42.500	4,800	bituminous	71
inc. 15 / arc. 7	26 / 350	1,000 / 45	390,000 / 110,250	7,380	slack	68
inc. 7 / arc. 12	180 / 9.5	110 / 2.700	138,600 / 307,800	6,760	Sidney	46
inc. 18 / arc. 12	30 / 6½	1,100 / 1,800	594,000 / 140,400	4,300	buckwheat	170
6½	122	110	87 230	1,400	bit. slack	62
8	inc. 19.25 / arc. 9.6	1,100 / 1,500	284,600	2,000	pea	143
25	1,200	125	3,750,000	55,420	soft coal	68
10	220	112	246,400	2,100	coal	117
10	217.7	113	246,001	5,320	lump	46
6	inc. 22 / arc. 6.8	1,060 / 1,500	201,120	1,800	.....	112
5	120	112	72,800	1,800	slack	40
9	120	125	135,000	2.400	bituminous	56
10.46	....	....	1,180,308	16,053	good lignite	73
14 / 11	200 / 10	110 / 1,5' 0	308,' 00 / 165,000	12,000	slack	40
11	20	1,100	242,000	3,200	McAl. lump	76
7½	203	115	171,197	3.640	Iowa slack	47
14	inc. 30½ / arc. 52	1,000 / 102	501,256	7,500	buckwheat	67
inc. 7½ / arc. 7½	14 / 10	54 / 1,000	5,670 / 75,000	3,200	coal	25
			Average watt-hours per lb. coal,			91.7

H. Blaxter, C. E. Scott, presented the preceding table as the result of their efforts to procure data on the consumption of coal in generating electricity. This information was obtained by correspondence, and does not compare favorably, the committee states, with the results secured in generating power for manufacturing purposes. Attention is also called to the great saving in operating in large units and running continuously, as shown by the report, which shows 208 watt hours per pound of hard screenings, where about 8,000,000 watts were generated, running full twenty-four hours, as against the report, which claims only thirty watt hours per pound of soft coal, the total output being less than 60,000 watts and the service being furnished only seven hours.

In order to facilitate comparisons, a table has been prepared on the basis of 90 per cent. engine efficiency, with same dynamo efficiency.

Coal per hour per I. H. P.				Watt hours per lb. of coal.
1.5	lbs.	should	produce	402.84
2	"	"	"	302.13
3	"	"	"	201.42
4	"	"	"	151.06
5	"	"	"	120.85
6	"	"	"	100.71
7	"	"	"	86.32
8	"	"	"	75.53
9	"	"	"	67.14
10	"	"	"	60.43
11	"	"	"	54.93
12	"	"	"	50.35
15	"	"	"	40 28
18	"	"	"	33 57
20	"	"	"	30.22

Discussions on Street Railway Practice.

M. K. Bowen, superintendent of the Chicago City Railway Company, has introduced an excellent method on that railway of improving the service in the operating departments of the road, which recommends itself and has shown excellent results in practice. This consists in the holding of regular meetings attended by heads of operating departments, at which some paper relating to street railway practice is read, after which a general discussion follows. These meetings are held once in two weeks, and the resulting effect of exchanging ideas has been found most beneficial.

At a recent meeting one of the papers read was by W. C. Carter, foreman of the 61st Street car house. Mr. Carter said in part:

Dirty Cars.—The condition of cars depends largely, as far as cleanliness is concerned, on the class of travel. The laboring element that patronizes some of our lines night and morning, will litter a car up more in one trip than the rest of travel will in an entire day. The washing and cleaning of cars at the barn is an important item; to get the best results from the labor employed requires some attention.

A good rustler in charge of the wash crew is an absolute necessity. I think that as a general thing cars are washed too much, especially on the inside. By wiping the windows on the inside, removing the slats and washing them, where there are portable slats, cars can be kept in very good condition.

Water should not be turned on the inside of the car oftener than once a week, and in clean, dry weather once every two weeks. Cars are slow to dry on the inside, especially in winter, and by turning water in two or three times a week the floor and bottom tends to become water-soaked. It soon commences to decay, and causes a sour and musty smell in the car. In clean and dry weather once a week washing cars on the outside, platforms and slats is sufficient. Use a soft brush on the car body very lightly, as too much rubbing soon destroys the lustre of the varnish.

After the crew has washed all the cars, have them devote their time to the windows. Dry wiping of the windows every other night soon puts a lustre on the glass that can not possibly be obtained with water. After the windows have taken on a polish they are very easy to keep clean. Of course, in stormy weather this course cannot be pursued.

Abnormal Breakage of Car Parts.—The largest breakage of car parts seems to be in brake rods. This, I think, can be attributed largely to the suddenness with which brakes are applied by gripmen. If a gripman would take more time to stop his car, and would apply his brake more gradually, the breakage of brakes and rods would be greatly reduced. You can not depend on defects of cars being reported by the train crew, especially on cable lines; hence, a night inspector is a necessity. He should inspect each car after it is in the barn, fix what he can, and mark all cars that are in an unsafe condition for the day repair gang.

All repair work, excepting finished work, should be done at the barns. All work such as finished work on car bodies, etc., should be centralized, as a concentration of forces can be more satisfactorily worked than to have the gangs scattered under half a dozen or more heads.

The "Dragon" fountain brush, manufactured by the General Agency Company, New York, is a device which is claimed to fill a long felt want on street railways, in the washing of cars. It is attached to a hydrant by hose; the water is sprayed over the top of and through the brush, thus making it unnecessary to carry water back and forth in pails. It is a labor saver, and performs the work more satisfactorily and quicker than by old methods. A large number of railways are now using them, and the General Agency Company reports a rapidly increasing business.

Street Railway News.

Extensions and Improvements.

Altoona, Pa.—The Altoona & Logan Valley Electric Railway Company has let the contract for an extension of its lines from Altoona to Bellwood, a distance of seven miles; also a contract for a second track from Altoona to Lakemont Park.

Boston, Mass.—The Laconia Car Company has contracted with the West End Street Railway Company to build for it 150 of its electric car trucks.

Flushing, L. I., N. Y.—The Highway Commissioners have decided to grant the franchise applied for by the Brooklyn City Railroad Company, which desires to extend its tracks over Strong's Causeway into the village. It is said that the road will be in running order by May next.

Milwaukee, Wis.—An ordinance has been introduced in the Common Council, granting the Milwaukee Street Railway Company the right to extend its electric service to Lake Park.

Mount Vernon, N. Y.—Work has been recommenced on the tracks of the Union Railway Company from Mount Vernon to the terminus at West Farms.

New Haven, Conn.—The Fair Haven & Westville Street Railway Company has contracted with the Westinghouse Electric & Manufacturing Company for the electrical equipment of the road.

The Winchester Avenue road will be extended from the West Haven terminus to Merwin's Point at Woodmont. The extension will be complete by June 1.

Niles, O.—It is reported that the Niles & Warren Electric Street Railway Company will extend its line to Girard.

Philadelphia, Pa.

The Hestonville, Mantua & Fairmount Railway Company, will begin immediately to electrically equip its lines.

The Common Council of Philadelphia has concurred in Select Council ordinances granting permission to the Philadelphia, Cheltenham & Jenkintown Passenger Railway Company to lay tracks, erect poles, overhead wires, etc., on Old York Road.

Pottstown, Pa.—The Pottstown Passenger Railway Company contemplates a number of improvements in order to make its line and park more attractive during the coming season.

Worcester, Mass.—The bill to extend the Millbury & Worcester electric railway has been passed to a third reading by the legislature.

New Roads.

Adamstown, Pa.—The Mohnsville & Adamstown Electric Railway Company was incorporated on March 6, 1894, for the purpose of constructing and operating an electric railway in Berks and Lancaster Counties. The president of the company is L. T. Custer, of Adamstown. Others interested are Esaias E. Billingfelt, Elmer E. Billingfelt, and S. W. Miller.

Albion, N. Y.—Emmons, Dwyer & Company, of Syracuse, have offered to build an electric railroad from Batavia through Albion to Lake Ontario.

Allegheny, Pa.—At a recent special meeting of the Select Council, the Millvale, Etna & Sharpsburg Street Railway Company was granted right of way along Liberty and East Ohio Streets.

Allentown, Pa.—Negotiations are on foot for the merging of the two electric railroads of the city of Bethlehem and Catasauqua under one management.

Boston, Mass.—The petition of Reynolds T. White and others for leave to build, equip and operate an elevated electric road in Boston and its suburbs was heard before the Committee on Transit lately. Mr. White proposes to construct a double track belt line of three and a half miles around the city. Mr. White is the inventor of the system to be adopted.

Bridgeton, N. J.—The City Council has passed the ordinance of the Bridgeton, Cedarville & Port Norris trolley road. Work will be begun at once.

Charlottesville, Va.—The Piedmont Construction & Improvement Company, T. O. Troy, president, expects to have an electric railway system in use here by the middle of June. Material has been purchased and contracts let.

Chesterfield, Va.—A bill is in the legislature to incorporate the Chesterfield Transit Company.

Chicago, Ill.—The City Council has passed the ordinance granting a franchise to the North Chicago Electric Railway Company to operate an electric street railroad on Lincoln Avenue, between Wrightwood Avenue and North 59th Street, and on Milwaukee Avenue, between Armitage and Lawrence Avenues.

Clayton, Mo.—The Clayton & Creve Cœur Railway Company has applied to the County Court for a franchise to construct and operate an electric railroad line from Clayton to Creve Cœur Lake.

Cleveland, O.—There has just been incorporated the Ohio Interurban Railroad Company, with a capital stock of $200,000, for the purpose of building and operating street railways. The incorporators are James L. Mauldin, James B. Crist, Clayton Chapman, Cecil L. Saunders, Frank J. Lewis and William C. Scover.

Detroit, Mich.—The Township Board of Springwells has granted a franchise to a Detroit corporation called the City & Suburban Traction Company, headed by Ellwood T. Hance, to run an electric street railway on Michigan Avenue from the city limits to the Dearborn line.

Galt, Ont.—The contract for the equipment of the Galt & Preston Street Railway has been given to Messrs. Ahearn & Soper, of the Westinghouse Company, of Ottawa.

Gettysburg, Pa.—Work on the Gettysburg Electric Railway has been resumed, the creditors who filed a bill in equity having been paid their claims.

Hamilton, Ont.—The contract has been let for the power house of the Hamilton, Grimsby & Beamsville Radial Railway, and it must be finished by June 1st.

Hampden, Me.—The Hampden & Winterport Electric Railway & Light Company was incorporated at the last session of the legislature, the incorporators being J. Manchester Haynes, George E. Macomber, of Augusta; Henry W. Mayo, of Hampden; Fred Atwood, of Winterport, and others. The Company is to construct a railway from the terminus of the Bangor Street Railway, at the Hampden town line, to Stockton Springs.

Hartford, Conn.—A meeting of the incorporators of the Hartford, Manchester & Rockville Tramway Company was lately held to take up subscriptions to the capital stock, which has been placed at $150,000. It is the intention of the company to extend the lines as far as Machester during the coming summer.

Holyoke, Mass.—The Aldermen have granted the People's Street Railway Company a franchise to lay its tracks on the largest part of the city.

Hopewell, Pa.—The charter has been secured, and capital to the extent of $175,000 subscribed, for an electric line, to run from Roaring Spring, Blair County, to Hopewell, Bedford County, by way of Woodbury and Loysburg.

