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Coal Handling Apparatus at the Southern Station of the Brooklyn City Railway.

A full description of the southern power station of the Brooklyn City Railway Company, with sections and plans, was published in the STREET RAILWAY JOURNAL for October, 1892. As will be remembered, this station is located on New York Bay, at the foot of 52d Street, South Brooklyn, is designed for a capacity of 12,000 H. P., and supplies power to the cars operating in the southern and western districts of the city. There are at present six Allis compound, condensing Corliss engines, with cylinder dimensions twenty-six inches and forty-eight inches by forty-eight inch stroke, which are belted to twelve 500 K. W. generators of the General Electric M. P. type. The steam generating equipment at present consists of eight batteries of Babcock & Wilcox boilers, each comprising two water tube boilers of 250 H. P. each.

The facilities for the receipt of fuel are excellent, and its cost for handling has been reduced by the use of labor saving appliances, to a minimum. Through the kindness of M. G. Starrett, chief engineer of the Brooklyn City Railway Company, and Charles A. Moore, engineer of the southern station, we are enabled to give the following details of the system.

Extending from the station into the bay is one of the most substantial piers in the city, 700 × 200 ft. in size, and reaching out to water of fifteen feet in depth at mean low tide.

FIG. 1.—GENERAL VIEW OF COAL HANDLING APPARATUS—SOUTHERN STATION OF BROOKLYN CITY RAILWAY.

Coal is landed at this pier in barges, and is then automatically conveyed to a pocket, shown at the center of Fig. 1, by means of a continuous or belt track on a raised trestle, upon which are cars operated by an endless cable, as will be described later. From this pocket fuel is carried to the hoppers over the boilers as required. The system used throughout in the travel of the fuel is that of the C. W. Hunt Company.

The elevator at the extremity of the pier (Fig. 1) is about thirty feet in height, and is supported by rails on a trestle about twenty feet in height, so that its position can be varied.

The elevator presents a number of very interesting

features, some of which have been installed here for the first time. One of these is the shape of the boom arm, which is that of a parabola whose focus is the upper surface of the hoisting drum. In consequence, the direction of the force acting on the boom trolley or truck is always at right angles to its travel. It is, therefore, in equilibrium, and has no tendency to change its own position, no matter what the position of the shovel may be. When the shovel reaches the proper height, it is stopped by a part of the trolley frame, and as the hoist still operates, the shovel is drawn directly over the delivery chute, into which it automatically dumps the coal. The boom, when not in use, is arranged to be swung close to the side of the elevator. The hoisting engine is of the Hunt type, with two 10×10 in. cylinders, and is geared to a Lidgerwood drum hoist of the ordinary type, the ratio of reduction being 4 to 1. This engine takes the steam from the main boiler house through a three inch pipe, and at 160 lbs. pressure, the pipe being protected by Magnesia covering to prevent loss of heat during the long transmission.

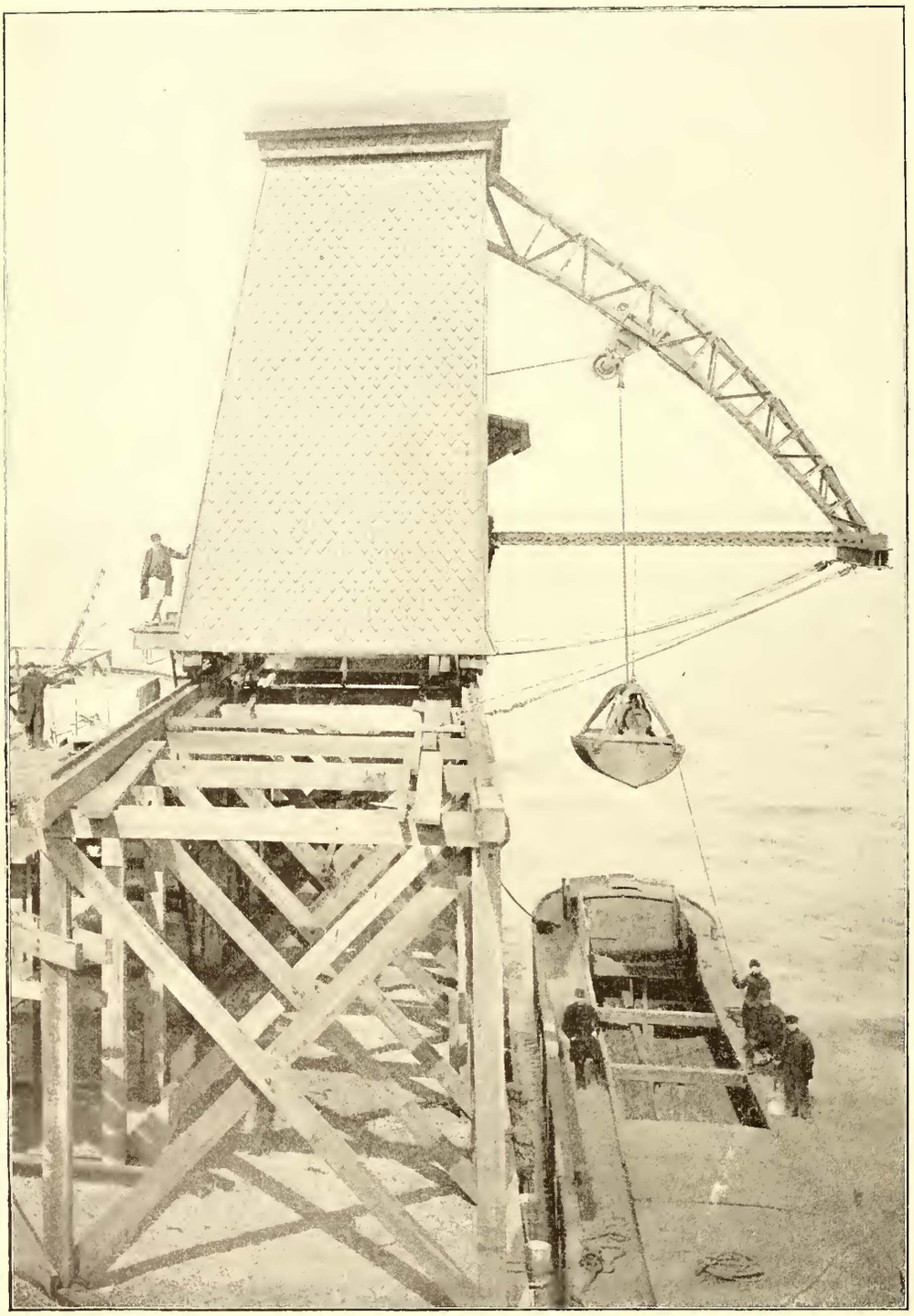


FIG. 2.—COAL ELEVATOR WITH PARABOLIC BOOM—SOUTHERN STATION OF BROOKLYN CITY RAILWAY.

Only one man is required in the tower to govern the movement of the dredge and hoist. These movements are controlled by four levers, two of which, the throttle and the friction brake on the drum hoist, are operated by the foot, and that for throwing the drum hoist out of gear and for opening and closing the bucket, by hand. From his position in the tower, this man can command a view of the barges below. Only three other men are required on the latter, one to direct the movement of the shovel and two additional to clean up the bottoms.

As already mentioned, the coal is carried from the elevator to the pocket by cable cars, each car having a capacity of about 3,300 lbs., which is also the capacity of the shovel. A general view of the cable railway, as seen from its upper end, is shown in Fig. 3. All the details of this portion of the installation have been carefully planned, and are of great interest. To prolong the life of the cable, there are no short turns made of the rope, the radii of all the curves being twenty feet. The curve sheaves are placed only twelve inches apart to reduce the flexure of the cable, and have wide, inclined flanges to retain the latter in place. The sheaves are cast with large hubs, which turn in journals bolted to the ties. These hubs are cast hollow and are filled with oil, and as a circular channel is cut in the base of the journal, each sheave practically revolves in a well of oil. The cable is seven-eighths of an inch in diameter, and is operated by a Hunt engine, with two 6 × 6 in. cylinders, located under the elevator. The cable is kept taut by a tension device of the ordinary type.

The sides of the coal cars are hinged at the top, and those of each car open sideways simultaneously. The sides are normally kept closed by rods, which are connected to the opposite ends of a double crank at both ends of the car, as shown in Fig. 3. The centers of the rods just pass over the center of the crank so that the sides are locked in a closed position. They open automatically on passing an obstruction set to trip the crank, when the coal falls out by force of gravity.

Each car is mounted on a two-wheeled radial truck, the framework of which is supported from the axle boxes by links, which allow the axles to depart from parallelism when passing around curves. The car wheels have outside flanges, and their treads are slightly cone shaped, the greatest diameter being nearest the flange. The effect while passing around a curve, therefore, is the same as if the diameter of the outside wheel was increased and that of the inner decreased, thus reducing the friction on the rails.

Each car carries its own grip, and consequently is

operated independently. The grip is set by the turn of a star shaped wheel on the rear of the car, and is so arranged that the car passes around the curve without the need of a guard rail, the grip itself acting as a guard. As soon as each car is loaded with coal at the elevator, its grip is tightened by a man located at that point, and it is then drawn to the coal pocket. Here it is automatically dumped while in motion, distributing its load, then returns to the extremity of the dock, where its grip is loosened and the brakes are applied. Only one man is required for this work. A view of the pocket, showing the circular track for the cars, is given in Fig. 4.

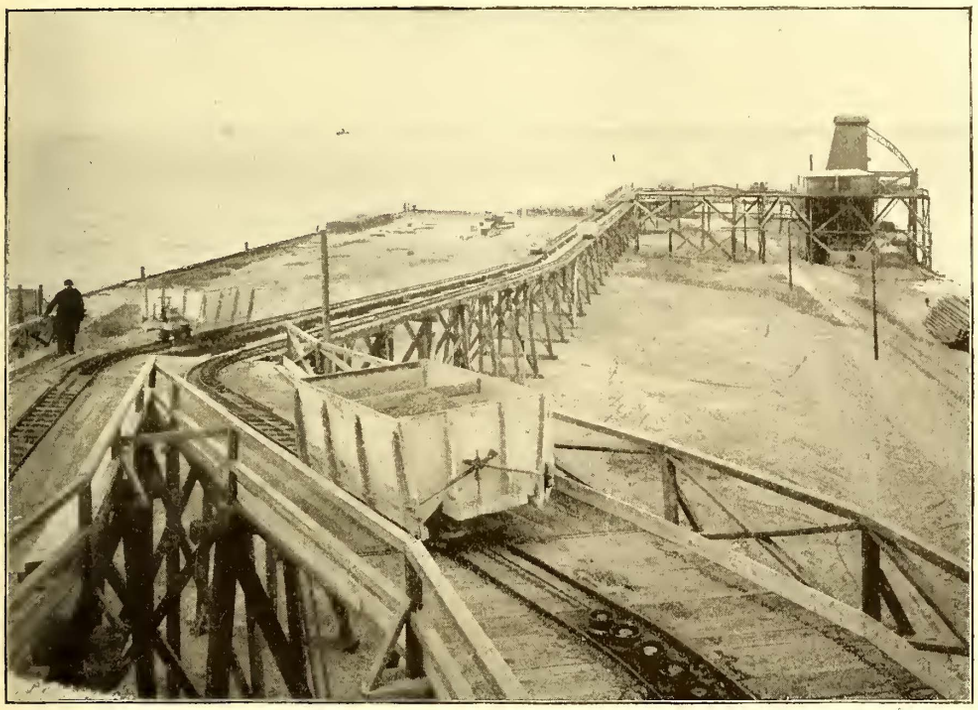


FIG. 3.—VIEW OF CABLE RAILWAY FROM COAL POCKET—SOUTHERN STATION OF BROOKLYN CITY RAILWAY.

From the pocket to the boiler room, the coal is conveyed by the Hunt bucket system. This, as will be remembered, consists of a series of buckets linked together in an endless chain, each being hung on pivots, and held in a normally upright position by gravity. The links are made of heavy wrought iron bars, and the entire system is mounted on wheels which run on tracks provided for the purpose. Each of the buckets has a capacity of about 200 lbs.

The bucket conveyor at the southern power station of the Brooklyn City Railway is 500 ft. in length. It extends entirely below the center of the coal pocket where it is filled, the pocket having inclined sides, so that its central line is its lowest part. Thence the conveyor is brought up at the front end of the pocket, thence, over a bridge of ninety-one feet seven and a half inches span, into the boiler room, where it travels about a circular track, after which the empty buckets return to the pocket to be coaled again.

They are filled by a rotating filler which consists of a revolving bucket driven by the conveyor chain, so that the proper load is secured whether the speed of the chain is fast or slow. There are thirteen discharge points on the bottom of the pocket, at any of which the filler can be located.

The conveyor is driven by a special engine located in the pocket, and with two cylinders, measuring 6 × 6 ins. each. This engine is supplied with steam from the boiler room. In the latter the coal from the conveyor is automatically dumped into hoppers by trips set from the floor. Each hopper has a capacity of ten tons, and one is located over each battery of boilers. From these the coal can be taken as required. It is the intention of the engineers of the Brooklyn City Railway to have weighing chutes located below these hoppers, so that all fuel will be weighed before being fed to the furnaces.

The coal handling apparatus has a capacity of about fifty-five tons an hour, or sufficient, with present consumption, so that enough fuel can be conveyed to the hoppers in an hour for an entire day's run. The cost of transferring fuel by this system is much less than by the old methods.