Indianapolis, Ind.—The Farmers' & Broad Ripple Street Railway Company, of Indianapolis, lately incorporated, proposes to operate an electric line from Indianapolis to Broad Ripple, and also may extend it to Noblesville. The capital is $100,000. The board of directors is composed of W. R. Myers, Secretary of State; John C. Green, A. N. Fisher, Henry Malpas and Oliver C. Myers.

Kansas City, Mo.—President A. A. Pearson, of the Merriam Park, Rosedale & Kansas City Electric Railway Company has filed a petition with the Board of County Commissioners of Wyandotte County, asking a franchise for the operation of the company's proposed electric street railway line.

Kenosha, Wis.—The City Council has passed an ordinance granting a franchise for a street railway to F. M. Kringle. The work must begin within sixty days, and must be finished within one year.

Marion, O.—It is said that a stock company of local capitalists has been organized to build an electric railway.

Moore, Pa.—It is reported that a franchise has been asked for for an electric railway here. The names of the applicants have not been divulged.

New Bedford, Mass.—The contract for building the Dartmouth & Westport Electric Railroad has been awarded to Arthur Hodges, of Boston. The road is to be completed by June 20.

Newport, Ky.—The building of the Newport & Evergreen Electric Street Railway will be begun shortly.

Niagara Falls, Ont.—A scheme is mooted by the Niagara Falls Park & River Railway Company to construct a bridge from the Canadian side of Niagara River to Navy Island, and thence to the Canadian shore. The company is also considering the extension of its line about two miles further up the river.

Norton, Va.—A bill is in the legislature to incorporate the Norton Street Railway Company.

Ogden, Utah.—The Ogden & Brigham City Railroad Company has been incorporated. The company will at once commence the extension of the motor line, now built as far north from Ogden as the Utah Hot Springs, to Brigham City. The following are the officers: James P. Sprunt, president; Edward Reed, vice-president; George F. Phillips, secretary.

Outrement, Que.—An electric railway is the latest possibility in this town.

Philadelphia, Pa.—The Philadelphia Elevated Electric Railway Company was incorporated on March 3, 1894, with a capital stock of $42,000. The president of this company is Walter N. Boyer, of Philadelphia. Others interested are Radcliffe B. Mills, John R. Bannan and Samuel R. Russell.

Portland, Ore.—The Portland Traction Company has been incorporated in San Francisco to build and operate all kinds of street railroads in Portland, Ore. The capital stock is placed at $400,000. The directors are Isaac Hecht, S. Prentiss Smith, Frank L. Brown, S. Schwabacher and Thomas N. Strong.

Pottstown, Pa.—The contract for the construction of the roadbed, track laying and overhead work of the Ringing Rocks Railway Company, has been awarded to Hugh E Crilly, of Allentown.

Reading, Pa.—The Reading & Womelsdorf Electric Railway Company was incorporated on March 10, with a capital stock of $30,000, for the purpose of constructing and operating an electric railway in Berks County. The president of the company is John A. Rigg. Others interested are Richmond L. Jones, Samuel E. Jones, and Samuel E. Rigg, all of Reading.

Skaneateles, N. Y.—It is reported that H. V. S. Lord, of Auburn, secretary of the Auburn Business Men's Association, is furthering a scheme for an electric railroad from Auburn to Skaneateles, a distance of eight miles.

Springfield, Mass.—A meeting of the projectors of a proposed electric street railway between this city and East Longmeadow, was held lately. G. M. Merrill, C. S. Roberson and C. M. Kirkham were appointed a committee on the matter.

Toledo, O.—The right of way from Monroe, Mich., and Detroit has been secured for the proposed electric railroad between Toledo and Detroit. The Toledo parties interested in the road claim that it will be in operation before the first of July next.

Washington, D. C.—A bill has been introduced to incorporate the Union Passenger Railway Company, of the District of Columbia. The incorporators are J. G. Slater, Anson S. Taylor, Henry K. Simpson, George W. Linkins and others, all of the District. The bill authorizes the company to operate a street railway in the streets of the city.

West Chester, Pa.—T. L. Eyre, J. H. Baldwin, Thomas Pennypacker and others have sold their charter for the West Chester & Downingtown Electric Railway to L. G. McCauley, H. B. Buckwalter, James McGraw and J. M. Baker, all of this place. The new owners promise to have the road in operation before next fall.

West Deptford, N. J.—The Camden, Gloucester & Woodbury Electric Railway Company has applied for a faanchise through this place.

West Richfield, O.—A meeting of the citizens of Royalton, Copley, Bath, Richfield, Brecksville, Parma and other townships in Summit and Cuyahoga Counties was held at the town hall in West Richfield recently to discuss the matter of an electric road from Akron to Cleveland. E. Hawkins, R. C. Ellsworth and Peter Bomgardner, of Richfield; S. E. Edgerton and Horace Edgerton, of Royalton; S. E. Witcraft, M. J. Sprankle, of Bath, and others are a committee on the matter.

The White-Crosby Company.

This is the title of a new corporation which will commence business May 1, as contracting engineers. The president of the new company will be O. T. Crosby, who has resigned his position as manager of the railway department of the General Electric Company, taking with him the best wishes of his associates for his success in his new venture. The vice-president and general manager of the new company will be J. G. White, of J. G. White & Company, the well known electrical engineers, and the secretary and treasurer of the company will be G. H. Walbridge, who has been associated with Mr. White for a long time.

The main offices of the company will be at Baltimore, and branch offices will be located in New York and Chicago. The former will be in charge of A. G. Greenburg, now of the insulated wire department of Washburn & Moen, while the Chicago representative of the company will be J. F. Easterbrook. The low rents and cheap markets of Baltimore will allow the company ample room for storing cars, wagons, equipment, etc., together with the best facilities for shipping to all parts of the country such material as is likely to be needed in carrying out contracts.

Mr. White has during the last two years closed contracts in Baltimore alone, amounting in all to about $800,000, of which over $500 000 has been for overhead construction alone, including material and labor. In addition, he has carried on a large business in other sections of the country, to the satisfaction of the principals. Mr. White has now in course of completion, or about to be taken. some additional contracts in Baltimore and elsewhere, which will be completed by the new company.

The manager of the supply department of the company will be H. H. Harrison, and the company will be prepared to supply all kinds of electric railway material promptly.

Personal.

Mr. W. H. Bone, of the Walker Manufacturing Company, was in New York last month on a business trip.

Mr. John H. Stewart, former president of the Ohio State Tramway Association, is about making his permanent residence in Chicago.

Major George W. McNulty, under whose direction as chief engineer of the Metropolitan Traction Company, the Broadway Cable Railway was built, has resigned from that office, and will be located at 45 Broadway, New York.

Mr. H. W. Brinckerhoff, late chief assistant engineer of the Metropolitan Traction Company, has resumed his practice as consulting mechanical and civil engineer, and will be associated with Major George W. McNulty at 45 Broadway, New York.

Mr. F. J. Pearson has been appointed chief engineer, and Mr. L. J. Hirt assistant engineer, of the Metropolitan Traction Company, of New York. Messrs. Pearson and Hirt were formerly connected with the West End Street Railway, of Boston. Mr. F. L. Hart will remain operating engineer of the Broadway road.

Mr. W. W. Hess, former editor of *The Car*, of Philadelphia, has severed his connection with that paper, and is now general manager of the Car Equipment Company, of Philadelphia. Mr. Hess's company has secured the agency, for the Middle and South Atlantic States and

Ohio, for the Graham truck, Johnson portable power house hoist, Johnson oil insulation, Ajax metal trolley wheel, Allen Electrical & Supply Company, etc. Mr. Hess is well qualified for the business in which he is now engaged, and we feel confident will make it a success.

Obituary.

HOADLEY B. IVES, president of the Fair Haven & Westville Railroad Company, of New Haven, Conn., died March 18. Mr. Ives had been president of the Fair Haven & Westville Railroad Company for many years, and was the possessor of considerable property.

HIRAM R. RHOADS, president of the Pennsylvania Street Railway Association, and of the Williamsport (Pa.) Street Railway Company, died, February 17, at his home in Williamsport. Mr. Rhodes, who was born in Philadelphia forty-nine years ago, was one of the early telephone workers, and opened the second exchange in Philadelphia. In 1880 he organized a telephone supply company, and in 1890 purchased the Williamsport Street Railway. At the time of his death he was also interested in several other street railway and lighting properties.

JACOB LIVINGSTONE BARCLAY, of Chicago, Western manager of the sales department of the Walker Manufacturing Company, died March 26, of appendicitis, at Pittsfield, Mass., where he had gone on some electrical business. The usual operation was performed by Dr. Bull, of New York, the famous specialist who was sent for.

Mr. Barclay was well known in electrical and street railway circles. He was born in Glasgow, Scotland, about thirty-six years ago. His first connection with electrical affairs was with Holmes, Booth & Haydens, with whom he remained for a considerable time. Later he was appointed Chicago representative of the Sprague Electric Railway & Motor Company. In this capacity he was most successful, and closed a large number of contracts for electric railway apparatus. Upon the consolidation of the Sprague and Edison companies, Mr. Barclay became connected with the Westinghouse Electric & Manufacturing Company, as its first Chicago electric railway representative, and did much to advance the Western interests of that company. Mr. Barclay has been Western representative of the Walker Manufacturing Company since November last. He leaves a widow and two children.

New Publications.

The Electrical and Street Railway Reporter. Vol. 1. No. 1. Published by the American Electrical Publishing Company, of New York.

This is the title of a new monthly which, as its name imports, aims to follow the development in the electrical and street railway fields. The first number contains a report of the proceedings of the National Electric Light Association, at Washington, as well as other interesting articles.

Illustrated Catalogue No. 1. Published by the Laclede Car Company, of St Louis, Mo.

This catalogue gives views of some twenty of the latest types of cars manufactured by the Laclede Car Company. They include open and closed electric and cable cars, cars with single and double trucks, combination cars, etc. The principal dimensions of each type are also given. The Laclede maximum traction truck, four wheeled truck, and the Robinson sand box are all illustrated.

Catalogue of Electric Trucks, Manufactured by the Taylor Electric Truck Company, of Troy, N. Y.

This catalogue gives a full description of the Taylor improved electric truck, describing in detail the principal features of the truck, as well as its advantages in service. These trucks have shown an economy and durability in service, together with easy riding and non-teetering qualities, which has made them extremely popular. A description is also given of the company's Empire State radial truck.

Catalogue A of the Wallace Electric Company, Chicago.

The first catalogue of the Wallace Electric Company has been entitled by them Catalogue A, and is most complete in the list of electric appliances which it illustrates and tabulates. The officers of this company are well known to the trade, and are well fitted by practical experience to serve it. The company itself, though a new one in the field, has already secured, we understand, a considerable trade, and promises to make a great success of the electrical supply business. The company, on May 1, will remove from 104 Michigan Avenue to 307 Dearborn Street.

Catalogue of Berlin Iron Bridge Company, East Berlin, Conn.

A handsome catalogue of 318 pages has recently been issued by the Berlin Iron Bridge Company, of East Berlin, Conn. This company, as is well known, is engineer, architect and builder in iron and steel. The company not only supplies bridges, as its name implies, but entire buildings, roofs, beams, girders, columns, etc. The catalogue gives views of the most important installations made by this company, with a short description of each. We notice among these views, engravings of a large number of installations made for street railway companies, showing that the excellence of the work of the Berlin Iron Bridge Company is recognized in this industry.