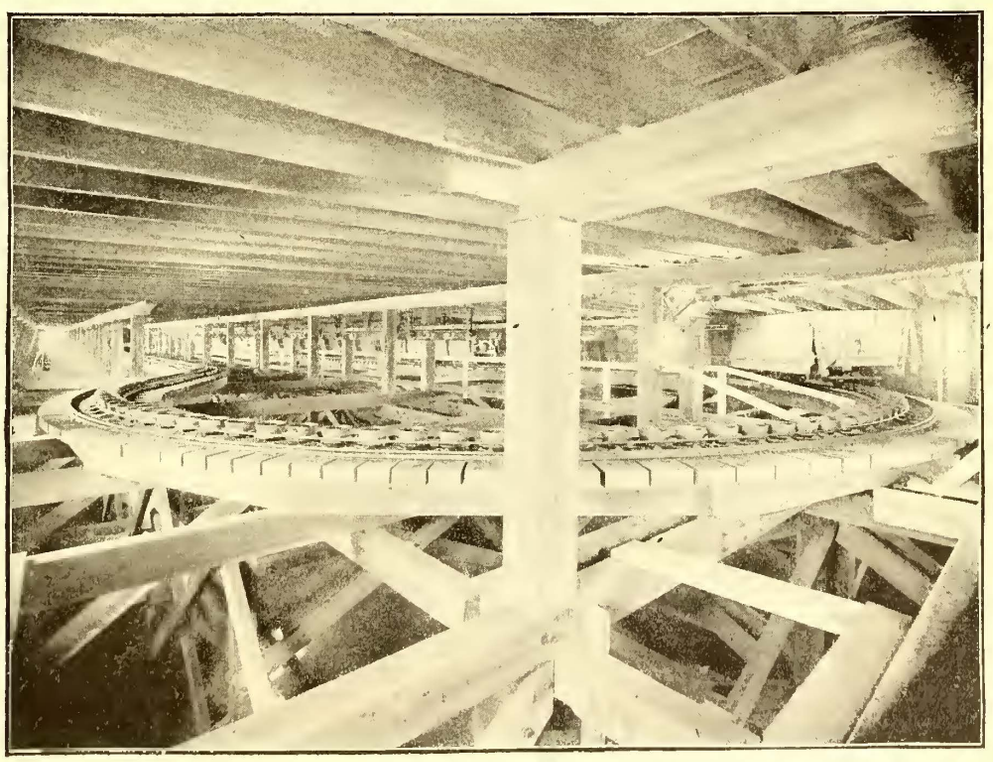


FIG. 4.—INTERIOR OF COAL POCKET—SOUTHERN STATION OF BROOKLYN CITY RAILWAY.

Buda-Pesth Electric Conduit System.

The results of the operation of the electric street railways at Buda-Pesth, which, it is remembered, are on the conduit system, has been most successful, according to the foreign electrical papers. In 1893 the road carried 12,500,000 passengers, and the receipts amounted to 2,500,000 francs, or nearly $500,000. A dividend of 8 per cent. was declared on the capital stock of 12,000,000 francs. Thenumber of cars has been considerably increased, and is now over 100.

THE Massachusetts Senate has voted to permit the street railways in that state to carry merchandize and mails.

Three Phase Electric Transmission of Power Applied to Electric Railway and Mill Operation.

The first important application of electrical power transmission to street railway and other power purposes has just been installed by the General Electric Company at Taftville, Conn., the power being transmitted from Baltic to Taftville, a distance of nearly four and one half miles. It is a typical transmission by three-phase currents, in which motors of the synchronous type are used not only to operate one of the most interesting cotton mills in this country, but also the power station of the Norwich (Conn.) Street Railway.

E. P. Taft, who is largely interested in the Taftville

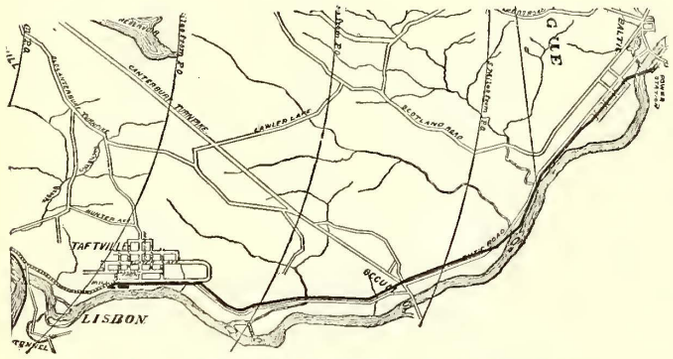


FIG. 1.—ROUTE OF THREE-PHASE ELECTRIC LINE.

cotton industry, long ago recognized the value of the available water power at Baltic, on the Shetugket River, near to which stood a ruined mill destroyed by fire some years ago, and having secured the property with the water rights, determined to utilize the power as soon as a successful means could be discovered. When the General Electric Company announced a practical solution of the power transmission problem, Mr. Taft carefully investigated the system and finally decided to adopt it for the operation of his cotton mills. The installation has now been completed, and the successful operation of the plant proves the advantages of the choice.

The Ponemah Mills are situated at Taftville, also on the Shetugket, and about three miles distant from Norwich. The original mill was operated for nearly a score of years by water power taken directly from the river, and when the new mill was erected it was found necessary to

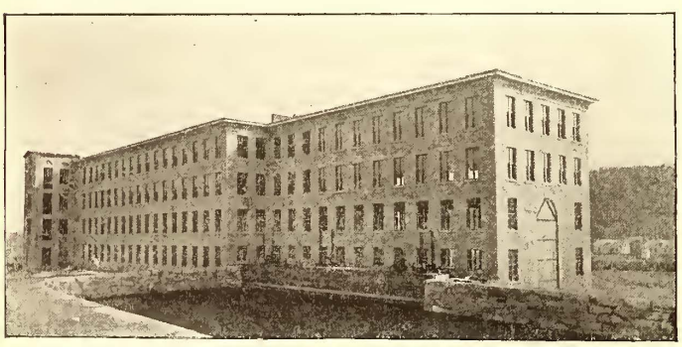


FIG. 2.—BALTIC MILL, SHOWING RESERVOIR AND INTAKE GATES.

drive it from two 350 H. P. Corliss engines, the existing dam being insufficient in capacity. In Fig. 1 are shown the relative positions of the generating station at Baltic and the receiving station at Taftville. The line is nearly four and one half miles in length and is carried along the highway up the river, skirting its bank in places and crossing it at intervals to shorten its route.

The rebuilt mill and generating station at Baltic is shown in Fig. 2. In the basement of this building are the wheel and dynamo rooms of the generating plant. The mill is of four stories, built of stone, and will presently be used as the Ponemah Mills in the cotton weaving industry. 400 ft. above the mill a fine stone dam 525 ft. long has been thrown across the river. The effective head on the turbines is thirty-two feet, and the water available, even in the driest seasons, is sufficient to furnish not less than 1,500 H. P.

Fig. 3 is a plan of the basement of the mill in which

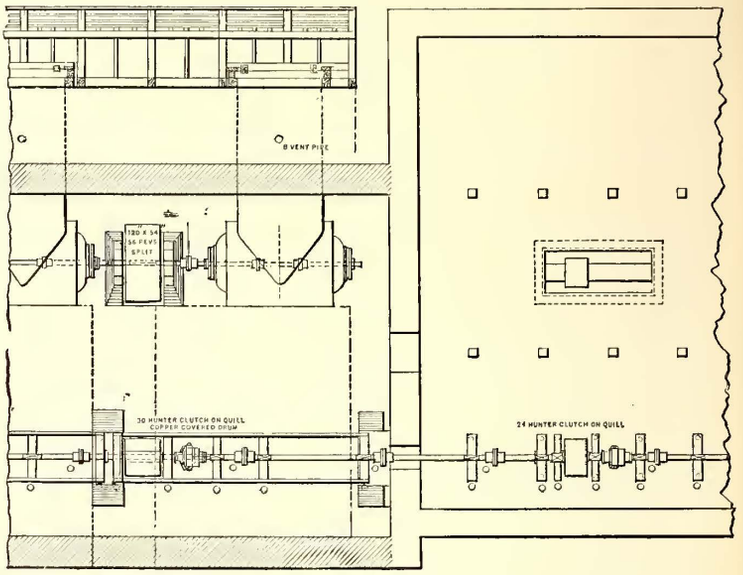


FIG. 3.—PART PLAN OF TURBINE AND GENERATOR ROOMS.

the power plant is located. It will be seen that the turbines are belted to pulleys on the main line shaft extending the whole length of the wheel room, and continuing through the partition walls into and along one side of the generator room. The pulleys are thrown into or out of action by Hunter clutches mounted with pulleys on quills, so that any or all of the wheels can be applied to driving the shafts. Similar pulleys and clutches are furnished in the dynamo rooms for throwing in or out the various machines that may there be placed.

Fig. 4 shows the wheel room and the arrangement of the turbines and line shaft. There are three double, forty-two inch, horizontal wheels and one double, twenty-

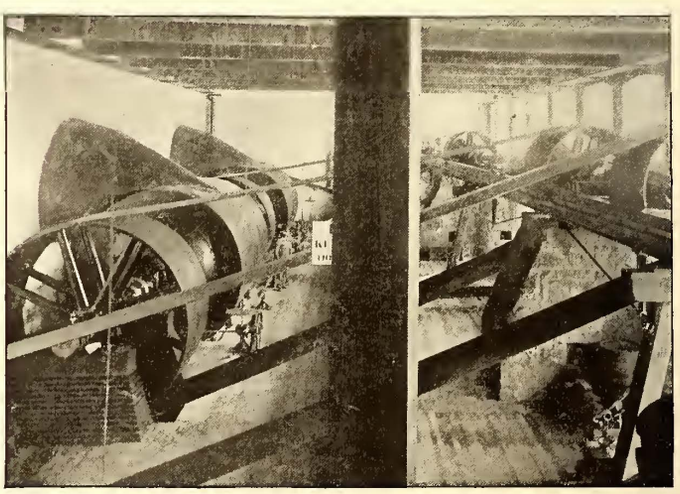


FIG. 4.—TURBINE ROOM AT BALTIC.

seven inch wheel, the former developing 800 effective H. P. each, at 157 revolutions per minute, and the latter 300 H. P. at 244 revolutions per minute. The belts pass obliquely upward to the pulleys on the line shaft, and the turbines are kept at speed by Schenck electric governors, which have proved themselves capable of doing very fair service. The wheel plant and shafting were made and installed by the P. C. Home Company, of Gardiner, Me. The line shafting is supported by heavy iron girders set on stone piers and additionally braced by timbers.

The dynamo room (Fig. 7), besides the shafting, is occupied by two 250 General Electric three-phase generators, delivering current to the line at 2,500 volts. Each

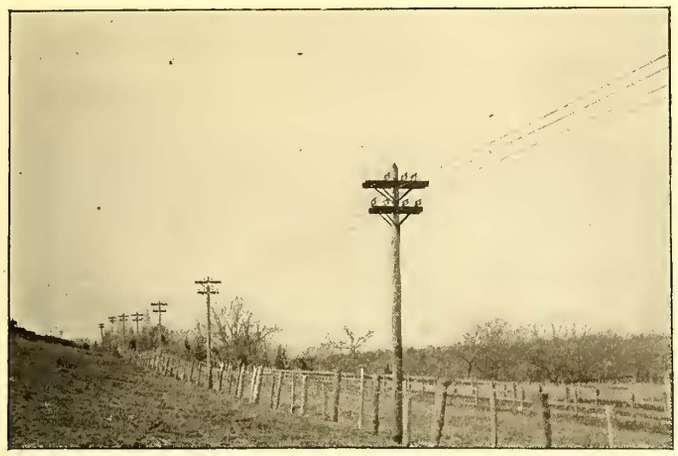


FIG. 5.—PORTION OF LINE—TAFTVILLE TRANSMISSION PLANT.

machine is provided with its own exciter, a three kilowatt, bipolar dynamo. The three-phase machines run at 600 revolutions per minute, and are set so firmly on substantial foundations as to run with scarcely a perceptible vibration. The driving pulleys on the main shaft are fitted with Hunter clutches, so that either machine can be dropped out without the slightest disturbance to the service.

The generators are connected to a common switchboard (Fig. 6), and may be run in parallel whenever desirable. To this end the board is furnished with synchronizing apparatus, the acoustic synchronizer being mounted on the face of the switchboard, and the equalizing switch being at the back. The most interesting novelties on this switchboard are the high voltage switches on the lower part of the board. These are mounted on marble bases, with substantial barriers erected between the switchblades, so that the circuit at full load and voltage may be broken without the slightest danger of arcing across from point to point. They have been amply tested, and have proved their ability to cope with the trying work required of them with the greatest ease.

The generators fall into parallel easily, and run as smoothly together as would a couple of railway generators. No artificial load is used in throwing them together, none having proved necessary.

The line, a characteristic bit of which is shown in Fig. 7, is a good piece of construction on substantial wooden poles placed 100 ft. apart. The upper wires on the cross arms are of No. 0 bare copper, and form the original three-phase circuit designed for the transmission. The wires on the lower cross arm are No. 0000 insulated wire, and are four in number. They were originally intended for a railway circuit, the generators for which were to be installed at Baltic to feed the Norwich Street Railway; but as the amount of copper necessary to do the work succesfully appeared too great, the system was changed, a second three-phase generator and motor were added, and three of the four proposed feeder wires were utilized for the three-phase circuit. All are supported on the General Electric Company's standard oil insulator, the fourth No. 0000 wire forming a convenient relay in case of accident to any of the others.

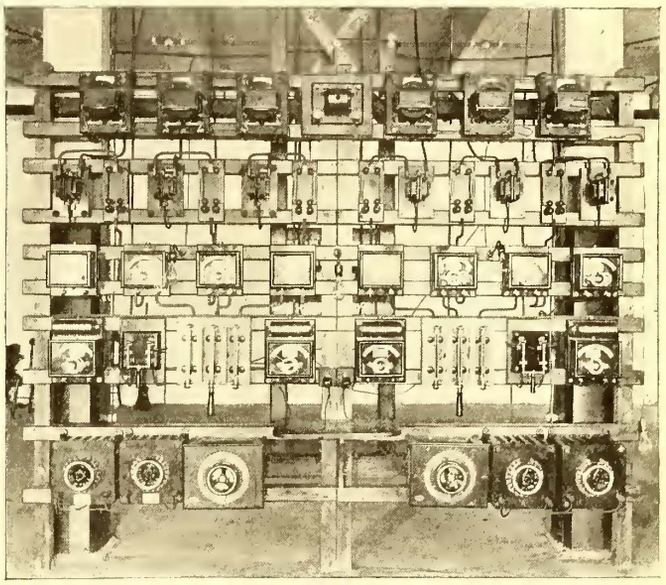


FIG. 6.—SWITCHBOARD IN BALTIC MILLS.

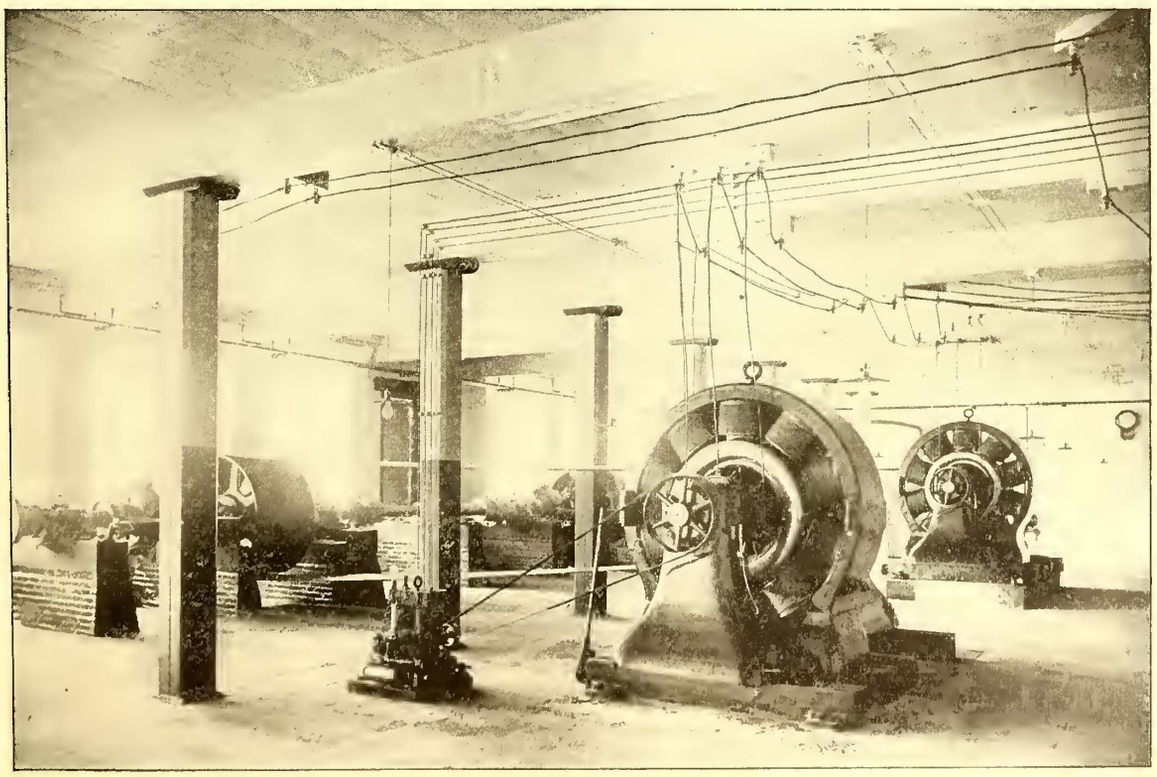


FIG. 7.—GENERATOR ROOM, BALTIC MILLS—TAFTVILLE TRANSMISSION PLANT.

At Taftville the three-phase circuits are led into the basement of the new mill, where they drive two three-phase, synchronous, self starting motors (Fig. 3), identical in size with the generators at Baltic. A view of this basement is given in Fig. 8, and one motor and a switchboard are shown in Fig. 9. Both motors are belted to a jackshaft which drives the mill machinery, and from which the railway generators are operated directly. The pulleys on this shaft are being equipped with friction clutches, so that the load can be thrown in and out of circuit.

The efficiency of the complete transmission at full load, from the power applied to the dynamo pulley to that delivered to the motor pulley, is just 80 per cent.

The motors start entirely unaided, coming up to synchronous speed in about fifty seconds from the time the current is thrown on. They are, like the generators, separately excited, the exciters being driven from the pulleys on the end of the motor shaft.

This is believed to be the first application of the three-phase system to street railway operation, and the success of the installation will go far toward popularizing the method for cases where it is applicable. In this connection a brief description of the Norwich Street Railway may not be without interest.

The Norwich Street Railway Company was organized in 1875 to take over the property of the Norwich Horse Railway Company, which was sold under foreclosure. The property of the company was operated by horse power until the spring of 1892, when the road, having been sold to Messrs. Shaw, Pond and Mason, of Boston, and Charles P. Cogswell, of Norwich, equipment with electric motors was commenced. The tracks were relaid with new fifty pound steel rails, on a well ballasted roadbed, and cars of modern type were obtained from the Newburyport Car Company. The motor equipment purchased was of the W. P. type.

In January, 1893, a syndicate of Boston capitalists, headed by Messrs. Tucker, Anthony & Company, bought both the Norwich and New London systems entire, with the exception of the interests retained by Messrs. Shaw and Cogswell. The electric equipment has been rapidly extended during the past year, and the road is now excellently equipped and operated under the efficient management of E. P. Shaw, Jr.

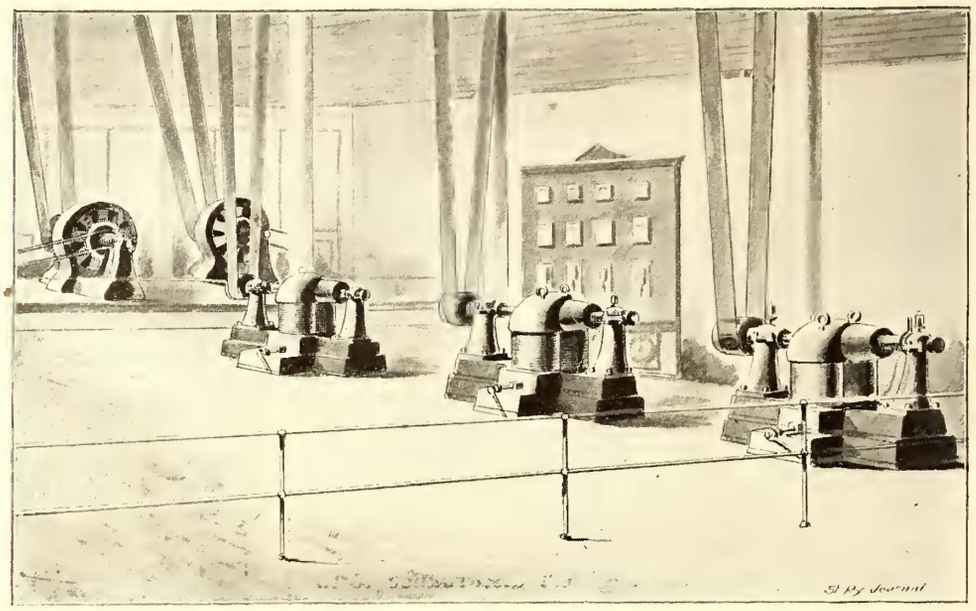


FIG. 8.—SYNCHRONOUS MOTORS OPERATING RAILWAY GENERATORS—PONEMAH MILLS.

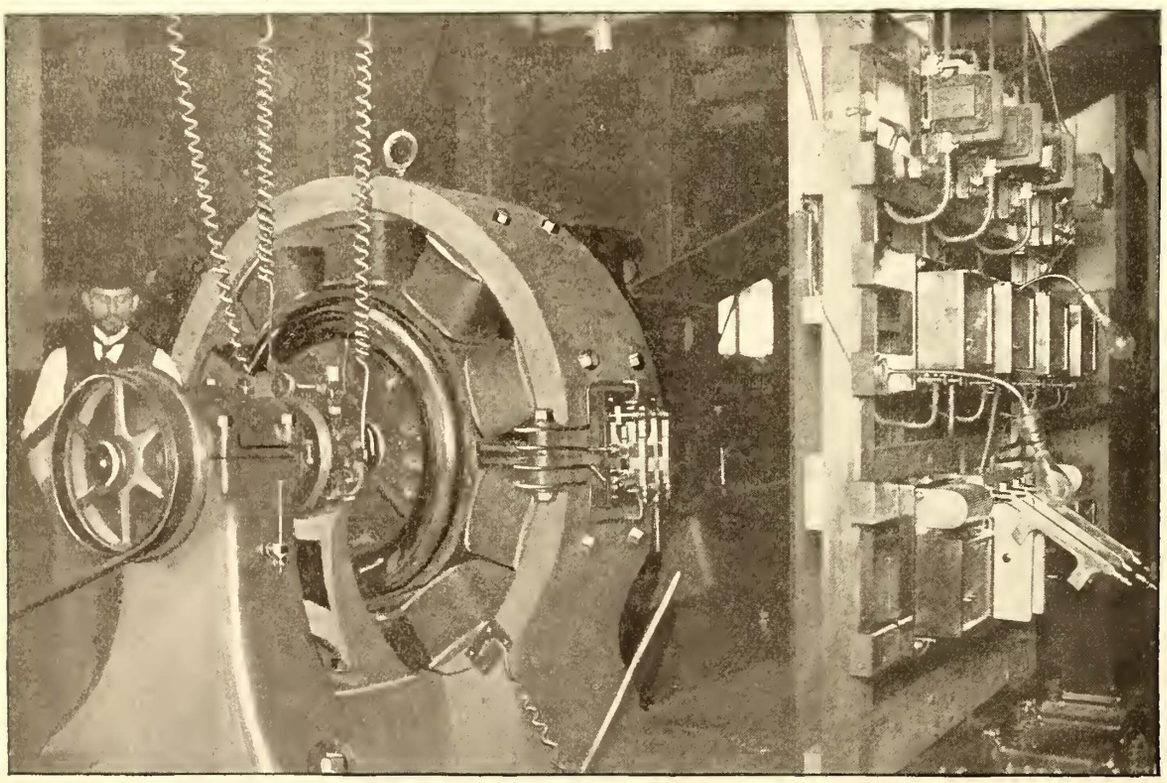


FIG. 9.—SYNCHRONOUS MOTOR AND SWITCHBOARD—PONEMAH MILLS.

Some interesting figures in regard to the comparative cost of maintaining macadamized roads with and without car tracks in the middle were recently presented by W. L. Dickenson in an address before the Massachusetts Highway Association. Mr. Dickenson found, as a result of a long series of observations at Springfield, Mass. that on residential streets having a moderate traffic and a driveway of thirty feet between curbs, unencumbered with street car tracks, so that the traffic is distributed over the entire surface, it is possible to furnish a good surface of macadamized pavement at an average annual cost of 1.3 cts. a sq. yd. for maintenance. On the other hand, when a track is laid in the middle, and the traffic is confined to a narrow strip on each side, travel soon grinds up the surface, increasing the cost of maintenance from four to five times.

The Isle of Man Tramways.

The Isle of Man is a beautiful little island, lying between England and Ireland, in the stormy Irish Sea. It is peculiar in many respects. Its arms are three legs; its cats and fowls have no tails; its government is carried on by a House of Keys, and no law is valid until the people, assembled around Tynwald Hill, give their consent.

But even the Isle of Man has been seized by the epidemic of progress, and its people have gotten an electric railway, hoping, by its introduction, to cope with the immense influx of visitors who begin to pour in in the early summer. The necessity for a new system of traction has been plainly evident for some years, the old horse car lines having proved themselves painfully inadequate, and as a considerable part of the income of the islanders is derived from their summer visitors, it was felt that a better system of traction would increase the inducement to visit.

It is at Douglas that the visiting multitudes converge. A fine line of steamboats connects this city with Liverpool, and in summer these boats are taxed to their utmost to carry the thousands anxious to escape from the crowded centers of trade in the northern and middle counties of England.

A joint stock company, known as the Isle of Man Tramway & Electric Power Company, has been recently incorporated with a nominal capital of £150,000 ($750,000) divided into 125,000 shares of £1, each of which 50,000 are 6 per cent. preference and 75,000 ordinary shares. There will also be £50,000 debenture bonds at 5 per cent., redeemable in 1914. The object of this company is the consolidation of the two existing car lines, that running from the Victoria Landing pier at Douglas to the Derby Castle gates, and that from the latter point to Grondle Glen; and the extension of the latter line as far as Laxey, where the famous Laxey lead mines wheel forms a perennial attraction. The franchise over this route, with the exception of about three miles controlled by the Town Commissioners of Douglas and which they will have the right to acquire by purchase, is perpetual. The length of the line when completed will be about seventeen miles of single track.

The Isle of Man Tramways is a horse line, employing fifty horses. Outside the station and buildings, a rolling stock of thirty-one cars and various machinery, it owns a large strip of land fronting upon Douglas Bay.

The electric line at present runs from the Derby Castle gates to Grondle Glen, a distance of about two and one-third miles. This line was operated experimentally during three weeks last summer with considerable success. The station for the generation of current is situated at Douglas, and another is at present in course of erection at Laxey. That at Douglas is a substantial building in which are housed the steam and electrical plants, the latter consisting of a generator and an accumulator plant.