A Text Book on Electro-Magnetism and the Construction of Dynamos. Vol. 1. By Dugald C. Jackson, professor of electrical engineering in the University of Wisconsin, etc. MacMillan & Company, New York. 290 pp.

Professor Jackson is a well known authority on electrical subjects, and his qualifications for writing on the subject of dynamos are excellent. The book before us was developed by the author from a series of lectures given by him to students in electrical engineering at the University of Wisconsin, and is admirably adapted for a text book at colleges or scientific schools, as well as for its use as a reference book by practical engineers. The theory of electro-magnetism and the magnetic properties of iron are taken up from the primary definitions, in a logical and thorough manner, to a study of constant potential, direct current machines. The subject of series arc lighting and alternating current dynamos is reserved for another volume.

Equipment Notes.

The Jewell Belting Company, of Hartford, Conn., has sent us a very handsome card case made up in seal leather, and forming one of the souvenirs of this company at the Electric Light Convention, at Washington, D. C.

H. L. Stillman, of Kenyon, R. I., agent for the Stillman railway system, has recently devised a restraining bolt for use on his system of rails, which, it is claimed, gives a great deal of additional strength to the construction.

The Peckham Motor Truck & Wheel Company, of Kingston, N. Y., has opened a Boston office at Room 315, 53 State Street, that city. A. W. Field, the popular vice-president of this concern, will be its New England representative.

The Gleason & Bailey Manufacturing Company, New York City, has recently purchased a controlling interest in a well established chemical fire extinguisher, and hereafter hand extinguishers and chemical engines will be added to its extensive line of fire apparatus.

The Manhattan General Construction Company, whose offices are at No. 50 Broadway, New York, and Equitable Building, Baltimore, Md., has been appointed by the Buckeye Electric Company its sole agent for New York and vicinity, and Baltimore and vicinity.

The J. W. Fowler Car Company has moved its main office from the Havemeyer Building, Cortlandt Street, New York, to Elizabethport, N. J. The company has fitted up handsome quarters in its new factory building, a description of which appeared in a recent issue of the STREET RAILWAY JOURNAL.

The American Fuel Economizer & Engineering Company, of New York, has issued a very handsome circular, descriptive of its fuel economizer system, of which George H. Burpee is the patentee. This system has been carefully worked out in all its details, and is giving good results in a number of plants.

The Sterling Supply & Manufacturing Company of New York, has moved into new and commodious offices in the Ross Building, Corner of Hudson and Bank Streets. Its shops are also in the same building, which will enable the members of the company to give prompt and personal supervision to all orders.

Johnson & Merritt have been appointed general sales agent for the Boston Incandescent Lamp Company. This firm has but recently organized. Elliott O. Johnson is well and favorably known in electrical circles and Matt. M. Merritt has a large acquaintance. The result of this happy "combination" should be mutual beneficial.

The Standard Glass Insulator Company, the manufacturers of Gray's patent process glass insulators, located at 120 Tremont Street, Boston, Mass., makes a very handsome display of its various kinds and designs of insulators. This company is probably the largest glass insulator manufacturer in New England. It manufactures insulators specially designed for street railway work.

The McKay Curtain Company, of Wilmington, Del., which is already well known in the railway world as a manufacturer of car window curtains of all kinds, as well as lambrequins, draperies, furnishings, etc., is giving special attention to street car work. This company makes a specialty in hair cloth for seat covering; a new style of goods, claimed to be better and cheaper than rattan.

John A. Roebling's Sons Company, of Trenton, N. J., will supply a large amount of the wire and the copper which will be used in the new Bennett-Mackay ocean cable now being manufactured by the Siemens Company. None of the wire was passed at less than 99 per cent. of Dr. Matthiessen's standard, while the aggregate of all the wire actually shipped was 99.873 per cent.

The National Water Tube Boiler Company, of New Brunswick, N. J., owing to the increase of its business, has found it necessary to have more extensive facilities in its New York office. The company has therefore secured commodious quarters at No. 74 Cortlandt Street, where the New York manager, Mr. Loretz, will be pleased to see the company's customers and friends.

The Davis Car Shade Company, of Portland, Me., has established an agency in Chicago with J. M. Denniston as representative. Mr. Denniston's office will be at No. 911 Monadnock Building. Among the orders recently closed by this company is one for the 250 new cars of the People's Traction Company, Philadelphia, which will be equipped with the Davis automatic curtains.

The Pettingell-Andrews Company, at present located at 192—202 Summer Street, Boston, has made arrangements to move to more spacious quarters on Federal Street. This company has recently branched out into the railway field, and means to make a determined effort to make this department as successful as its general supply department. There is every reason to believe that it will succeed.

The Babcock & Wilcox Company, of New York, has moved its main offices to 29 Cortlandt Street, New York, corner of Church Street, diagonally opposite the home of the STREET RAILWAY JOURNAL. This company in announcing its removal, has sent us a handsomely printed leaflet giving views of its different offices in the principal cities of the country, and these show the extent of the business of this company.

A. Groetzinger & Sons, of Allegheny, Pa., sole manufacturers of "Dermaglutine," improved process rawhide for electric street car service and mechanical purposes, etc., are experiencing a great improvement in their business right along; orders for "Dermaglutine" pinions are coming in freely on all sides, from new as well as old customers. From the general outlook this firm confidently anticipates a much larger trade this year than ever before.

The Tripp Metallic Packing, manufactured by Wm. B. Merrill & Company, of Boston, is to be applied throughout to the new engines about to be erected by the Philadelphia Traction Company, of Philadelphia. The Quincy Street Railroad, during the last month, has also placed an order for the "Tripp," and the continued increased demand for this packing throughout the country denotes a very general satisfaction with the results derived from its use.

The John Stephenson Company, Limited, of New York, has recently been awarded an order for 100 open cars by the Metropolitan Traction Company. The style of car selected is a most tasteful one, and will certainly prove a most attractive addition to the company's rolling stock. The Stephenson Company has also a number of other orders on hand, and supplied all the rolling stock for the Mobile Street Railway Company, described in another connection.

The Graphite Lubricating Company, of Bound Brook, N. J., has recently issued an interesting pamphlet descriptive of its graphite and bronze bushings, bearings, washers, &c. References are given to the principal users of this material, and among this company's customers are numbered many of the prominent manufacturing companies in the country. The material has been employed with success for electric railway service, including its use for trolley bushings.

T. E. Crossman, of Brooklyn, announces that he is now located in the Franklin Trust Building, 166 Montague Street, that city, and is ready at all times to perform stenographic work of every description. Mr. Crossman, as is well known, is the official reporter of the American Street Railway Association, the Electric Light Association the American Water Works Association and others. The excellence of Mr. Crossman's work is recognized by all who have any acquaintance with it.

The Fulton Foundry & Machine Works, of 21 Furman Street, Brooklyn, N. Y., is doing a good business and is prepared to accept all orders for first class castings. E. B. Willcox has reorganized this department of the work, putting all labor on a piece work basis, and writes us that he proposes to keep his works running every day. The long reputation of this concern for first class work, extending over some thirty years, is a guarantee of the quality of the castings turned out.

The Jackson & Sharp Company, of Wilmington, Del., has no difficulty to fill its factory with orders. The demand for cars on the new street car department of this company is great, and orders are coming in in a rapid fashion from different sections of the country. Among those lately received is an order from the Hartford Light & Power Company, of Hartford, Conn., for sixteen open, and four closed cars. The Jackson & Sharpe Company tells us that these cars will be exceptionally fine and tasteful in finish.

The Goubert Manufacturing Company has removed from 32 Cortlandt Street, New York City, where it has been located for many years, and now occupies more commodious headquarters at 14-16 Church Street, corner of Cortlandt. The new offices are attractive in appearance, and in their arrangement and furnishing offer every convenience for taking care of the large business done by the company in the "Goubert" feedwater heater and "Stratton" steam separator, of which this company is the sole manufacturer.

Westinghouse, Church, Kerr & Company, whose ten years of successful business career has made them well known in all branches of the engineering trade, have removed their New York offices from 17 Cortlandt Street to the Havemeyer Building, 26 Cortlandt Street. As a convenience to the technical press, and for the information of their numerous friends, they have gotten out a circular letter giving much interesting information as to the details and principles that have led to the development of their well earned and deserved business success.

The Ball Engine Company, of Erie, Pa., among recent shipments and orders mentions the following made to public buildings in different parts of the country: Two 100 H. P. engines to the Criminal Court building, Chicago; one 100 H. P. engine to the House of Correction, Chicago; one 60 H. P. engine to the Illinois State Reformatory, Pontiac, Ill.; one 100 H. P. engine to the Industrial Home for the Blind, Chicago; two 100 H. P. engines to the State Asylum for Chronic Insane, Wernersville, Pa.; one 135 H. P. engine to the Willard State Hospital, Willard, N. Y.

The Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., reports activity in all the departments of its extensive factory. This company has recently greatly extended its brass founding department, and has now what are claimed to be the best facilities in the country for turning out car trimmings and other brass castings. The company has recently put upon the market a street sweeper which is illustrated and described elsewhere in this issue, also a car jack which is certainly very simple in construction, and should prove most convenient in repair shops, car houses, and for emergencies.

E. F. De Witt & Company, of Lansingburgh, N. Y., report a a large and increased demand for the De Witt Common Sense sand box. The general testimony of those street railway managers who have seen this box has been that it has solved the problem. One of Mr. De Witt's customers, the Cayadutta Electric Railroad Company, of Gloversville, N. Y., has been using the boxes under very severe conditions of service and grades, and in a recent letter to the manufacturers expresses itself as follows: "We are very much pleased with your sand boxes. and have used them to good advantage. T. C. FRENYEAR, general manager."

The Peckham Motor Truck & Wheel Company, of New York, tells us that it is pushing its works to their full capacity on orders for the following named companies: Brooklyn Heights Railroad Company, and Coney Island & Brooklyn Railroad Company, of Brooklyn, N. Y.; Consolidated Traction Company, of Jersey City, N. J.; North Hudson Company, of Hoboken, N. J.; Third Avenue Cable Road, of New York; People's Traction Company, of Philadelphia, Pa.; Cincinnati Consolidated Railway Company, of Cincinnati, O.; Leavenworth Electric Railway Company, of Leavenworth, Kan.; Yonkers Railway Company, of Yonkers, N. Y.

The New Castle Car Manufacturing Company, of New Castle, Pa., has issued a new circular showing views of a number of recent cars turned out of its shops. These engravings show a wide range in the style of cars, and the fact that a very fine line is being constructed by the company. Some of the cars shown are those in operation on the Braddock & Turtle Creek Street Railway Company, Beaver Valley Traction Company, Punxsutawney Street Passenger Railway Company, Bridgeport, Bellaire & Martin's Ferry Street Railroad Company, Warren Street Railway Company, Buffalo & Williamsville Street Railway Company, Youngstown Street Railway Company, and other lines.