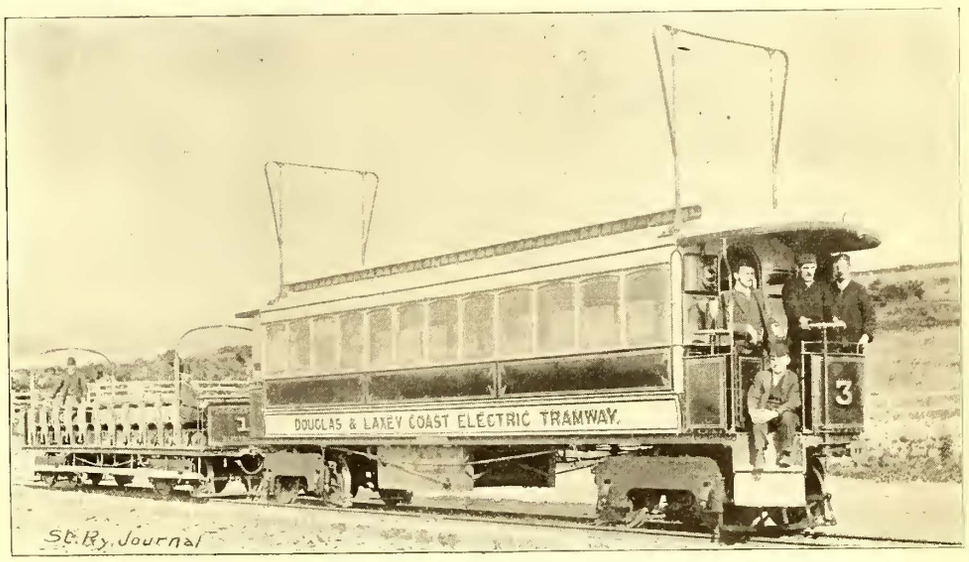
The boiler plant consists of five steel boilers of the Lancashire type, furnishing steam to five compound condensing engines. These are connected by rope drives to five Hopkinson dynamos built by Mather & Platt, Limited, of Manchester. These dynamos, when operating, furnish current to the line as well as to the accumulators, which serve to regulate the output. The whole electrical work, both plant and machinery, was designed by Dr. Edward Hopkinson.

The rolling stock consists of nine large motor cars and twelve open cars, such as are shown in the illustration. The current is brought from the line to the motors on the cars by a peculiarly European method. Instead of the trolley with an underrunning wheel, two collecting bars are fixed on the car, one at each end. These press against the overhead conductors, and take the current by a sliding contact. Thus when they pass a pole, one bar is always in contact with the overhead wire.

The extension of the line to Laxey, seven miles from Douglas, is rapidly nearing completion, and is expected to be in operation this summer. It will be double track throughout, except two short single tracks at Douglas, constructed of heavy steel rails set on ties laid on a well grouted bed. The bridges and culverts are of stone. The road is really a railroad if judged by its construction, but as it has been classed as a tramway, the speed of travel is limited by law to ten miles per hour.

The overhead wires will be suspended from double armed center brackets.

The company owns about fifty acres of land at Onchan Head, which overlooks Douglas Bay. This is to be enclosed and laid out as a park, free of expense to the company, and is expected to become a source of considerable revenue on a short trip service.



ELECTRIC CAR—ISLE OF MAN TRAMWAY.

The horse road carried in 1892, 813,114 passengers, and in 1893, 911,410, and showed a net profit of £3,784 on the latter year's working, the expenditures being about £100 over 50 per cent. of the receipts. Referring to the experimental operation over the two and a third miles at the close of the visiting season last summer, 20,000 passengers were carried in nineteen days, 1,689 miles were run and the receipts averaged 35.36*d.* or about seventy-one cents per car mile. The fare charged from Derby Castle to Laxey is one shilling or twenty-five cents, that from Derby Castle to the grounds three pence or six cents, and a similar fare from the landing pier to the Castle.

In addition to the operation of the road, the company contemplates the supply of current to large consumers located in the vicinity of the Douglas generating station.

The three miles mentioned as being open to purchase at the end of four years by the Douglas town commission, form the only difficulty which this electric railway has to face. According to a decision of the Queen's Bench, the value of a tramway undertaking to fall into the hands of a municipality is to be arrived at by giving a certain number of years' purchase on a rental value. According to Sir F. Bramwell, the judge, the purchase amount would mean the value of the lands and buildings of the company, with such sum added as would represent the cost of construction of the road, less an allowance for depreciation, no account being taken of past or prospective profits. This decision has just been affirmed by the Court of Appeals, but is now to be carried up to the House of Lords, the court of last resort.

New Motors of the Westinghouse Electric & Manufacturing Company.

The accompanying engravings will give an excellent idea of a new type of motor brought out by the Westinghouse Electric & Manufacturing Company, styled by its manufacturers their No. 10 and No. 12 motors. As will be seen, the type appears to resemble the No. 3 single reduction motor of the same makers, without the iron frame which serves as its support. The absence of this frame reduces the weight of the new motor without diminishing its rigidity. As a circular form of field may be mathematically proven to afford the greatest strength for any given weight of material, as a four pole field must evidently give greater output than one of only two poles, and as the toothed armature, with a two circuit winding and lathe wound coils, has been practically demonstrated to be unsurpassed, all these features of the No. 3 type of motor are retained in the newly designed machine.

The No. 12 motor is manufactured in three standard sizes, as follows: Of 20, 25, and 30 H. P. capacity.

The No. 10 motor, which is designed for heavier work, is built in 40 and 50 H. P. sizes.

The armature is of the drum type and wound with machine made coils, each consisting of heavy insulated wire wound in rectangular form. The two longer sides of the coil are enclosed in cells of special insulating material, the whole being then wrapped with insulating tape of a superior quality. The coils are connected to the commutator segments so that the armature winding has only two circuits, obviating the possibility of the armature becoming electrically unbalanced, and requiring the use of but two brushes. The armature is short and compact, and special means have been employed in its construction to prevent grease from the bearings coming in contact with the coils.

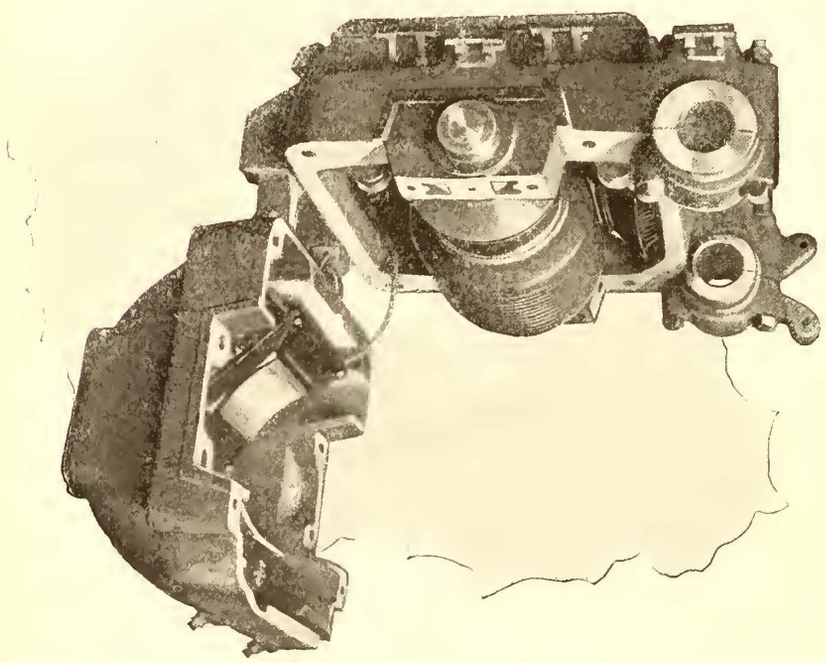


FIG. 1.—SINGLE REDUCTION MOTOR WITH ARMATURE IN UPPER FIELD.

The field consists of four pole pieces projecting radially inward from a circular yoke or ring which parts in a horizontal plane through the shaft. In order to secure rigidity of construction the two lower pole pieces, half of the circular yoke and end plates are made in a single, solid casting, which secures strength and at the same time completely protects the lower half of the motor. These features are well shown in Fig. 1.

The rectangular frame which was a distinct feature of the No. 3, has been incorporated into the upper half of the field of the No. 10 and No. 12, so as to do double service, forming a part of the magnetic circuit and a part of the frame, and thus giving sufficient strength to the motor to hold the armature shaft always in perfect alignment with the car axle. On the side which is farthest from the axle of the car, the two halves of the yoke are hinged together, so that the interior parts of the motor are made easily accessible without the necessity of dismounting.

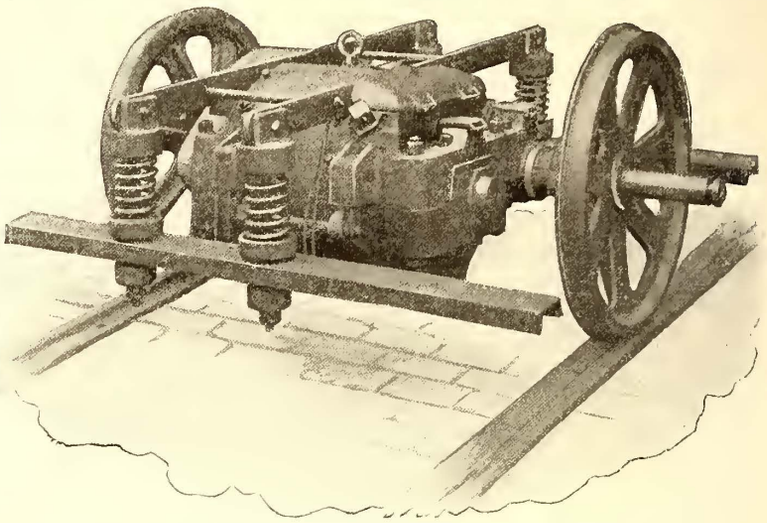


FIG. 2.—SINGLE REDUCTION MOTOR, SHOWING SUSPENSION.

The lower field casting has three openings, one directly below the commutator and the others at opposite ends of the casting. These openings are closed by watertight covers, which may be removed to give access for the purpose of repair or removal of dust or dirt.

The two brush holders, 90 degs. apart on the top of the commutator, are held in position by a frame which is so designed as to constitute a part of the end of the upper field, and, together with a lid, completely encloses the commutator end of the motor, and entirely protects the inner parts. The lid is hinged and normally kept closed by a stiff spring.

The method of suspension shown in Fig. 2 relieves the axle of practically all the direct weight of the motor, and avoids entirely, it is claimed, what has been termed "hammering" of the rail joints. By reason of the increased strength of the upper field yoke, it is possible to suspend the motor directly in the line of its center of gravity, by means of suspension bars which run parallel to the sides of the truck, and have their ends supported upon spiral springs. The motor is thus freed from jars and yet accurately maintains the meshing of the gears while yielding to the motion of the truck.

By reason of the improvements and of a more efficient utilization of the iron in the fields and armature and of the copper in the windings, it has been possible to effect a material reduction in the weight of the new motor.

Reference to the illustrations shows the advantages of the motor in respect to accessibility. The hinged lid, already referred to, permits ready handling of the brushes and inspection of the commuter. The openings in the lower field afford access to the lower part of the motor. When it is desired to gain access to the whole interior of the motor, the car is run over a pit and the lower half of the field opened down, either with or without the armature, as may be desired. The armature bushings are carried in pillow blocks which, when the motor is closed, are secured to both the upper and lower fields. By removing the bolts holding the pillow blocks to the upper half of the field, the lower half may be opened down with the armature, which can then be rolled out upon a board, thus avoiding the necessity of lowering the armature into

the pit and again raising it. By removing the bolts between the pillow blocks and the lower half of the field, the armature is kept in the upper half of the field, permitting removal of field coils, etc., in the lower half.

The lower half of the field is readily opened down by the use of a rope passed around the axle, which is thus made to take the part of a pulley block.

From what has gone before it will be seen that the following are the characteristics of the machines described: Light weight, ample capacity of the armature and field windings, large bearing surface in the journals, protection from external injury, very high efficiency, great starting torque.

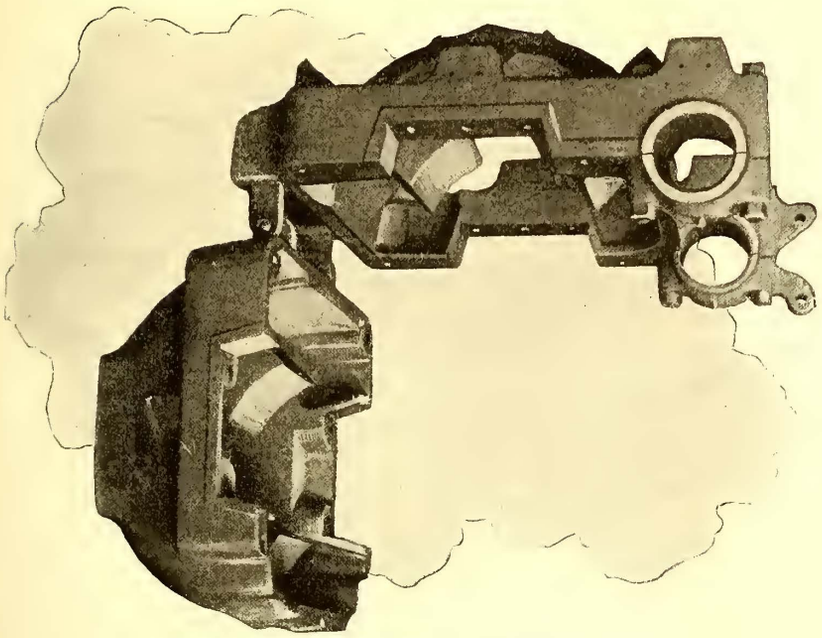


FIG. 3—SINGLE REDUCTION MOTOR CASTINGS.