The Breese & Mansfield Company, of Philadelphia, Pa., is a new corporation to which has been awarded the agency of the Walker Manufacturing Company for the States of Pennsylvania, Maryland and Delaware, and for the District of Columbia. The company is named after C. B. Breese and Frank Mansfield, both of whom are well known in electrical circles. Mr. Breese was connected for a long time with the Hall Signal Company, of New York, and Mr. Mansfield has had long experience in electric construction through his connection with the Sprague Electric Railway & Motor Company, and other corporations. The headquarters of the company will be at 120 Betz Building, Philadelphia.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., closed contracts last month for the complete equipment of all the cars of the Williamsport Passenger Railway Company, of Williamsport, and all the cars of the Citizens' Electric Traction Company, of Pittsburgh, with its patent automatic safety appliances. Other lines which are equipping their cars with the Crawford safety appliances are the following: Philadelphia Traction Company; Citizens' Street Railway Company, Indianapolis; New Orleans Traction Company; Central Traction Company, Pittsburgh; Duquesne Traction Company, Pittsburgh; Pittsburgh Traction Company; Pittsburgh & Birmingham Traction Company.

Westinghouse, Church, Kerr & Company, represented in leading cities of the United States, have recently undertaken the manufacture of ice making machines, and have met with a spontaneous demand for the same from electric lighting stations, who find that the addition of an ice plant can be very conveniently run, without very materially increasing the present steam plant. The advantages obtained are that the product is obtained with almost no increase of cost for superintendence, office force or labor account, and but little for fuel, and the market is made by the popular demand for pure ice. Southern street railway managers will find it would mean a source of profit to add to their equipment an ice plant.

The R. Woodman Manufacturing & Supply Company, 63 Oliver Street, Boston, Mass., has recently issued what is termed a "Pocket Catalogue." This neat and attractive little pamphlet contains illustrations and descriptions and prices of this company's punches, which are shown in many styles, intended for all kinds of service in connection with street railroad business. Woodman's "baby punch" is intended to be worn as a watch charm, at the same time it is perfect in every detail and is sold for $5. In glancing over the list of street railways now using the Woodman punches, we find such well known companies as the West End Street Railroad Company, Boston, Mass., Baltimore Traction Company, Baltimore, Md., Lynn & Boston Railroad Company, Lynn, Mass., Denver Street Railroad Company, Denver, Colo., and hundreds of other street railway companies.

Chas. A. Schieren & Company, of New York, manufacturers of the celebrated Schieren perforated electric leather belting, have recently received a letter from the Risdon Iron & Locomotive Works, of San Francisco, Cal., which furnished some Schieren belts last summer to the Union Iron Company, of Mentone, Cal. The president of the latter company writes the Risdon Iron & Locomotive Works as follows: "The two double perforated electric leather belts I purchased of you last summer for the Union Ice Company's factory, of Mentone, San Bernardino County, Cal., are doing splendidly. The twenty inch belt on a twenty-six inch motor pulley has a velocity of about 5,000 ft. per minute. The thirty inch belt has a velocity of about 3,000 ft. per minute. Each transmits 1,500 H. P., and are as perfect as when first put on. THOS. J. BARBOUR."

Albert & J. M. Anderson are in receipt of the following very favorable test made by the Brush Electrical Engineering Company, London, Eng., of their "Aetna" globe strain insulation. The test shows that the resistance of this insulation could not be measured by the deflection method; 6,000 volts alternating current were also placed

across it without the slightest sign of breaking down the insulation. A tensile stress of 3,000 lbs. was applied, by means of a lever and weights, but did not affect the insulating material: "Test of Aetna arc lamp hanger. In the original condition the insulation resistance was approaching infinity, but after boiling in water for ten minutes and drying, it was greater than 6,000 megs. It was then allowed to thoroughly dry for seventy-two hours, and again being measured, the insulation resistance went up to over 10,000 megs. It was after this placed across 6,000 volts alternating current without any effect whatever."

Carleton & Kissam, proprietors of the United States Steam & Street Railway Advertising Company, have lately added to their long list of street cars in which they control the advertising privileges, the cars of the North & East River Railway Company, New York; Steinway Railway Company, Long Island City; Newport Street Railway Company, R. I.; Hamilton Street Railway Company, Hamilton, Ont., and also effected a lease with the Brooklyn Union Elevated Railway Company, Brooklyn, N. Y., for the advertising privileges in all its cars and on all its stations from May 1, 1895. Though Carleton & Kissam have suffered the loss of some of their lines in New York City, they have more than made up by adding the above companies' cars to their list, and they have under negotiation several very important deals. Many of the largest corporations and syndicates who control the operation of the street cars in America's greatest cities, prefer to do business with Carleton & Kissam than with others, as they have found the least annoyance and the greatest net income to them from such a source.

The Altoona Manufacturing Company, of Altoona, Pa., builders of improved M. A. Green automatic cut-off engines and general foundry and machine work, reports that recent shipments and orders of the Altoona Manufacturing Company include the following engines and steam plants: One 80 H. P. engine shipped to J. T. Pugh, of Philadelphia, for operating and lighting his new auger factory; one 125 H. P. engine to the Western Glass Company, of Colorado City, Colo., for lighting the factory of the company and the city at large; one 80 H. P. engine to the New Castle Car Manufacturing Company, of New Castle, Pa., for operating and lighting its new street car factory; one 150 H. P. engine with steam power plant complete, shipped to the Farmington Light & Power Company, of Farmington, Ill., for the central station lighting plant in that city; two 175 H. P., special railway engines with boilers and steam plant complete, which were shipped last week to the Lynchburgh & Rivermont Street Railway Company, of Lynchburg, Va., whose plant is now in process of erection. Among the orders received last month were one 60 H. P. engine for lighting the new Christ Methodist Episcopal Church of Pittsburgh; two 50 H. P. engines for lighting the fine new McIntosh-Verner Building on Penn Avenue, Pittsburgh, and two 150 H. P. engines, with steam power plant complete, for the Ringing Rocks Electric Railway Company, at Pottstown, Pa. These two latter engines will be of interest to the electrical fraternity, owing to the fact that they are to be direct connected to two power generators of a design imported from Germany, and they are the first engines that have been direct connected to this make of generators in the United States for electric railway service.

F. W. Friis, principal of the National Railroad Detective Agency, of New York and Newark, has been very busy ever since February 16, when he bought the Special Detective Agency in New York. As he had plenty of business on hand from his New Jersey office, the only thing Mr. Friis had to do was to start up in the new office, to keep both ends busily employed. The location of the New York office at No. 176 Broadway, corner of Cortlandt Street and Maiden Lane, was selected in order that the agency's customers in railroad lines and friends could call without loss of time, when in New York. On March 1 Mr. Friis removed his Newark office from 673 Broad Street to the handsome Prudential Building, Newark. Besides detective work, Mr. Friis is doing a collecting business in his Newark office under the name of the Merchants' Collecting Agency. This department is managed by Jas. C. Thomas, and the business in this line has become extensive, covering claims in all parts of the country. There are telephone connections in both offices. Mr. Friis at first experienced great trouble in obtaining good, honest and reliable inspectors. In several cases, he tells us, inspectors in his employ were guilty of breach of trust; in some instances he has taken them to court to have them punished, but got no satisfaction. In order to avoid this, he has made out a set of rules, which must be kept by all inspectors in his employ, and any one entering his force must furnish a bond of $100 by a responsible real estate owner. This is signed by the bondsman, the inspector, and Mr. Friis, and is also signed and stamped by a Notary Public. This rule of asking each inspector to furnish a bond is so that he may have a hold on his men. Another rule of the Agency is that it will charge nothing for work or expenses if the work does not prove satisfactory; in other words, the company guarantees its work. The Agency makes a written contract with its operatives, in which the latter agree under oath, and the forfeit of their bond, also the forfeit of a week's pay, to report the truth and nothing but the truth. These new regulations cannot fail to give anything but a good result. The New York office is managed by Mr. Friis personally, with the assistance of his superintendent, S. Frankel.

WESTERN NOTES.

L. K. Comstock, of 1437-38 Monadnock Block, Chicago, is putting a 1,500 light, isolated plant in the Leland Hotel, that city. Two M. A. Green engines, and two 50 K. W. generators will be installed.

The Fitzgerald-Van Dorn Company, of Lincoln, Neb., has just closed a contract with the Metropolitan West Side Elevated Railroad Company, of Chicago, to equip its entire rolling stock with its automatic drawbar for elevated railways.

The United States Graphite Company, of Saginaw, Mich., does a large business in the sale of curve grease and motor grease to street railway companies. We understand that these graphite products give good satisfaction. The mines of the company are at Sonora, Mexico.

The Lodge & Shipley Machine Tool Company, of Cincinnati, O., has recently received, with other orders, several for its celebrated motor gear lathe, also triple facing machine, and engine crank, disk turning and boring lathe. This company makes a specialty of machines to rapidly produce work heretofore done in lathes.

The Meaker Manufacturing Company, of Chicago, Ill., on March 1 renewed its contract with the Chicago City Railway Company for the use of the well known Meaker portable register, of which there are 1,600 in use on this road. This contract disposes of the rumor that stationary registers were to be used in place of portable registers on this road.

The Louis K. Comstock Company, is the title of a new corporation doing business in Chicago, which will take care of the work heretofore carried on by Louis K. Comstock, electrical engineer and contractor. The new concern will have the same offices in the Monadnock Building, and is prepared to give prompt attention to all orders in connection with the construction of electric railways, power plants and isolated plants.

L. K. Hirsch, of Chicago, Ill., has worked up a large trade by selling new rails to street railroads and taking old rails in part payment. He finds a market for these old rails at a very low figure. Some of these rails are nearly as good as new. He not only stands ready to furnish bottom prices on new material, but can quote very advantageous prices on second hand material, such as T rails, second hand cars, motors and locomotives. He will also purchase for cash any old equipments.

The Chicago Rawhide Company, of Chicago, reports doing an excellent business. The managers of this company say their trade has been such that they have found it necessary to run their works to their full capacity during all the winter months, a record which speaks well for the executive ability of the management. Mr. Preble says the company's foreign trade is constantly growing, which is indeed flattering. Taking all in all, the Chicago Rawhide Company has reasons to feel proud of the past, and can look forward with certain expectations of a good spring trade.

The Ohio Brass Company, of Mansfield, O., has recently issued a handsome and complete catalogue, giving views of the well known type W trolley wire appliances and other apparatus manufactured by it. This company does not confine itself by any means to equipment necessary for the overhead line, but is ready to supply voltmeters and ammeters, lightning arresters, switches, arc lamps, drills, trolley poles, brackets, etc. In fact, in looking over the index to this catalogue, it is hard to find any item useful on electric railways in the line of general supplies that is not included.

The National Carbon Company, of Cleveland, O., has sent us a handsome calendar for 1894, decorated with a birdseye view of the extensive works of this company. An especially valuable feature of this calendar is that a moonlight schedule for street lighting for each month is given with the calendar. By means of this a central station superintendent operating three arc lights has always before him the time for extinguishing his lights. The view of the company's works gives an excellent idea of the extent of the company's sales and the popularity of its products.

The International Register Company, of Chicago, finds its present quarters too small, and will remove about April 1 to 195-197 South Canal Street, where the company has secured large and commodious space in a modern manufacturing block. The company's new quarters are admirably located for the manufacture of its well known fare register, and are conveniently near the central business district. The company reports business as improving, several contracts for registers having been secured recently, among them the Chicago General Street Railway Company which has adopted the company's portable registers.

Fisher & Porter, of Chicago, tell us that the Providence Steam Engine Company's works are full of orders and are now running a double set of hands night and day. Comments on the merits of these engines "the Improved Greene," are superfluous under such a state of facts these dull times. The Providence Company has a pair of these engines of 1,200 H. P. each in the Rockwell Street station of the Madison Street cable road in Chicago. The running of these engines should be seen to be appreciated. Fisher & Porter are the right men in the right place, and are to be congratulated on having such an excellent engine to represent.

The Fiber & Stowell Company, of Milwaukee, Wis., in spite of the hard times, reports doing an excellent business, so large in fact that the company has outgrown its present quarters, and finds it necessary to add 100 × 80 ft. to its already large plant. The prospects for the future business of this company are more than flattering, as the managers are about closing a large contract, which will keep their works busy during a large part of the spring. The company is also in the market for a large lot of new machinery, and when the new shop is completed it will also be equipped with the most modern labor saving tools known to the trade.

Edward M. Bentley, formerly of the Bentley-Knight Electric Railway Company, who has been for the past four years and a half in charge of the patent department of the Thomson-Houston Electric Railway Company and the General Electric Company, severed his connection with the latter company on March 1. Mr. Bentley has opened an office at 40 Water Street, Boston, taking up the work of expert in patent cases and solicitor of patents. The law firm of Bentley & Blodgett with which Mr. Bentley, who is a member of the bar as

well as an expert, has been connected, will be dissolved, and his former partner, G. R. Blodgett, will succeed him as head of the patent department of the General Electric Company, making his headquarters at Schenectady.

The Metropolitan Electric Company, of Chicago, is getting in a stock of porcelain floor tubing of all sizes, to meet the requirements of the Board of Underwriters. This company carries a full stock of the P. & B. specialties, and is selling a large quantity of P. & B. armature varnish. W. C. McKinlock, secretary of the Metropolitan Electric Company, has just returned from an extensive business trip, with some good sized orders for the specialties handled by his company. One of these, the Xentric switch, is not as generally known as some other switches on the market, as it has but recently been introduced, but it is claimed to have no superior. It is made by that well known manufacturer, H. T. Paiste, the Metropolitan Electric Company handling his specialties.

The Shultz Belting Company, of St. Louis, reports some very large orders, particularly from foreign climes. This company has contracted to fill an order for 10,000 ft. of leather belt for Russia, and 3,500 ft. for India. The head of the company, J. A. J. Shultz, looks to the future with a great deal of encouragement, and rightly so, considering the large number of substantial orders on the company's books. He thinks the prospects exceedingly bright for his business. The company is building up a large foreign business because of the superior make of the Shultz belt. The above order for the Russian market is but one out of many for that country. There are branch offices not only in the principal centers of the United States, but in the chief cities of Europe, India and South America. The Shultz Company, as is well known, manufactures both solid and link belts. The latter have long ago found favor in the largest power plants and manufactories of this country and Europe.

The Heine Safety Boiler Company, of St. Louis, looks upon the coming year as apt to be a lucrative one from the point of view of the manufacturers of high class water tube boilers. Steam users throughout the country are coming more and more to think with the high class boiler makers that a water tube boiler of the first class is, after all, by far the cheapest steam generator, although the first cost may be greater. The company calls attention to the fact that the most economically operated, the largest size and largest paying steam plants in the country are those having high class water tube boilers, and among these may be numbered those in which the Heine safety boiler has become standard. The Heine Company has already obtained some large contracts since the advent of 1894, and among the latest is one for 5,600 H. P., to be installed in the electric lighting plant of the Municipal Electric Light & Power Company, of St. Louis. The contract was awarded to the Heine Company by the Edison Illuminating Company, of St. Louis, which has gained control of both the Municipal and Missouri Electric Light & Power companies.

The Laclede Car Company, of St. Louis, informs us that its works are filled with new cars at the present time in the various stages of construction. This company has received a large share of the car contracts recently let by the Philadelphia Traction Company, of Philadelphia, Pa. The first order called for 250 cars both closed and open, while a second one, recently obtained, calls for 150 additional closed cars. These are to be similar to those obtained in the first order, namely, eighteen foot bodies, equipped with two twenty-five horse power Westinghouse motors, mounted on Bemis extended spring base trucks. The company has received some very encouraging testimonials from the Philadelphia Traction Company, and the Philadelphia press has been unqualified in its praise of the handsome Laclede cars recently put in operation in that city. The Cincinnati Street Railway Company, of Cincinnati, O., has placed an additional order with the car company for thirty sixteen foot motor cars. Laclede cars are the standard of the railway company, this being about the tenth consecutive order that has been placed with the car works. These cars are to be equipped with twenty-five horse power General Electric Company's single reduction motors. The Brightwood Railway Company, of Washington, D. C., has ordered two motor cars. The company looks forward to the future with much confidence, and expects its shops to be continually filled with work. The demand for new cars is especially heavy from the eastern part of the United States.

Guido Pantaleoni, 608 American Central Building, St. Louis, representative in that city of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., reports the sale of three 750 H. P. generators to the Compton Heights, Union Depot & Merchants' Terminal Railway Company, of St. Louis, and one of 750 H. P. capacity to the Lindell Railway Company, of the same city. The former machines are to be belted each to a 750 H. P. engine of the Porter-Allen type, made by the Southwark Foundry & Machine Company, of Philadelphia, Pa. The machine for the Lindell Railway Company has already been delivered and is now in use, while the larger equipment is marked for delivery on May 15. The latest motor equipments of both the above named street railway companies are of the Westinghouse type, and each motor is of twenty-five horse power capacity, two motors to each car. There are now 200 Westinghouse motors in operation on these two systems, and a large number additional on other roads in St. Louis. The former are making a remarkable record for themselves. About one-half of them have been in operation in the neighborhood of ten months and during that time each car equipment has cost the railway company but $11.25. This item includes necessary gear and pinion renewals. The Westinghouse representative, Mr. Pantaleoni, is rightly very proud of this record, because the cars of this company are steadily at work both winter and summer, the conditions being such that the loads are constantly fluctuating, and at times heavy grades and large crowds speak volumes for the efficiency of the Westinghouse Company's motors.

List of Street Railway Patents.

U. S. Street Railway Patents Issued February 20, 1894, to March 20, 1894, Inclusive.

February 20.

Car Brake—Robert S. Haines, Savannah, Ga., assignor of one-half to Benjamin F. Peet, Springfield, Mass. No. 514,926.

Consists of a truck frame, car wheels and brake shoes with links pivotally connected to and suspended from the truck frame and supporting the shoes, the pairs of links or toggles connecting the shoes, and a transverse bar or beam uniting the toggle links at their middle joints and which is constructed to constitute an armature, and an electro-magnet supported by, and depending from the top of the truck frame and in direct working proximity to the electro-magnet.

Brake—Henry Kleiman, Allegheny, Pa. No. 514,940.

Comprises a truck frame, the axles and ground wheels, said truck frame being provided with opposite supports, brake bars arranged in the supports, extending beyond the same and provided with brake shoes for clamping against the wheels, friction pulleys arranged upon the axles, a centrally located vibratory lever provided at its opposite ends with oppositely-disposed standards, flexible friction shoes arranged upon the pulleys, connections between the ends of the standards with opposite ends of the shoes and between the remaining ends of the shoes and the brake bars, and means for vibrating the lever.

Electric Railway System—Nikola Tesla, New York. No. 514,972.

An electric railroad system operated by electric currents of high potential and frequency, having an insulated and electrically screened supply conductor extending along the line of travel, a motor car or cars carrying a conducting plate or bar in inductive relation to the screened conductor and an electrical connection between the said plate and the motor.

Car Brake Adjuster—James Howard, New York. No. 515,079.

Consists of a ratchet bar, a ratchet block connected therewith, a brake lever capable of limited movement on the ratchet block, lengthwise of the car, and a hand pull rod connected with said brake lever.

Automatic Grip Opener—Wm. P. Courtney, Oakland, Cal., assignor of one half to Albert Brown, same place. No. 515,115.

A cable grip provided with the guide and bearing rollers upon the rear edge, a safety bar movable within said guide within the plane of the sides of the grip frame, connections between said safety bar and the detent of the grip, and a spring catch whereby the safety bar and detent are retained in their elevated position when forced upward.

Electric Railway Conduit—Morris S. Towson, Cleveland, O., assignor to Albert G. Wheeler, Chicago, Ill, No. 515,179.

Consists of a slot rail, a conductor and a box, having an open end and a slot in its bottom, a conductor, carrier or clamp passing through said slot, and having an enlarged head secured in said box by an insulating compound.

Safety Car Fender—Francis De Fontes, Baltimore, Md. No. 515,198.

A safety fender having a triangular platform secured to the car truck frame; a car axle having a sprocket wheel; a transverse shaft on the under side of the platform and parallel with the axle, and provided with a sprocket wheel and two mitre gear wheels; two short shafts, each having a gear wheel meshing with the gear wheels of the transverse shaft, and each provided with sprocket wheels; two safety rollers in front of the platform and parallel with the angular sides thereof, and the two together forming a V; a cushion adjacent to the intersection of the V point of the said two rollers; and drive chains between the short shafts and said rollers for actuating the latter.

Trolley Conductor and Support—Myron D. Law, Washington, D. C., assignor to Albert G. Wheeler, Chicago, Ill. No. 515,238.

Embraces a conductor, having rails of L shape in cross section provided with contact flanges and supporting webs, said flanges being arranged in alignment with each other, the supporting webs being overlapped at the connecting ends of the rails.

Indicator for Electric Cars—Henry C. Beckmann, St. Louis, Mo. No. 515,274.

Comprises a fixed conductor, having a freely swinging contact rod electrically connected with the trolley wire; a laterally projecting rigid contact rod moves with the car; a suitable indicator in the car is electrically connected with the rod and also with the return conductor of the road.

Electric Railway Trolley—Chas. J. Van Depoele, Lynn, Mass., assignor to the Thomson-Houston Electric Company, Boston, Mass. No. 515,308.

Consists of a car, an overhead conductor, a contact device making underneath contact with the conductor, a standard on the roof of the car, an arm carrying the contact device pivoted on the standard on a tranverse axis, and free to swing around the standard, a spring connected to the pole or arm for pressing the contact device upward against the conductor, and a line connected with the arm above its pivot for moving the arm.

February 27.

Car Brake—Henry H. Sessions, Chicago, Ill., assignor to the Pullman's Palace Car Company, same place. No. 515,555.

Means for operating car brakes, consisting of an axle having a friction gear secured thereon, a second friction gear slidably mounted thereon, and a bevel faced gear rotatably mounted on a movable sup-

port and adapted to be thrust into engagement with the sliding gear whereby the latter may be thrust into frictional contact with the fixed gear.

STREET CAR—Thomas H. Wickes, Chicago, Ill., assignor to the Pullman's Palace Car Company, same place. No. 515,567.

Consists of a car having its end walls provided with removable and interchangeable bulkheads, one of which is constructed to receive doors to adapt it for a closed car, and the other of which is adapted to contain sashes or panels to provide a closed end wall for an open car.

CONDUIT ELECTRIC RAILWAY—Joseph A. Cassidy and Wm. A. Butter, New York. No. 515,572.

Embraces with a car an electric contact bar to operate contact levers arranged within a conduit, thereby electrically communicating with an electric conductor; toggle mechanism connects said bar to the car, and means for operating the toggle mechanism.

SAFETY CAR FENDER—Wm. R. Fowler, Baltimore, Md. No. 515,581.

Embraces rigid pendent rods, a fender loosely and vertically movable on said rods provided with a projecting lip, springs on the pendent rods to force the fender downward, a pivoted latch having a lip hook to engage the lip on the fender, a pendent swinging frame forward of the fender, and a rod attached to the pivoted latch and operated by the swinging frame to release it.