The controlling apparatus is second only in importance to the motor. The series-multiple controller which the Westinghouse Company introduced with type "G," has proved so acceptable that it is with the utmost confidence the company now offers its new and improved controller stand No. 14, shown in Fig.

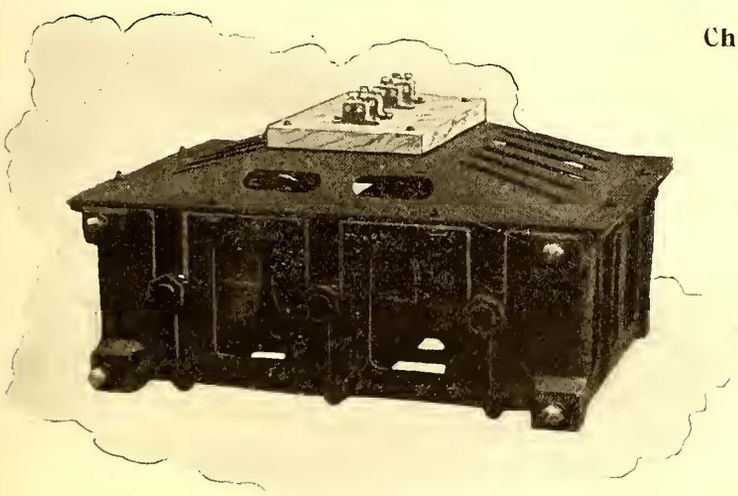


FIG. 5.—DIVERTER.

The No. 14 is a platform controller having two removable handles, one for controlling the speed and the other the direction of travel of the car. The handles are provided with locking devices which prevent their removal except when in the position for no current. The electrical combinations of the motors made by the new controller are improved over those of the earlier type, in that the motors divide the work equally, and the car starts more easily and attains its maximum speed more smoothly.

The construction of the new controller is similar to that of the old type. Corresponding positions of the handle give speeds to the car similar to that of the old style. This feature will at once recommend itself from the fact that the motormen accustomed to running cars with the "G" controller will be able to use the new one.

The new diverter, type No. 7, is shown in Fig. 5. The resistances are made up of strips of sheet iron placed between strips of mica. The diverter is made completely fireproof, and at the same time there is provided the very best ventilation.

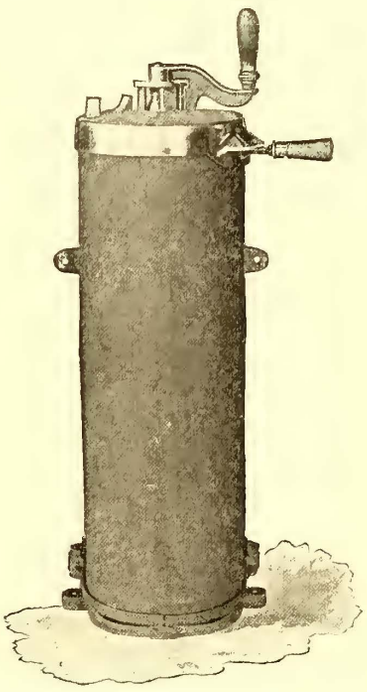


FIG. 4.—SERIES MULTIPLE CONTROLLER.

One of these diverters is used on each car, its function being to reduce the current while the motors are being started, thereby preventing the sudden jerking of the car and unnecessary strain on the motors.

Changes in the 50th Street Power House of the Broadway Cable Railway.

As already mentioned, the lower section of the Columbus Avenue cable railway of New York, upon which work is now being pushed, will be operated from the 50th Street power station of the Broadway & Seventh Avenue Railway Company. The plans adopted for altering this power station to admit two new sets of drums are the addition of a driving drum at each of the outside ends of the present driving drum shafts. The drums for operating the upper section of the Broadway road are now keyed to their shafts, but they will be mounted on quills and arranged so that they can be thrown in and out of connection with the shaft, by means of friction clutches. The new drums will be of the overhanging type, that is, will have no outside bearings, and will be designed to operate the cable at a speed of twelve miles per hour.

Plans are being drawn up for the uptown power station for the Columbus Avenue line and for the Lexington Avenue line, but the details have not been entirely settled on yet.

ON removing the tracks of the horse car construction on Prytania Avenue, New Orleans, preparatory to the electric construction, the cypress ties, which had been in service for about thirty years, were found to be in so sound a condition that they were employed in the new construction, resulting in quite a saving, as new ties had been distributed over the route before the work had been begun.

Problems in Straddled Track Construction.

During the recent construction of the lines of the City & Suburban Railway Company, in Baltimore, it became necessary to devise a new arrangement of the tracks on Pratt Street, which is occupied jointly by two tracks of the City & Suburban Railway Company and a single track of the Baltimore & Ohio Railroad. Pratt Street extends along the water front of the city, is only from twenty-nine to thirty nine feet in width, and during the day it is crowded with heavy traffic, which not only greatly

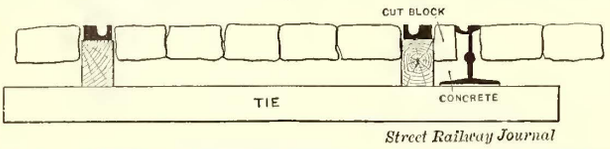


FIG. 1.—ORIGINAL ARRANGEMENT OF TRACKS—BALTIMORE.

impedes street railway service, but also renders the maintenance of the tracks difficult and expensive. About one mile of the street is occupied by the tracks of the two companies, which are broken by numerous switches reaching the different piers along the water front. The cars of the Baltimore & Ohio Railroad run through the street only between midnight and about 5.30 A. M. They are hauled by a four-wheel locomotive weighing about fifty-eight tons, from which it will be seen that the track is subjected to heavy service. In reconstructing this portion of the City & Suburban system several plans for

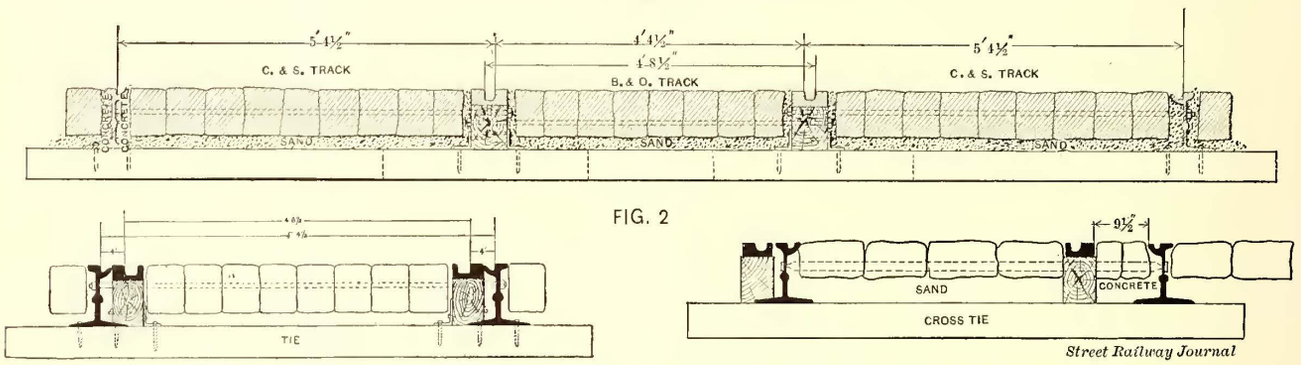


FIG. 2

FIG. 3.

FIG. 4.

DIFFERENT ARRANGEMENTS OF TRACKS PROPOSED—BALTIMORE.

improving the arrangement of the tracks were worked out by Frank H. Sloan, chief engineer of the company, and as they may furnish helpful suggestions to others who are called upon to deal with similar problems, the various plans are reproduced, together with brief notes about each of them.

Fig. 1 shows the original arrangement of the tracks, modified by the substitution of girder rails for the old tram rails formerly used in the tracks of the City & Suburban Railway. In this plan one track of the City & Suburban Company is entirely independent, the outer rail of the other being used by both steam and electric cars. The gauge of the steam track is four feet nine inches, and the electric tracks five feet four and a half inches. The rail of the steam track is a grooved tram rail two and a half inches deep, laid on a 5 × 8 in. yellow pine stringer, giving a depth of ten and a half inches from the tie to the top of the rail. The girder rail of the electric tracks is a Johnson eighty pound, ten inch girder, with electrically welded chairs, the difference in height between this and the tram rail being met by a one-half inch iron plate placed beneath the chairs of the girder rail. The objection to this plan was the space of four inches between the girder and tram rail, which was filled by a cut paving block on concrete. Former experience demonstrated the difficulty of keeping this small space filled, as it was frequently cut out by the wheels of heavy teams, and the loss of horses by catching their hoofs in this space was a considerable item of cost to the City & Suburban Company. It was, therefore, deemed advisable to adopt some plan by which this small space could be avoided.

Fig. 2 shows a plan which, under some circumstances, would prove most satisfactory, as it reduces the number of rails to four, and also occupies less street room. In this plan the Baltimore & Ohio track was placed in the center, using a center groove tram rail, 6⅝ × 2½ ins., on a 6½ × 7½ in. stringer. The outer rails are ten inch Johnson girders with electrically welded chairs. In this plan the center track is given additional support by ties placed between those carrying the outer rails. This plan, apparently so admirable, could not be adopted on account of the danger of blocking both of the electric tracks by a car on the center track.

Fig. 3 is a plan submitted by the Johnson Company. This shows only the combination of the steam and electric tracks on one side of the street, the other electric track being entirely independent. While this plan presented a compact arrangement of the tracks, it was considered objectionable because of the large surface of metal in the street, presented by the close contact of the two tracks. The width of the tram rail is four and seven-eighths inches, and the girder three and seven-eighths inches, making two surfaces of eight and three-quarters inches of metal.

Fig. 4 presents a modification of the plan shown in Fig. 3, giving only one wide surface of metal by straddling the steam and electric tracks instead of placing the steam track wholly inside the electric rails. The rails shown in this plan are the same as shown in Fig. 1, a grooved tram rail, 2½ × 5 ins., and a ten inch Johnson girder with electrically welded chairs. A desire to avoid even a single wide surface of metal, and the rather narrow space of nine and a half inches between the two center rails, led to the rejection of this plan.

Fig. 5 is the finally adopted plan which met most fully the views of the two railroad companies and the city authorities. As will be observed, it is simply a modification of the plan shown in Fig. 4, the distance between the rails of the two straddled tracks being increased, so as to avoid any wide surface of metal, and any paved space so narrow as to promise trouble. The outer rail of one electric track is placed in the center of the steam track, and the four rails of these tracks are carried upon one set of

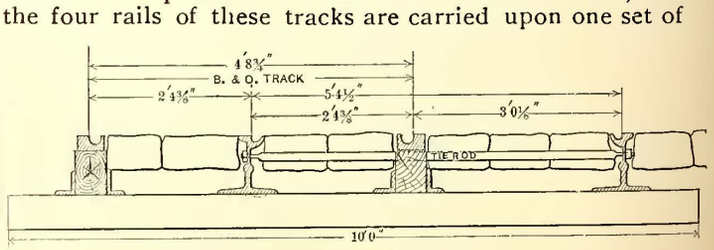


FIG. 5.—ARRANGEMENT OF TRACKS ADOPTED—BALTIMORE.

10 ft. × 6 × 8 in. yellow pine ties, spaced three feet center to center. The other independent electric track is carried on ties 8 ft. × 5 × 8 ins. similarly spaced. The rails are a grooved 2½ × 5 in. tram rail for the steam track, and a ten inch Johnson girder, with electrically welded chairs, for the electric tracks. The stringer for the tram rail is reduced to 5 × 7½ ins., so as to give this track the same height as the girder of the electric track, and the steam track is strengthened by bracing the stringer on the ties with angles, which was also done in the ori-

ginal construction. The rails of the straddled electric track are stiffened with tie rods which cut the stringers of the steam track just beneath the rail. On the other electric track tie rods are also used. This construction was put down ten months ago, and although it has been subjected to very heavy service, it has given entire satisfaction.

"Brothers-in-Law."

Of all the troubles which arise in the management of a street railway, one of the greatest is, how to prevent dishonest conductors from "knocking down." We will not say stealing; oh, no, taking money is not stealing. All kinds of schemes and devices have been tried, from the much hated spotter to the famous bell register. When the register first put in an appearance it gave the conductor much trouble; he was terribly afraid that he would be compelled to be honest, but after much effort he found a way to overcome even this objection.