STREET CAR FENDER—Walter W. Play, Toronto, Can., assignor to John Henry Banes, same place. No. 515,609.

Consists of a mold board shaped foot attached to the end of a vertical spring-actuated spindle below the car in front of the wheel, a spring-actuated brush on the rail behind the mold board, the brush being actuated independent of the foot.

ELECTRIC RAILWAY—Benjamin F. Comstock, Decatur, Ill. No. 515,654.

Embraces with a trolley railway, a double track, electric cars adapted to run on same, a single trolley wire, trolleys provided with rollers and pointed plates carried by the cars, and adapted to run upon and pass each other on the single trolley wire.

CAR BRAKE—George W. MacKenzie, Thomas C. Sloan and Moses B. Sloan, Beaver, Pa. No. 515,692.

Embraces two independent brake-actuating mechanisms connected to and actuating the same winding shaft, and a mechanism for releasing the brakes set by either mechanism.

FENDER FOR STREET CARS—Wm. H. Brock, Brooklyn, N. Y. No. 515,728.

Embraces a fender movable longitudinally of the car, and means for actuating the fender by the rotation of the car axles.

MEANS FOR SWITCHING FROM MAIN TO SIDE TRACKS—John B. Duguid, Toledo, O. No. 515,823.

Consists of a car carrying a wheel guide, standard movable therein and carrying a wheel, a lever for operating the standard, a bar for operating the lever, a catch for holding the same, and a spring for returning it, and a guide upon the track for co-action with the wheel.

STREET CAR FENDER—Randolph C. Lothrop, Somerville, Mass. No. 515,868.

Embraces an advanced frame attached to the car; the forward end thereof being capable of both a vertical and lateral movement; a revolving guard roll is attached to the front of said frame, arranged to be carried along thereby at a slight elevation above the track; means for revolving said guard roll towards the car; and a safety net or platform immediately behind the roll.

HANGER FOR TROLLEY WIRES—George Forbes, Williamsport, Pa. No. 515,907.

Covers a hanger having two separable members adapted to be secured together and hold a trolley wire between them, one of said members having perforations to receive holdback or suspending wires.

STREET CAR SIGN—Edgar J. Rauch and Wilfred A. Keith, Brockton, Mass. No. 515,967.

Comprises a rotatable sign on the exterior of the car having inscriptions on its sides, a dial fastened on the interior of the car correspondingly inscribed, a rotary handle supported at the center of the dial and connected with the sign, and means for locking the handle in different positions.

MARCH 13.

ELECTRIC RAILWAY—Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. No. 516,188.

Embraces in an electric induction railway, a source of irregular or alternating currents, a conductor extending therefrom along the way, a movable coil in electrical connection with the conductor, a vehicle, a magnetic device on the vehicle to move the movable coil, an electric conductor on the vehicle in suitable inductional relation to the coil, and a translating device connected with the latter conductor.

STREET CAR FENDER—Thos. Davies, Toronto, Can. No. 516,266.

Embraces angular plates, supported by springs and held at an angle to each other, in connection with a cup or fingers projecting from the plates.

SAFETY CAR FENDER—George Q. Seaman, Alexandre Wilson and Wm. Jones, Brooklyn, N. Y. No. 516,408.

Comprises a curved, upwardly-inclined bottom or guard secured at its upper and lower edges, having a loose main portion so as to form a yielding pocket, the central portion of which is capable of moving in relation to the edges, and having side guards arranged adjacent to the curved guard.

ELECTRIC RAILWAY SUPPLY SYSTEM—Jas. F. Cummings, Detroit, Mich., assignor of one-half to Eugene M. Engleman, Milwaukee, Wis. No. 516,565.

Embraces a motor, car, conduit and two distributing conductors therein with which said motor is in traveling connection, of a contact device having rotary laterally spring pressed travelers arranged horizontally and contacting with the inner faces of said conductors respectively, and springs engaging the travelers on the opposite side.

CLOSED CONDUIT ELECTRIC RAILWAY—Edward H. Brown, Salem, Mass., assignor to the Magnetic Electric Company of West Virginia, Boston, Mass. No. 516,626.

Embraces in combination with a car provided with magnets, a main electric supply wire, magnet contacts, and separate and independent inclosures for the same, the inclosures forming sections of a continual central rail, said main wire independent of said inclosures and directly connected with said contacts.

MARCH 20.

ELECTRIC RAILWAY SYSTEM—Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. No. 516,666.

Embraces a vehicle electrically propelled along a line of way, having definite stopping and starting points thereon, of one or more conductors at such points making connection with the electric motor on said vehicle, and an energy storage device in connection with said conductor.

OVERHEAD ELECTRIC RAILWAY—John C. Henry, Westfield, N. J. No. 516,808.

A line structure for an overhead electric railway, comprising a trolley wire, rigid supports carrying insulating hangers for said trolley wire, a guy wire running in a zigzag course along the line of the trolley wire, and connected on one or both sides with said rigid supports, and poles for sustaining the wires.

CONDUIT FOR ELECTRIC RAILWAYS—Herluf A. F. Petersen, Milwaukee, Wis. No. 516,876.

Embraces a conduit for underground conductors, with a casing divided into two longitudinal conduits or passages, one of which is arranged to contain the conductors, and the other provided with a longitudinal slot in its upper wall, arranged out of line with said conduit or passage containing the conductors, and a suitable longitudinal cover arranged to normally close the conduit or passage in which the said conductors are located.

BRAKE—Heinrich Bussing, Brunswick, Germany. No. 516,912.

A brake consisting of a horse shoe fitted to the rail, a brake block supported thereby, a rod, a supplemental brake block and an operating means for moving the brake blocks toward each other.

STREET CAR—Peter M. Kling, St. Louis, Mo. No. 516,934.

Embraces a platform having a partition at one end thereof extending transversely of the length of the car, and dividing the platform into two parallel passageways between the car body and dashboard.

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.

The Lake Shore Route.

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

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

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

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

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

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by Spencer Trask & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., March 19.

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

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	101½	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	101½	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	112	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	112	115
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	110	115

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.....	80	90
City & Suburban Ry. Co	50	3,000,000	.....	1	.....	30	33
Central Pass. Ry. Co	50	300,000	.....	...	.....	60	65
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	15	16

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort	1892	500,000	.....	5	.....	108½	109
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	105	105¼
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	108	109
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	100½	101
" " "	1891	1,250,000	M. & S.	6	1901	101½	102½
City Pass. R. R. Co	1891	2,000,000	"	5	1911	112	112½

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,400,000	J. & J.	4	1887	76¾	77
West End Com'n	50	9,085,000	J. & J.	3	1890–1892	46½	47

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co	10	6,000,000	Q.—J.	2	.....	178	.....
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	67	.....
" " common	100	6,000,000	.....	...	1893	18	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	.....	155
Long Island Traction Co	100	30,000,000			1893	22	.....

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

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	0	.....	.....	65
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	5

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

CHICAGO STOCKS AND BONDS.—Corrected by William B. Wrenn, 167 Dearborn Street, Chicago, Ill., March 21.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	320	325
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	249½	249½
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	145½	147¾

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	101	.....
Chicago Passenger	1883	400,000	F. & A.	6	1903	102	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	98	100
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	102	103
West Chicago Street	.....	4,160,000	M. & N.	5	.....	102¼	102½
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	.....	98
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	103	103¼

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,750,000	Q.—J.	5	.....	105¾	106¼
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	108½	109½
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	60	65
" " " Pref.	100	100,000	.....	6	.....	98	99
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	.	.....	19½	21

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1894	100	.....
" "	.....	50,000	J. & J.	7	July, 1895	101½	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	99	100¼
" " extended	.....	150,000	J. & J.	5	.....	101	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	111½	112½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1921	102½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104¾	106
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	109	115
" " " "	.....	300,000	J. & J.	6	Jan. 1914	103	104
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	.....
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	113	115
S. Cov. & Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	114½	115¾

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. Hayes & Sons, Bankers, Cleveland, O., March 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co	100	12,000,000	.....	....	1893	47	48
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	57	60

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	101	102¼
" " City " "	1893	2,349,000	.....			95	96

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

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

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

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

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	87	88
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	38	39

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	90	99½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	115	115½
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	114½	115
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. March 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$400,000	J. & J.	4	.....	50	55
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	...	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Aug. 1, 1894	104	.....
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 188 Common Street, New Orleans, La., March 22. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.	100	1,200,000	Quart.	1½	1867	127	131
Crescent City R. Co.....	100	1,150,000	"	3	1866	.....	90
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	40	43
New Orleans City & Lake Co.	100	1,500,000	Quart.	2½	1860	110	118
Orleans R. R. Co.....	50	185,000	"	2	1868	45½	.....
St. Charles Street R. R. Co ..	50	600,000	"	2½	1865	56½	58½

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	.....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100	.....
do do new	1886	40,000	M & N	6	1896	100	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	113	118
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	96	.....
St. Charles Street R. R. Co...	1881	120,000	J & D	6	'93-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, March 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$2,000,000	M. & N.	4	May, '91.	176½	176¾

BONDS.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by JAMES MCGOVERN & Co., 6 Wall St., New York, March 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	186	190
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	145	.....
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	120	125
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4	.....	298	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	40	50
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	240	260
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q.—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	120	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	190	200
Third Avenue.....	100	5,000,000	Q.—M.	4	.....	175	177
23d St.....	100	600,000	Q.—F.	2½	.....	.....	290
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	132	135
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	108	.....
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	104	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	103	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	103	.....
" 2ds Interest as rental	.....	1,000,000	J. & J.	5	July, 1905	100	.....
Broadway Consolidated.....	.....	8,500,000	J. & J.	5	 1943	102	102¼
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	115	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	100	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	98	100
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	.....	57
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	104	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	114	114¼
23d St.....	.....	250,000	M. & N.	7	May, 1893	100	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	103

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING, 143 South Fourth st. (Bullitt Building), Philadelphia, March 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	265	270
Continental.....	50	1,000,000	J.—J.	6	1873	126	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	331	335
Germantown.....	50	1,500,000	Q.—J.	2½	1858	110	112
Green & Coates...	50	500,000	Q.—J.	3	1858	123	125
Hestonville...	50	2,050,000	.....	...	1859	35	38
Lombard & South.....	25	500,000	A.—O.	8	1861	90	90
People's Traction Co.....	50	10,000,000	.....	...	.....	28½	29
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	152	153
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	77	79
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	97⅞	99
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	226	230
Second & Third.....	50	1,060,200	Q.—J.	5	1853	207	210
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	225	230
Union.....	50	1,250,000	J.—J.	9½	1864	195	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	100½	101
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	102½	103
Baltimore Traction.....	25	5,000,000	.....	1	1889	15⅝	15⅞
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	13	13½

BONDS.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	107½	110
" " Imp.	1892	1,250,000	M.—S.	6	1901	104½	105
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100	101
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort..... ...	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by Richard C. Patterson, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., March 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by John B. Barbour, Jr., 306 Times Bldg., Pittsburgh, Pa., March 17. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co	50	1,500,000	.....	..	.....	19	.....
Citizens' Traction R. R. Co	50	3,000,000	J. & J.	3	.....	59	59½
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	12⅞	13
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	57	60
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	18¾	19
Pittsburgh, Allegheny & Man	50	3,000,000	.....	1¾	.....	39⅛	39½
West End R. R. Co	50	200,000	J. & J.	...	.....	....	.....
Second Avenue R. R. Co	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.. ..	.....
Fort Pitt Incline Plane Co	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co	50	3,000,000	.....	...	.....	25	25¼
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co	1887	1,250,000	A. & O.	5	1927	108¾	109½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	107½	110
Pitts. & Birmingham Traction Co	1892	.....	.....	5	.....	95	96
Pleasant Valley Ry	1892	1,250,000	J. & J.	5	1919	99¾	101
P., A. & M. R. R. Co	1891	1,500,000	J. & J.	5	1931	104	105
Duquesne Traction Co	1890	1,500,000	J. & J.	5	1930	99⅝	100
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	101	103
Central Traction Co	1889	375,000	J. & J.	5	1919	102	103
Union R. R. Co	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co	1887	75,000	J. & J.	5	1922	102	103½
Birmingham, Knoxville & Allentown Tract. Co	.....	.....	.....	6	.....	.....	95
Suburban Rapid Transit	.....	.....	.....	6	.....	96	100
Fort Pitt Incline Plane Co	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	. ...	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co	1889	250,000	J. & J.	6	1919	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by Chace & Butts, Bankers, Providence, March 17.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	.. .	.....
BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	95	98
Newport St. Ry. Co	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. Clark & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, March 15.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry	100	5,000,000	.....	...	1890	33	36
Buffalo (N.Y.) Ry	100	6,000,000	.....	...	1891	53	56
Paterson (N. J.) Ry	100	1,250,000	.....	...	1891	13	20
Columbus (O.) St. Ry	100	3,000,000	Q.—F.	1	1892	33	34
North Shore Traction Co. (Boston) Pref	100	2,000,000	A.—O.	6	1892	.....	80
do do Common	100	4,000,000	.....	...	1892	14	17
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	.....	80
do do Common	100	3,000,000	.....	...	1892	15	20
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	35	40
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry	1890	3,000,000	A & O	5	1930	88	95
Buffalo (N.Y.) Ry	1891	5,000,000	F & A	5	1931	95	99
Paterson (N. J.) Ry	1891	850,000	J & D	6	1931	85	95
Newark (N. J.) Pass. Ry	1890	6,000,000	J & J	5	1930	93	94
Columbus (O.) St. Ry	1892	2,600,000	J & J	5	1932	88	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	85	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by Philip Barth, Broker, 440 California Street, San Francisco, Cal., March 9.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co	100	1,000,000	Monthly	5	.....	.....	100
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	.....	110
Market Street Cable Co	.....	17,892,000	.....	...	.....	38¾	39
Metropolitan Electric	.....	.....	.....	...	.....	22½	30
Presidio & Ferries R. R. Co	100	1,000,000	.....	...	.....	.. ..	13½
Sutter St. R. R. Co	.....	.....	.....	...	.....	90	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	.....	5	.....	102¼	.....
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	103	.....
Geary St., Park & Ocean	.....	.....	.....	...	.....	.....	108
Market Street Cable Co	.....	3,000,000	J. & J.	6	1913	119	119½
Omnibus Cable Co	.....	2,000,000	A. & O.	6	1918	.....	118
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	114	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	99	110
Powell Street R. R.	.....	700,000	M. & S.	6	1912	.....	112
Sutter St. Cable Co	.....	.....	.....	..	.....	102½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by James Campbell, Banker & Broker, Rialto Building, 218 N. 4th St., March 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds	100	2,500,000	.....	...	1876	50	60
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue	100	112,000	Dec. '88	2	1885	125	150
Lindell	100	2,500,000	.....	...	1890	73½	75
Missouri	100	2,000,000	Q.—J.	2	1891	180	200
People's	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis	100	2,000,000	J. & J.	3½	1890	155	160
Fourth Street & Arsenal	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban	100	2,500,000	.....	...	1891	30	40
Southern, Pfd	.....	800,000	.....	...	.....	90	92
" Com	.....	700,000	.....	...	.....	82	85
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground	1892	1,800,000	J. & J.	5	1912	96	98
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	102	103
Fourth St. & Arsenal	1888	50,000	J. & J.	6	1898–1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	99	101
Missouri Cable	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort	1882	125,000	J. & D.	6	1902	98	100
" 2d mort	1886	75,000	M. & N.	7	1902	100	102
People's Cable	1889	800,000	J. & J.	6	1889–1914	90	95
St. Louis Cable	1890	1,500,000	M. & N.	5	1900–1910	100	102
Union Depot	1890	4,000,000	A. & O.	6	1900–1910	104	105
Southern	1884	200,000	M. & N.	6	1904	103	105
Southern	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban	1891	1,400,000	F. & A.	5	1921	95	97
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by Crane, Parris & Co., Bankers, 1344 F Street, N.W., Washington, D.C., March 17. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	290	305
Metropolitan R. R.	50	750,000	Q. J.	2	1864	84	97½
Columbia R. R.	50	400,000	Q. M.	1	1870	60	75
Belt R.R.	50	500,000	Q. J.	...	1875	20	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	.....	.....
Georgetown & Tenallytown	50	200,000	.....	...	.....	.....	.....
Rock Creek R. R.	100	401,700	.....	...	.....	.....	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'ton & Geo'town conv't.	'83–'91	3,000,000	J. & J.	6	1899-1929	130	150
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	80	.....
Belt	1921	240,000	J. & J.	6	1921	.....	95
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	100	110
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

Financial.

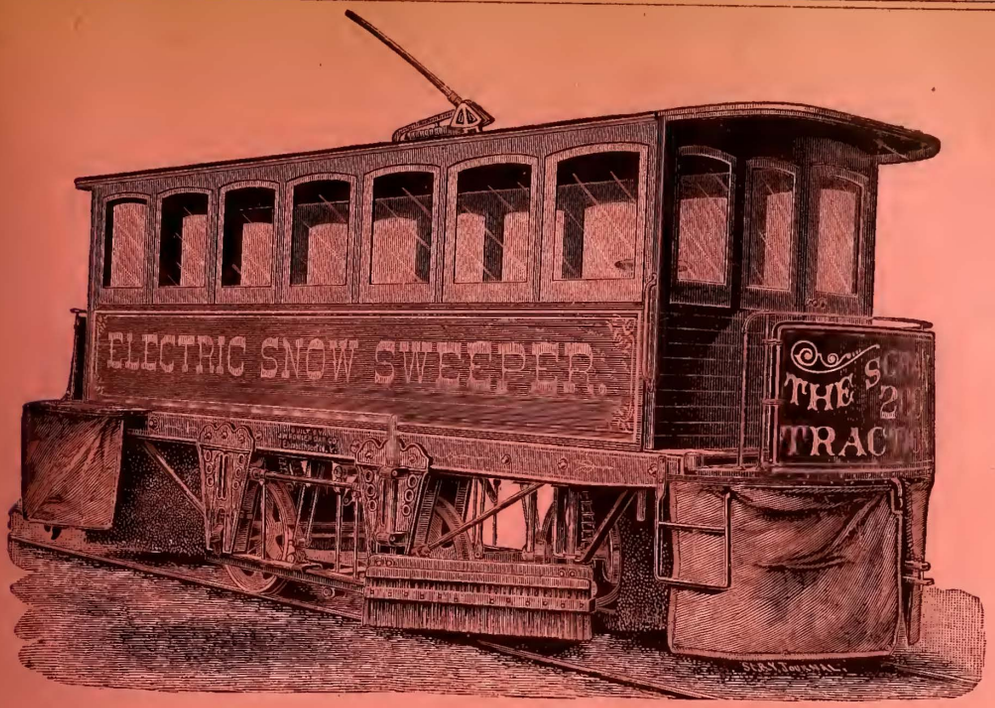
H. V. Harris has been appointed receiver of the Louisville Terminal Railway Company, of Louisville, Ky.

$ $ $

The capital of the Montreal (Que.) Street Railway Company has been increased from $2,000,000 to $3,000,000, the stockholders on March 31 will receive at par one share for every two held.

$ $ $

The Framingham (Mass.) Union Street Railway has petitioned the legislature for leave to raise $24,000 preferred stock, it being under-



Snow Sweeper with full length cab, the motorman operating same on the inside. Same as built by us for Scranton Traction Co.

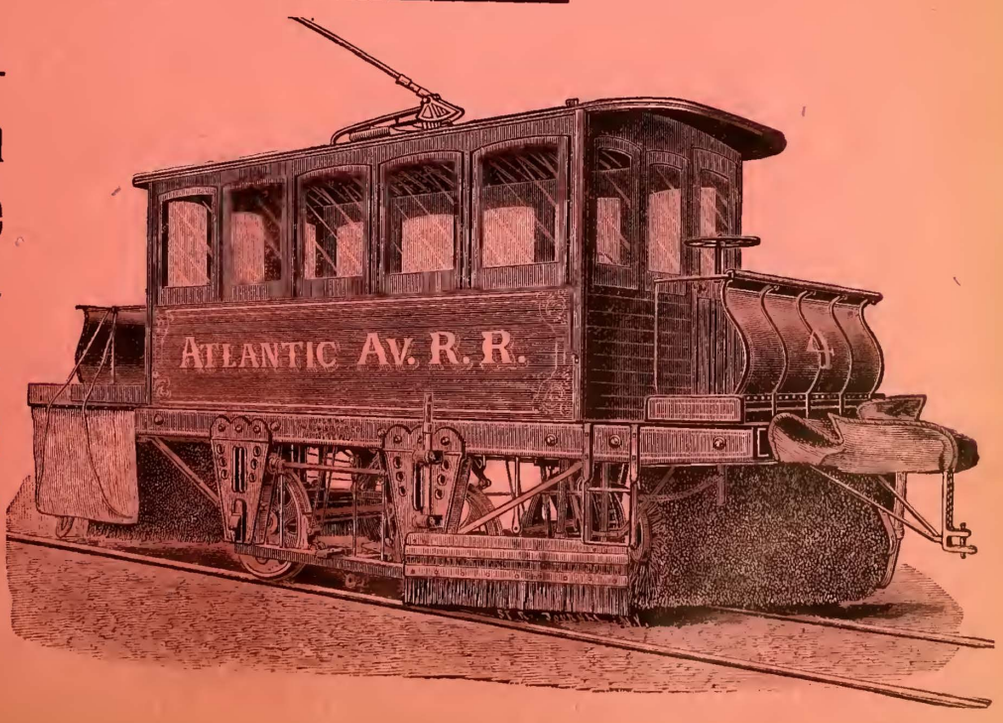
ELECTRIC SNOW SWEEPERS

BUILT BY THE

J. W. FOWLER CAR CO.

WORKS AND GENERAL OFFICE,
ELIZABETHPORT, N. J.

Electric Snow Sweeper to be operated with the motorman on the platform, motor operating the brooms inside cab. Same as built by us for the Atlantic Ave. R. R. Co., Brooklyn, N. Y.