There are three classes of registers, the hand register and punch, the portable register, which the conductor suspends from his neck, and the stationary register, which has a dial similar to a clock. Of these the first two styles have been successfully beaten by bogus registers or the "brother-in-law" method. For the benefit of those who are unacquainted with these instruments we will say that there are three styles of "brothers-in law." These are

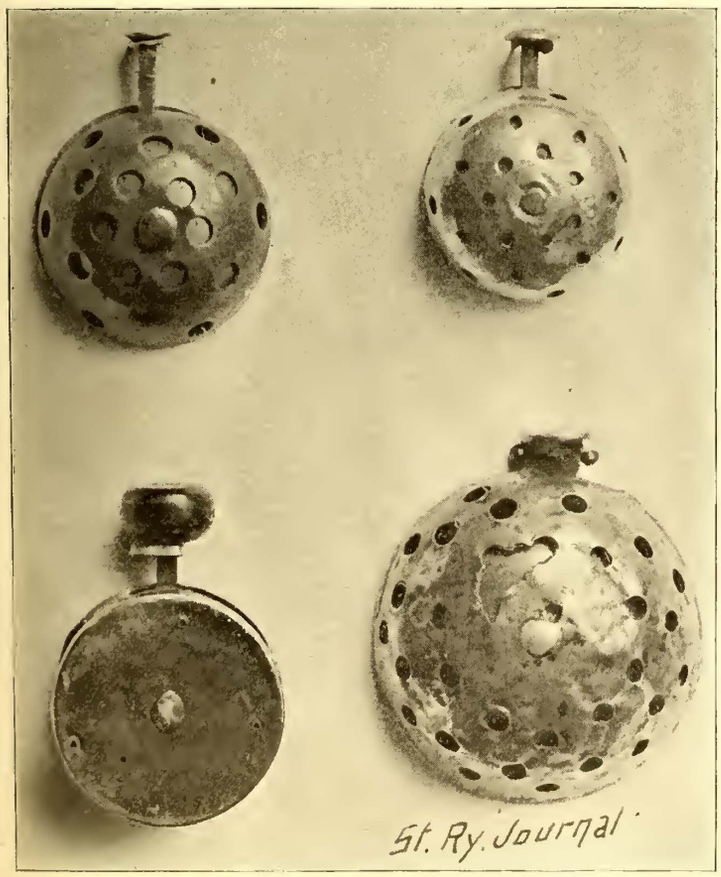


FIG. 1.—PALM "BROTHERS-IN-LAW."

the palm signal bell, the vest signal bell, and a bell which works under the arm. We illustrate the different styles of the "palm" bells in Fig. 1. It will be noticed each has a small push knob. This knob when pushed will trip a lever, which rings "one fare;" it is a small device compact in shape, intended to be carried in the palm of the hand, so that the conductor, when he wishes to appropriate a fare, will have a bell to sound, thus deceiving the passenger.

In Fig. 2 we illustrate the "vest bells," which are designed to be suspended from the neck, and so constructed that they can be rung from the same position that the register is rung from; in fact the same motion is used, and unless you are watching the dial to see that it moves, you will be deceived every time.

The largest of the group is a clumsy affair, intended to be worked under the arm, but was never much of a success. The one in the form of a change box was

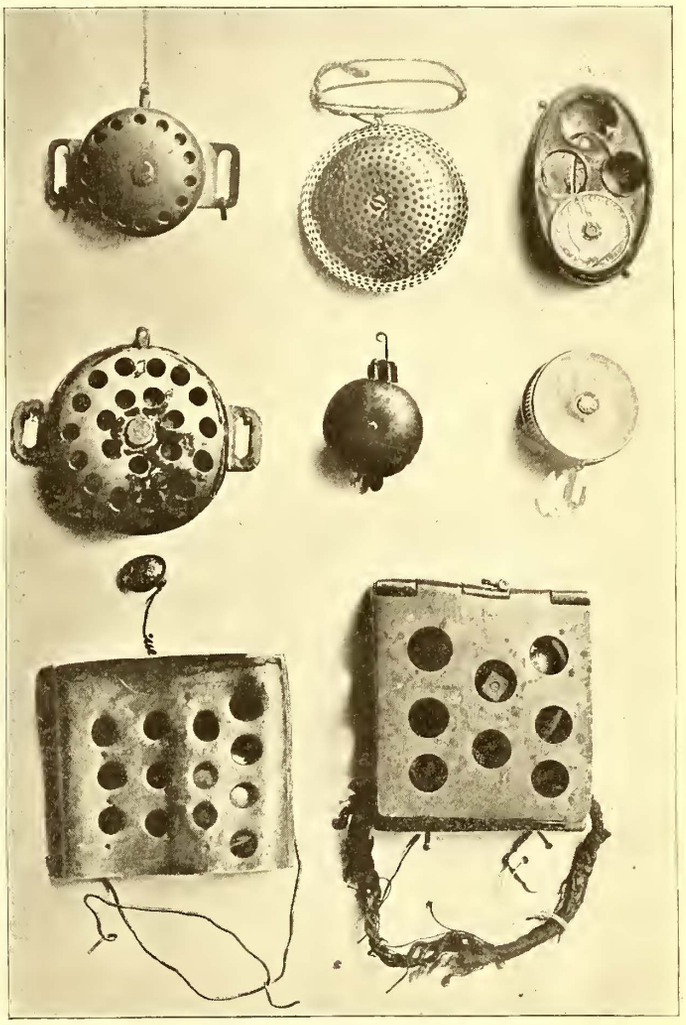


FIG. 2.—VEST "BROTHERS-IN-LAW."

one of the first produced. It was taken from a conductor in 1878, and was only secured after a hard fight.

The conductor said he would never give it up, that he would fight first. The superintendent who made the demand was a man of muscle; he quietly walked to the door and securely locked it, remarking that he would see about it. They had a rough and tumble fight right then and there, first one on top and then the other; finally the superintendent got the better of his man and secured the "brother-in-law." This man was arrested, as have been dozens of others for the same offense, but when brought to trial could not be convicted; the jury nearly always disagree in such cases a sad commentary on our laws and our courts, for this is out and out stealing.

In justice to the present conductors we wish to say, that very little of the "brother-in-law" work is being done at the present time.

THE Bristol (Eng.) Tramways & Carriage Company, Ltd., has deposited a bill in Parliament asking for power to extend several of its existing lines. There will be in all about three and a half street miles of new track. The present St. George's line, which has many steep grades, has been operated by horse power since the opening, now for about sixteen years. This line is two and a half miles in length. It is proposed to extend this line a little more than one and a half miles up what is known as Two Mile Hill to Kingswood, a boot and shoe manufacturing town of 11,000 population, and which, on account of its altitude and consequent difficulty of access, has neither steam railroad nor street railway accommodation.

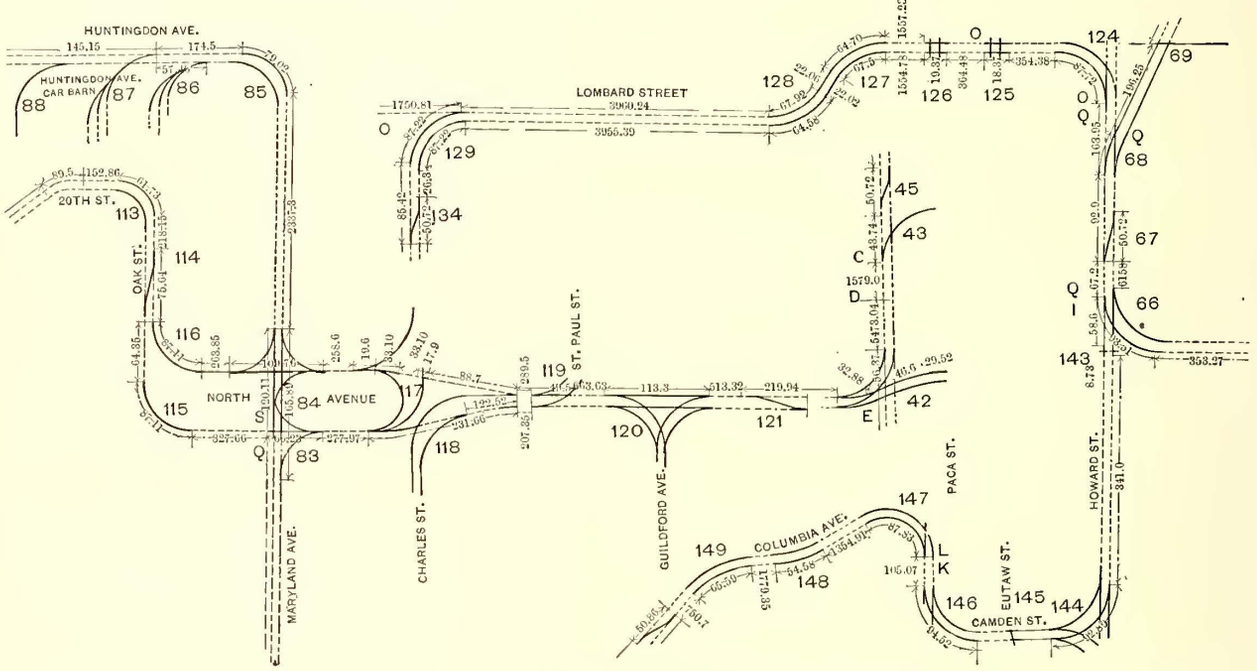
Reference Map of the City & Suburban Railway, of Baltimore.

An elaborate reference plan of the entire system of the City & Suburban Railway Company, of Baltimore, Md., showing distances, track construction, location of special work, length of curves, etc., in great detail, has recently been made by Frank A. Sloan, chief engineer of the company. The map is seven feet six inches square, and is drawn on a single sheet of heavily mounted paper made especially for the purpose. Every curve, piece of special work, crossing, switch, etc., is shown on the map, each with its individual number, and in its proper location relative to other parts of the system. The tangents, of course, are necessarily shortened, in order to bring the plan within bounds, but the length of each is indicated, and the relative position is given.

The numbers assigned to the special work refer to a tabulated statement on the margin of the map, where all the details of construction of each piece of work are given. Large letters indicate the different subdivisions of track, and marginal tables give the length of each in feet of single track, together with full details of track construction. It will be seen that such a map as this embodies a complete record of the permanent way of the system, and is of inestimable value to the maintenance-of-way department. In the event of repairs at any point on the entire system, no search for plans is necessary, as the entire record of every portion of the track is available at a glance.

The map will admit of the addition of extensions of the system, and any changes from the present standards of construction can be indicated in a marginal table of changes.

The great size of this map precludes its reduction to a size that will permit us to show it entire in our pages, but we have reproduced portions of it, which will suffice to indicate the character and the manner in which the details are shown. We also reproduce the headings of the



PORTIONS OF REFERENCE MAP, SHOWING METHOD OF CONSTRUCTION—CITY & SUBURBAN RAILWAY, BALTIMORE.

STRAIGHT TRACK CONSTRUCTION—GAUGE OF TRACK 5 FT. 4½ INS. STANDARD TRACK CENTERS 9 FT. 8½ INS.

Ref. Map Letter.	Rail.					Joint.					Tie Rods.		Chairs.		Cross Ties.			Remarks
	Size.	Manufacturer.	Sect.	Wt.	Spike.	Style.	Bolt. No.	Bolt. Size.	Spike.	How Laid.	Size.	Space.	Size.	Kind.	Kind.	Size.	Space.	
A	7″	Penna. Steel Co.	91	80	5″x½″	26″ splice.	6	1″x3½″	.....	Opp. & sus.	1½″x⅜″	7½′ c c	.....	.....	Ga. pine.	6″x7″x8′	2′ 6″ c c	.....
B	4″ T	" " "	6A	58	5½″x½″	24″ angle jr.	4	¾″x3½″	.....	Brok. & sus.	.....	.....	.....	.....	" "	" " "	"	trk. cen.
C	7″ Gr.	Johnson Co.	80-254	80	"	Whit'n spl.	6	1″x3½″	5″x½″	Opp. & sus.	1½″x⅜″	7½′ c c	.....	.....	" "	" " "	"	11′ 10½″
D	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
E	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
F	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

SUMMARY OF DISTANCES BY SUBDIVISION OF TRACKS IN FEET OF SINGLE TRACK.

Ref. Map Letter.	Towson & Pratt St. Route only.	Circuit.	Hampden and Highland Town Route only.	Common to Hampden and Highland T'wn and Towson & Pratt St. r'ts.	John St. Route only.	Common to John St., Hampden & Highland Town and Towson & Pratt St. routes.	Common to John St. and Hampden & Highland Town routes.	Wilkens Ave. and Claremont St. Yard route.	North Ave. route.	Supplementary track.	Total Electric Track, Jan. 1, 1894.
A	4,576.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	4376.6
B	40,729.6	.....	.....	.....	.....	.....	.....	.....	.....	387.00	41116.6
C	10,783.6	.....	.....	.....	.....	.....	.....	.....	.....	240.64	11024.24
D	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
E	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
F	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

SPECIAL WORK CONSTRUCTION.

Ref. No.	Manufacturer.	Manufacturer's Blue Print No.	C. and S. Ry. Plan No.	Total Angle.	Rail Sec.	Construction. Chairs.	Spikes.	Joints.
1	Johnson Co.	16165	M 7	90°0′0″	75.213	St. Gr.	3½x½ ins.	St'd Girder
2	"	17569	M 9	16°0′0″	75.213	"	" "	" "
3	"	13307	.....	90°0′0″	66½.141	4 in. bulb	" "	16 in. "
4	.....	.....	.....	.....	.....	.....	.....	.....
5	.....	.....	.....	.....	.....	.....	.....	.....
6	.....	.....	.....	.....	.....	.....	.....	.....

CITY AND SUBURBAN TRACKS USED BY FOREIGN RAILWAY COMPANIES.

Foreign Company.	Location.	Feet of Single Track.
Baltimore Traction Co	Hillen St. bet. Forrest St and High St.....	2,041.1
" " "	Howard St. bet. Lombard St. and Camden St..	1,602.59
" " "	Park Ave. bet. Saratoga St. and Franklin St..	720.71
.....	.....	.....
.....	.....	.....
.....	.....	.....

various marginal tables which appear upon the map, in order to show how fully the record of construction is pre-

CAR MILEAGE.

Route.	Miles.
Towson and Pratt St. Route (Towson to W. Pratt Stable)	21.05
Hampden and Highland Town Route (Falls Rd. to Highland Town Barn)	13.84
John St. and Columbia Ave. Route (Madison and No. to Gwynn Falls)	4.65

served. The map will be properly framed, and placed in the office of the general manager, J. F. Heyward.

Committees to Report at the Atlanta Convention.

A list of the subjects to be discussed at the next meeting of the American Street Railway Association at Atlanta, Ga., October 17, 18, and 19, 1894, has already been published in these columns. The committees appointed to report on these subjects have just been announced by the secretary of the Association. We give below a complete list of the committees and subjects:

1. "Can the T Rail be Satisfactorily Used in Paved Streets?" Joel Hurt, president of the Atlanta Consolidated Street Railway Company, Atlanta, Ga.; S. Hendrie, manager of the Wyandotte & Detroit River Railway Company, Detroit, Mich.; H. J. Crowley, engineer of the Atlanta Consolidated Street Railway Company, Atlanta, Ga.

2. "City and Suburban Electric Railways:" Elwin C. Foster, superintendent of the Lynn & Boston Railroad, Boston, Mass.

3. "Mail, Express and Freight Service on Street Railway Cars:" Richard McCulloch, electrical engineer of the Citizens' Railway Company, St. Louis, Mo.

4. "The Best Method of Treating Accidents and Complaints:" John B. Parsons, general manager of the West Chicago Street Railroad, Chicago, Ill.

5. "Street Car Wheels and Axles:" D. S. Cook, electrical engineer of the Trenton Passenger Railway Company, Trenton, N. J.

6. "Transfers and Commutation:" Rodney Curtis, president of the Denver Tramway Company, Denver, Colo.

7. "The T Rail Construction of the Terre Haute Street Railway Company:" M. F. Burke, superintendent of the Terre Haute Street Railway.

8. "A Standard Form for Accounts for Street Railways:" H. I. Bettis, consulting engineer of the Atlanta Consolidated Street Railway Company, Atlanta, Ga.

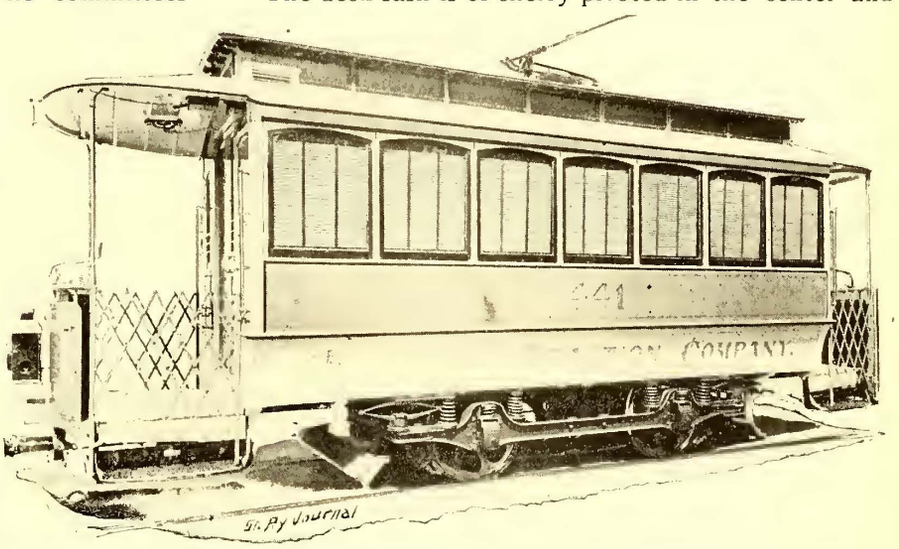
SOME very quick work in electric railway construction was recently performed on West State Street, Trenton, by the Passenger Railway Company of that city. The erection of poles, it was known, would be strenuously opposed by certain residents of the street, on which are located the homes of some of the most prominent and wealthy residents of the city. For this reason, the company's workingmen did not commence the work of overhead line construction until late on the afternoon of April 6, and by 11 o'clock the following morning electric cars were running over the road. The day before, not a single evidence could be seen of the company's intention to put up their wires. A few of the residents commenced hostilities as soon as the intention of the railway company was evident. Its workmen were assaulted with brooms, water and other weapons, and a judge was called out of bed at 5 o'clock in the morning to grant a writ of certiorari, but the railway company secured its point.

Cars for the Electric Traction Company, Philadelphia.

We present an engraving of the type of cars being built for the Electric Traction Company of Philadelphia, by the Jackson & Sharp Company of Wilmington, Del. The length of the car inside is 18 ft. 7 ins., and over the platform it measures 26 ft. 7 ins. The width of the car over the panels is 6 ft. 6 ins., and at the sash rails 7 ft. 6 ins. The height of the car body from the under side of the sill to the trolley board is 9 ft., and from the track to the top of the trolley board 11 ft. 5½ ins.

All sills are of Georgia long leaf, yellow pine, all cross framing is of oak, and all posts, top rails, ventilator rails and all material used in the framing are of white ash. The roof is of the dome pattern, extends the whole length of the car, and is covered with the best quality of duck. The ceiling is of three-ply, bird's eye maple veneer neatly and tastefully decorated. The car is lighted with one large bronze combination candle and electric lamp in the center, and one light at each end.

The deck sash is of cherry pivoted in the center and



CAR FOR THE ELECTRIC TRACTION CO.—PHILADELPHIA.

glazed with Muranese glass, wine color. Two beveled edged plate glass mirrors are located in each end in neat cherry frames in the interior of the car. The hand rails are of cherry and are mounted on bronze brackets with twenty padded hand straps to match the finish. There are seven windows on each side and two in each end glazed with double thick glass embedded in rubber on all edges. The blinds are of cherry with white bass slats. The doors are double and operate simultaneously.

The finish of the car is cherry throughout, with neat carving over all windows and doors. The seats and backs are covered with handsome Wilton carpet. The space between the seats and floor is neat panel work. The floor is covered with slats of maple.

There are large roomy platforms equipped with Stanwood steps and a new style of gate. Fitzgerald-Van Dorn radial drawbars are used. The cars are painted chrome yellow, with white concave panels and corner posts, with the name of the railway company in silver on the concave panel, and the numbers in gold on the panels and dashes. The ornamentation is in gold, and the corner posts are blue.

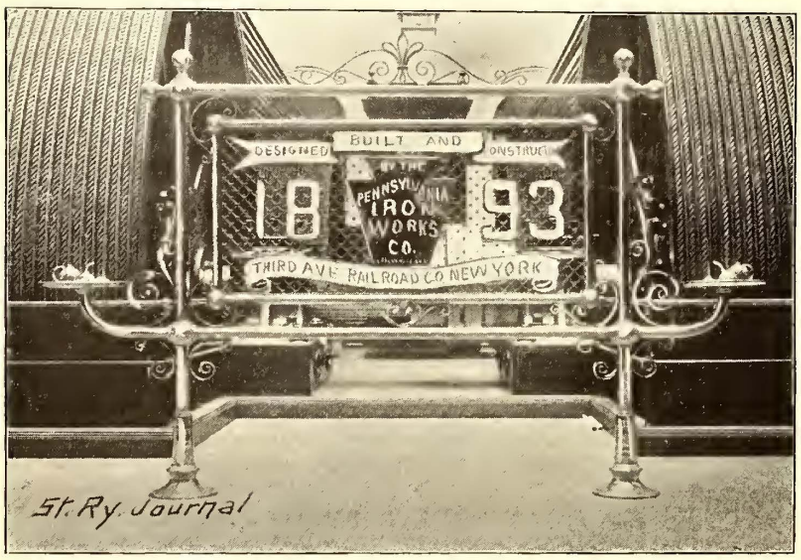
The trucks are of the McGuire type, neatly painted, striped and varnished. The electric equipment is of the Curtis Electric Manufacturing Company's make.

Consolidation at Grand Rapids.

The Consolidated Street Railway Company, of Grand Rapids, Mich., has purchased the North Park dummy line, which will hereafter be operated as part of that system. The deal also includes the summer resort of the North Park Company, comprising fourteen acres of land and a pavilion, certain valuable rights, etc.

A Handsome Name Plate.

A very handsome name plate has recently been erected in the 65th Street station of the Third Avenue cable railway of New York. It is located in the center of the room directly in front of the main line of shafting, and faces the visitors' gallery, is constructed of highly polished brass tubing, and is 14 × 8 ft. high. Between the uprights is an open work panel, bearing in the center the keystone emblem of the State of Pennsylvania in polished brass, on which appears in black letters the name of the Pennsylvania Iron Works Company, the builders of the station. Above and below the keystone are handsome ribbons of brass, with the name of the Third Avenue Railway Company in black letters.



NAME PLATE—THIRD AVENUE UPTOWN CABLE STATION, NEW YORK.

The whole is beautifully decorated with brass scroll work on each side, and attached to the uprights by handsome brackets are brass trays for holding the oil cans.

Changing Grade in Chicago.

The question of elevating the tracks of the Chicago, Rock Island & Pacific and the Lake Shore & Michigan Southern Railways, in Chicago, has recently taken on a new phase. The subject is of interest to street railway companies from the fact that the lines of the Chicago City Railway Company cross the right of way of the roads whose tracks it is proposed to elevate. At first, a head room of twelve feet was proposed, but this, it was maintained by the officials of the Chicago City Railway Company, was insufficient for the operation of its trolley cars. An agreement was finally reached by which the head room was increased to thirteen and thirteen and a half feet, except in one or two places. For this, and other considerations, the railway company was to pay them the sum of $250,000, out of which a second amount was to be paid the railway company for the work required to deepen the subways the required amount. The ordinance was passed and vetoed by the mayor.

During further consideration of the question a new council was elected, and negotiations are now under way for another agreement on the subject.

New Chicago Tunnel.

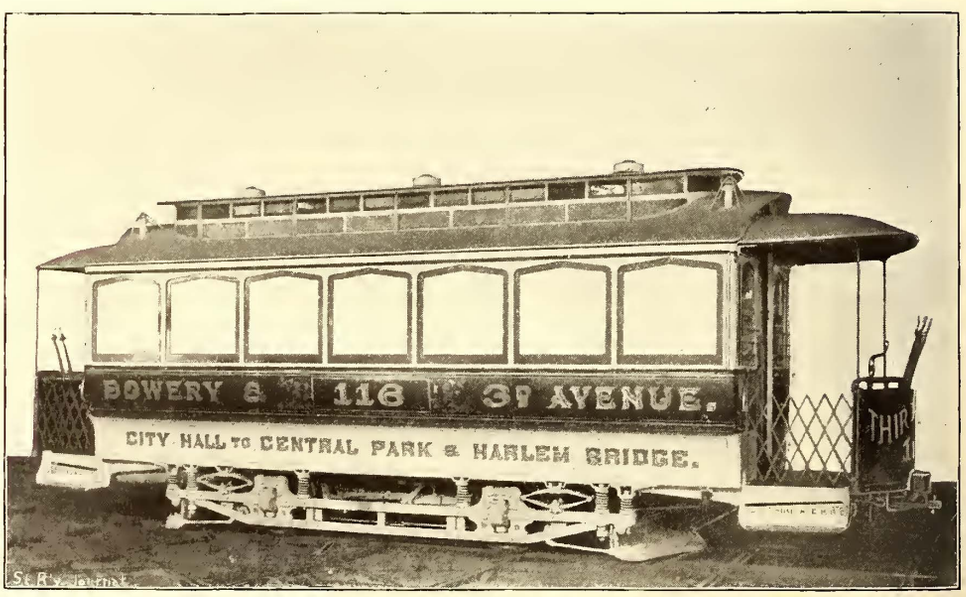
The new tunnel at Van Buren Street under the Chicago River, constructed for the use of the West side Cable cars of the Blue Island Avenue and South Halsted Street lines, was opened last month. The construction has taken four years and has necessitated the expenditure of $1,500,000, including the cost of right of way, legal expenses, etc. The length of the new tunnel and its approaches is 1,513.9 ft. The arch is fifteen feet nine inches in height above the level of the car tracks, and has a span of thirty feet. The steepest incline is a 10 per cent. grade for 500 ft., and at the foot of this grade there is a second one of 1.81 per cent. for 100 ft., where the lowest point of the tunnel is reached. The ascent is then made by three grades.

The tunnel is lighted by arc lamps driven by three sixty kilowatt Waddell-Entz dynamos, directly connected to three McEwen high speed, simple engines of 100 H. P. capacity, each running at 275 revolutions per minute. The capacity of these dynamos is much in excess of the present demand; and a number of incandescent lamps, for use in neighboring buildings, will probably be run in connection with the plant.

Peckham Trucks in New York.

The latest street railway in New York to operate the Peckham truck, is the Third Avenue Railway Company. A view of one of the handsome cars of the Third Avenue Railway mounted on this style of truck is shown in the accompanying engraving.

The car is of the Laclede type, with a twenty-two foot body, and measuring thirty feet over all. These cars are fitted up in an extremely tasteful manner, and have proved quite popular with the patrons of the company.



THIRD AVENUE CABLE CAR WITH PECKHAM TRUCK—NEW YORK.

The truck is of the 6 D, standard Peckham type, and though it has been running for a short time only on the road, has attracted much attention, on account of its easy riding qualities and absence from jar. The success of the Peckham trucks on the Broadway cable railway, of New York, was one principal reason for their adoption on the Third Avenue road, and it is said that most of the 175 cars which the Third Avenue Company has ordered from the J. G. Brill Company will be mounted on Peckham trucks.

THE street railroad vestibule law of Ohio, has been declared invalid by the Common Pleas Court at Springfield.

THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS.*

BY EDWARD E. HIGGINS.

FIFTH PAPER.

Class V. Surface Railways in American Cities of from 100,000 to 500,000 Inhabitants.

There are twenty-four cities in the United States having a population of from 100,000 to 500,000 by the census of 1890. Fifteen are in the Eastern States, six in the Central, two in the Western and one in the Southern. The total track mileage exceeds 3,000, of which about 65 per cent. is operated by electricity, 20 per cent. by horses, 10 per cent. by cable and the balance by other systems of motive power.

Twenty-one of these cities are represented in the Table of Statistics, twenty appearing in the class now under consideration. The population of one city and its suburbs exceeds 500,000; two are grouped together in one population center; two cities are represented, first, separately, and, again, in combination; and one city is represented, first, alone and, second, with a large addition of suburban population served by a separate railway system. The statistics of three cities are not sufficiently complete to be included in the table.