J. W. FOWLER CAR CO.

BUILDERS

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Electric,

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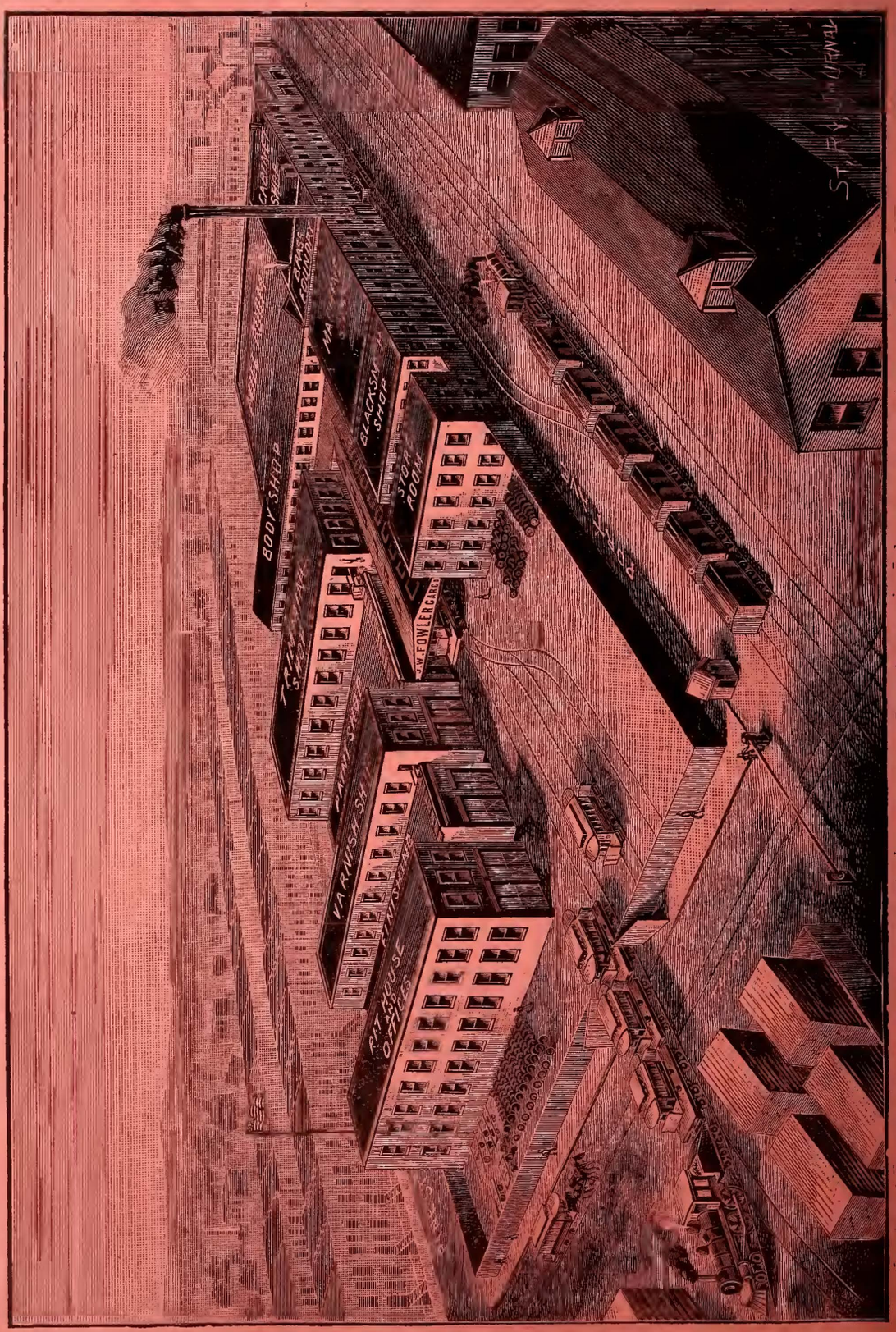

WORKS AND GENERAL OFFICE,
ELIZABETHPORT, N. J.
NEW YORK OFFICE, HAVEMEYER BUILDING.

stood that the amount will be used in equipping the line with electricity if the bill is passed.

$ $ $

THE Columbus (O.) Street Railway Company reports as follows for February: Gross earnings, 1894, $36,173.56; 1893, $37,812.27; decrease, $1,638.71. Operating expenses, 1894, $19,937.45; 1893, $27,695.57; decrease, $7,758.14. Net earnings, 1894, $16,236.13; 1893, $10,116.70; increase, $6,119.43.

$ $ $

THE Paterson (N. J.) Railway Company reports as follows for February: Gross earnings, 1894, $15,197.04; 1893, $16,147.56; decrease, $950.52. Operating expenses, 1894, $9,811.80; 1893, $16,519.99; decrease, $6,708.19. Net earnings, 1894, $5,385.24; 1893, deficit, $372.43; increase over 1893, $5,757.67.

$ $ $

THE Scranton (Pa.) Traction Company makes the following statement of its operations for January: Gross earnings, 1894, $19,773.92; 1893, $14,487.25; increase, $5,286.67. Operating expenses, 1894, 10,524, 63; 1893, $9,800; increase, $724.63. Net earnings, 1894, $9,249,29; 1893, $4,687.25; increase, $4.562.04.

$ $ $

THE Scranton (Pa.) Traction Company submits the following statement of its operations for February: Gross earnings, 1894, $15,438.65; 1893, $12,176.28; increase $3,262.37. Operating expenses, 1894, $10,236.54; 1893, $9,450.21; increase, $786.33. Net earnings, 1894, $5,202.11; 1893, $2,726.07; increase, $2,476.04.

$ $ $

THE Buffalo (N. Y.) Railway Company submits the following comparative statement of its operations for February: Gross earnings, 1894, $102,544.17; 1893, $95,794.11; increase $6,750.06. Operating expenses, 1894, $65,884.59; 1893, $75,287.70; decrease, $9,403.11. Net earnings, 1894, $36,659.58; 1893, $20,506.41; increase, $16,153.17.

$ $ $

THE accompanying figures show the gross receipts of several of the street railway companies in Washington, D. C., for the year ending December 31. The statistics are taken from reports made by the railway companies to the Senate in accordance with law: Anacostia & Potomac River Railway, $59,515.24; Belt Railway Company, $141,896..19; Brightwood Railway Company, $36,907.45; Eckington & Soldiers' Home Railway Company, $54,744.53; Metropolitan Railroad Company, $411,582.97; Rock Creek Railway Company, $23,325.42; Washington & Georgetown Railway Company, $1,024,748 45.

$ $ $

THE Hestonville, Mantua & Fairmount Passenger Railway Company, of Philadelphia, Pa., has decided to issue the additional capital stock and bonds for the electrical equipment of its line. The proposition is to issue $533,900 of preferred stock and $750,500 bonds, the latter free of tax, with interest at the rate of 5 per cent., to run for thirty years; dividends on the preferred stock to be at the rate of 6 per cent. per annum, and the stock to be entitled to share in any dividends over and above 6 per cent., after that amount has been paid on the common stock. Holders of the latter are given the privilege of subscribing for one share of the preferred stock for every four shares of the common owned or held by them.

$ $ $

THE annual meeting of the Louisville (Ky.) Railway Company stockholders was held last month. The old board of directors was elected, consisting of Alexander H. Davis, of Syracuse, N. Y.; H. H. Littell, of Buffalo, N. Y.; Isaac N. Seligman, of New York, and J. B. Speed, St. John Boyle, Harry Bishop, J. W. Gaulbert, T. J. Minary and Alex. P. Humphrey, of Louisville. The old officers were re-elected. The report of the treasurer for the year ending December 31, 1893, showed the gross earnings for the year to have been $1,281,992.88, and the operating expenses, including taxes, interest and other charges, $1,208,555.54, leaving a net surplus of $73,437.34. The plans of the company looking to the extension of electrical equipment, were carried forward throughout the year, notwithstanding the stringent money market and depressed state of business, and the directors reported that the gross earnings of the company were slightly in excess of the previous year, and that it has not been deemed absolutely necessary to reduce the wages of its employes.

$ $ $

THE annual report of the Baltimore (Md.) Traction Company, for the fiscal year ending December 31, 1893, shows the following results: Gross earnings, $1,062,884.82; operating expenses (64½ per cent.) $689,317.73; net earnings, $373,567.09; fixed charges, interest on bonds, taxes and insurance, $355,202.10; balance, $18,364.99. During the year there was constructed 22.08 miles of track. The company now has 78.47 track mileage; 15.30 cable, 36.50 electric, 23.59 horse and 3.08 electric owned jointly. The horse car lines are now in process of change to electric power, and it is expected that during the present year horses will disappear from all the lines in the company's system. There were purchased during the year sixty electric cars and two electric sweepers, the company now owning 389 cars, of which 184 are horse, the balance being cable and electric, with trailers and a full complement of sweepers and salt cars. During the year 1893, the company's cars traveled 5,982 646 miles and carried 21,123,916 paying passengers.

The company is capitalized as follows: Stock, $5,750,000; first mortgage, 5 per cent. bonds, $1,500,000; extension and improvement, 6 per cent. bonds, $1,250,000; Traction Company's first mortgage, 5 per cent. bonds, secured by mortgage on North Baltimore division, $1,750,000.

President Hambleton, in his report to the stockholders read at the annual meeting of the company, held February 7, said: "As we all know, the year 1893 was a disastrous one for the country, with great financial stringency and extraordinary business depression. The street railways suffered, in common with all other interests, and while such conditions were operative, together with the sharp competition of rival lines—three of which paralleling our own at different points, all having put into operation their respective cable or electric plants last year—our receipts were made to appear less satisfactory than we had reason at the beginning of the year to expect. Nevertheless the earnings of the company have been, all things considered, quite encouraging. The month of September, being the first month in which we en-

countered the severest competition, showed a decrease of $27,000, as compared with the receipts of the same month of the previous year; since that time the comparative earnings have been very much more favorable, until in January of this year there was a difference of only $8,000, as compared with the same month of last year."

California in Three and a Half Days.

From the snow clad regions of the East to the delightful semi-tropical climate of California is a matter of only a few days' journey if the Northwestern Line is used for the trip. Palace drawing room sleeping cars leave Chicago daily and run through to California without change, covering the distance in the marvellously short time of three and a half days, and all meals en route are served in dining cars. Daily Tourist Sleeping Car service is also maintained by this line between Chicago and San Francisco and Los Angeles, and every Thursday the party is personally conducted by an experienced excursion manager. Completely equipped berths in Tourist Sleepers are furnished at a cost of only $4 each from Chicago to the Pacific Coast, thus affording a most favorable opportunity for making the journey in a comfortable and at the same time economical manner. Variable route excursion tickets, taking in all principal points of interest, are sold at exceedingly low rates. Illustrated pamphlets descriptive of the Mid-Winter Fair and full information concerning rates, routes, etc., will be mailed free upon application to W. A. Thrall, General Passenger and Ticket Agent Chicago & Northwestern Railway Company, Chicago, if you mention this publication.

Of Interest to Travelers.

The Baltimore & Ohio Railroad announces that it has placed on sale round trip tickets at reduced rates to the winter resorts in Florida and the South, and also to such points of interest as Luray, Natural Bridge and Gettysburg. This company has also arranged to place on sale excursion tickets to San Francisco and other points in California, on account of the Mid-Winter Fair, at unusually low rates. Excursion tickets are now on sale to Baltimore and Washington via the famous Royal Blue line.

With its vestibuled train service, via Washington, to Cincinnati, St. Louis and Chicago, the Baltimore & Ohio is in the best of condition to handle Western and Southern travel. That the line is a popular one, is attested by the immense World's Fair business handled this summer.

Those contemplating a trip West or South this winter should write to C. P. Craig, general Eastern passenger agent, 415 Broadway, New York, for rates and other information.