Only four cities of the entire number were operated in either 1890 or 1892 wholly by horses or by any one motive power. In this class, for the first time, we find a fair proportion of the mileage operated by the cable system, and, as early as 1890, several of the systems had commenced the introduction of electricity, although to hardly so great an extent, proportionally, as in the classes hitherto discussed. In 1894, however, we find the electric mileage, as above stated, about 65 per cent. of the total, with only 20 per cent. still operating by horses.

We are now dealing with properties of size and earning power sufficient to merit the attention of the best financial talent and the ablest and most sagacious management. Capital liabilities of from $5,000,000 to $40,000,000, gross income of from $1,000,000 to $2,000,000 and net earnings of from $300,000 to $800,000—all indicate a speculative and investment field in which the wide variety of financial methods—good, bad and indifferent—which have been developed in the steam railroad industry of the country can find full play. The increasing disposition of conservative banking houses and investors to extend their operations into this field, the profits which have been realized in the important transfers, reorganizations, consolidations and reconstructions of the last five years, and the frequent listing of the more important securities upon the great stock exchanges of the country make it certain that, whatever good or ill fortune may befall individual investors in time to come, the great street railway industry has emerged from its comparative obscurity and will henceforth rank second only to steam railroads in the money markets. Certain elements of safety in street railway investments will come to be more generally recognized. Competition, for example, is much less a menace to consolidated street railway properties serving single municipalities than is the case with even widely ramified steam railroad systems which can be easily paralleled or, in various ways, injured by rivals. "Cut rates," "rebates," "differentials," and all similar methods of attracting business, together with the credit system in any form are unknown in the street railway industry. "Bills and accounts payable" is far more likely to form an important feature of a street railway balance sheet than is "bills and accounts receivable," and in this respect the business is much more attractive than are the numerous "industrial" enterprises. As against these obvious and most important advantages we have, in some cases, franchise limitations and burdens of more or less importance, but possible losses from these causes may always be provided for by amortization funds, the annual burden of which, if established in the early days of the enterprises, may be almost insignificant. Such companies as are fortunate enough to have obtained "perpetual" franchises are in a most favorable position.

It is worth while then to study with the utmost care the results so far achieved by these large properties and to carefully weigh the influences which will affect their permanently safe earning power and their ability to meet the expectations of their security holders.

The twenty-one cases of this class represented in the table differ from those heretofore discussed, in that few of them were operated, either in 1890 or 1892, exclusively by any one motive power. Moreover, the complete municipal systems are made up in most instances of independent roads, and the changes in motive power and service within the two years specified have taken place somewhat less rapidly than in the smaller cities. Without attempting, therefore, to discuss the statements of 1890 and 1892 separately, it seems best to divide the entire twenty-one cases into four groups according to the gross earning power per capita developed up to 1892. The first group contains two systems only, which earned $4.06 and $4.95 per capita respectively in 1892, the second group contains five systems, which earned from $5.18 to $5.51 per capita, the third group contains ten systems, which earned from $6.32 to $8.08 per capita, and the fourth group contains four systems, which have earned from $10.14 to $13.35 per capita in 1890 and 1892.

DISCUSSION OF TWO SYSTEMS SHOWING A PASSENGER INCOME LESS THAN $5.00 PER CAPITA PER ANNUM.

Case No. 115, which serves a well known Eastern city of over 250,000 inhabitants, has exhibited a gross earning power much inferior to all the cities of this class, although the margin of profit with horse operation has been satisfactory and has rapidly increased from year to year. The manufacturing interests in this city have been, until lately, secondary in importance to the commercial, and the city has been somewhat "sleepy" in consequence. The business district is exceedingly small and the residential section covers a large area, so that distances are great and compel riding. The policy of the horse railway management was to keep the horse equipment up to a high standard of excellence at the expense of speed, and the horse car schedules were consequently "slow" to a fault. This fact is responsible for the extremely low gross earning power in 1890 ($2.99), and although this was increased in 1892 to $4.06 (and in 1893 to $5.31), owing largely to the increasing proportion of electric railway mileage, the present totals are still much below the average. The proportion of operating expenses to passenger income has steadily decreased since 1890, and is now less than 65 per cent., while the net income, although but 2.8 per cent. in 1890 on the extremely heavy capitalization, $113,000 per mile of track, was, in 1893, 3.7, and will doubtless materially increase for several years to come, as the future of this city and its street railway systems is, for various reasons, unusually promising.

The street railway system represented in case No 121 was wretchedly poor in 1890 both in physical condition and in service rendered. The city itself is prosperous, with large manufacturing and commercial interests, and with many special attractions for residence. During the last three years immense improvement has been made in the street railway system, and the passenger income is now (1893) $6.46 per capita, a moderately large figure, though by no means up to the average of other cities in this class. This system also has a large capitalization due, in part, to the somewhat extensive cable mileage introduced since 1890.

TABLE V.—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
102	70.0	.....	.....	.....	70.0	45.0	1,000,000	14,300	9.50	300,000	4,300	2.90	1,300,000	18,600	12.40	425,000	B.A.P	102
	50.0	30.0	.....	.....	80.0	.....	1,500,000	18,800	14.30	800,000	10,000	7.60	2,300,000	28,800	21.90	.....	.....	
103	*45.0*	*27.5*	*42.0*	*6.0*	*120.5*	*69.6*	*3,668,700*	*30,300*	*34.30*	*4,859,000*	*40,200*	*45.40*	*8,527,700*	*70,500*	*79.80*	*761,536*	B.A.P	103
	5.0	*145.6*	*30.0*	*15.0*	*195.6*	.....	*8,420,000*	*43,000*	*78.70*	*7,617,000*	*38,900*	*71.10*	*16,037,000*	*81,600*	*149.80*	.....	.....	
m 104	*14.4*	*14.5*	*61.0*	*22.7*	*112.6*	*58.4*	*6,923,400*	*61,200*	*52.00*	*5,272,000*	*46,600*	*39.60*	*12,195,400*	*107,800*	*91.70*	*272,808*	B.A.P	m 104
	14.5	*18.3*	*62.6*	*23.9*	*119.3*	.....	*7,035,000*	*59,200*	*52.90*	*5,410,000*	*45.500*	*40.70*	*12,445,000*	*104,700*	*93.20*	.....	.....	
105	29.3	11.2	10.0	.....	50.5	25.3	5,000,000	99,000	37.60	2,170,000	43,000	16.30	7,170,000	142,000	53.90	994,185	B.A.P	105
	.....	*86.2*	*10.0*	.....	*96.2*	*53.6*	*5,000,000*	*52,000*	*37.60*	*4,683,500*	*48,600*	*35.20*	*9,683,500*	*100,600*	*72.80*	*1052,724*	Net.	
106	53.2	8.8	.....	.....	62.0	35.7	4,200,000	67,700	31.30	2,875,000	46,400	21.50	7,075,000	114,100	52.80	s 389,073	Net.	106
	14.5	*55.8*	.....	.....	*70.3*	*39.5*	*5,200.000*	*74,000*	*38.80*	*3,327,500*	*47,400*	*24.90*	*8,527,500*	*121,400*	*63.70*	*307,090*	"	
107	56.3	.....	3.0	.....	59.3	46.2	1,800,000	30,400	11.20	.....	.....	.....	1,800,000	30,400	11.20	27,700	.....	107
	61.4	.....	3.4	.....	64.8	49.0	2,300,000	35,500	14.30	.....	.....	.....	2,300,000	35,500	14.30	83,287	.....	
108	119.0	9.0	.....	.....	128.0	84.4	500,000	3,900	3.10	.....	.....	.....	500,000	3,900	3.10	.....	.....	108
	81.0	50.0	.....	.....	131.0	81.0	6,000,000	45,800	37.30	6,000,000	45.800	37.30	12,000,000	91,600	74.50	.....	.....	
109	80.0	.....	.....	23.0	103.0	58.0	5,385,000	52,300	32.70	2,595,000	25,200	15.80	7,980,000	77,500	48.40	1242,377	B.A.P	109
	.....	*114.4*	.....	.....	*114.4*	*60.3*	*5,385,000*	*47,300*	*32.70*	*5,071,000*	*44,500*	*30.70*	*10,456,000*	*91,800*	*63.60*	*838,406*	Net.	
110	88.4	.....	.....	.....	88.4	.....	6,147,000	69,600	33.00	5,375,000	60,900	28.90	11,522,000	130,500	61.90	213,200	Net.	110
	.....	.....	.....	.....	*104.1*	.....	*7,054,000*	*67,800*	*37.90*	*7,128,000*	*68,600*	*38.30*	*14,182,000*	*136,500*	*76.30*	*719,718*	.....	
111	64.7	.....	3.0	.....	67.7	54.6	2,000,000	29,500	9.20	.....	.....	.....	2,000,000	29,500	9.20	55,700	.....	111
	73.3	.....	3.4	.....	76.7	59.6	2,500,000	32,600	11.50	.....	.....	.....	2,500,000	32,600	11.50	226,787	.....	
112	76.4	9.0	7.4	.....	72.8	.....	2,166,600	29,800	9.40	1,100,000	15,100	4.80	3,266,600	44,900	14.20	81,929	B.A.P	112
	38.9	*43.5*	*22.0*	*2.0*	*106.4*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
p 113	76.2	.....	.....	73.4	149.6	109.6	4,669,350	31,100	19.30	1,608,200	10,700	6.70	6,277,550	41,900	26.00	49,078	B.A.P	p 113
	104.1	45.0	.....	.....	149.1	.....	4,894,350	32,800	20.20	1,054,000	7,000	4.30	5,948,350	39,900	24.60	.....	.....	
114	67.5	.....	2.4	5.0	74.9	47.2	1,077,400	14,400	4.30	2,786,500	37,300	11.00	3,863,900	51,500	15.20	98,948	.....	114
	58.3	13.0	2.5	7.5	81.3	z 53.2	1,538,255	18,800	6.10	3,756,000	46,200	14.80	5,294,255	65,100	20.90	28,400	.....	
115	63.8	.....	.....	.....	63.8	42.3	205,000	3,200	.80	1,500,000	23,500	5.90	1,705,000	26,700	6.70	188,907	.....	115
	47.0	*52.5*	.....	.....	*99.5*	*60.4*	*5,870,500*	*59,000*	*22.90*	*5,370,257*	*54,000*	*21.00*	*11,240,757*	*113,000*	*43.80*	*518,736*	.....	
t 116	*44.0*	*52.4*	.....	*32.0*	*128.4*	*67.4*	*3,925,000*	*30,700*	*14.40*	*1,400,000*	*10,900*	*5.10*	*5,325,000*	*41,600*	*19.50*	*211,437*	B.A.P	t 116
	.....	*188.7*	*19.0*	.....	*207.7*	.....	*19,050,000*	*91,800*	*70.00*	.....	.....	.....	.....	.....	.....	.....	.....	
117	109.3	11.2	10.0	23.0	153.5	83.3	10,385,000	67,500	34.90	4,765,000	31,000	16.00	15,150,000	98,700	51.00	2236,562	B.A.P	117
	.....	*200.6*	*10.0*	.....	*210.6*	*113.9*	*10,385,000*	*49.300*	*34.90*	*9,754,500*	*46,200*	*32.70*	*20,139,500*	*95,300*	*67.60*	*1891,130*	Net.	
u 118	*45.0*	.....	*84.2*	*18.2*	*147.4*	*66.1*	*13,331,173*	*90,500*	*44.50*	*7,375 000*	*50,200*	*24.70*	*20,706,173*	*140,800*	*69.20*	*37,740*	B.A.P	u 118
	59.0	*47.7*	*107.0*	*21.3*	*235.0*	.....	*25,892,000*	*110,200*	*86.60*	*10,956,000*	*46,800*	*36.80*	*36,848,000*	*157,000*	*12340*	.....	.....	
119	*49.7*	*24.9*	*29.8*	.....	*104.4*	*61.9*	*10,983,953*	*105,800*	*32.00*	*5,441,500*	*52,300*	*15.80*	*16,425,453*	*158,100*	*47.70*	.....	.....	119
	28.0	*100.8*	*24.1*	.... z	*152.9*	*102.6*	*17,588,095*	*115,000*	*51.20*	*9,185,500*	*60,100*	*26.70*	*26,773,595*	*175,100*	*77.90*	.....	.....	
v 120	110.7	12.6	24.5	.....	147.8	86.2	7,694,950	52,000	20.60	2,327,000	15,700	6.30	10,021,950	67,600	26.80	19,200	B.A.P	v 120
	71.3	*138.0*	*26.5*	.....	*235.8*	.....	*10,275,000*	*43,700*	*27.60*	*2.550,000*	*10,800*	*6.80*	*12,825,000*	*54,200*	*34.30*	.....	.....	
w 121	144.0	.....	.....	.....	144.0	93.8	7,590,000	52,700	17.50	1,772,500	12,300	4.10	9,362,500	65,000	21.60	420,072	B.A.P	w 121
	41.0	*155.7*	*37.0*	.....	*233.7*	.....	*11,050,000*	*47,400*	*25.60*	*10,727,000*	*45,700*	*24.70*	*21,777,000*	*93,100*	*50.20*	.....	.....	
x 122	116.1	.....	15.9	45.0	177.0	103.3	6,861,000	38,800	15.20	4,439,500	25,100	9.70	11,300,500	63,800	25.00	110,827	B A.P	x 122
	16.7	*220.5*	*43.4*	.....	*280.6*	.....	*23,237,000*	*82,600*	*51.30*	*16,025,000*	*56,900*	*35.40*	*39,262,000*	*139,500*	*86.90*	.....	.....	

m. This report does not include about 15 miles of miscellaneous and newly constructed track. p. This report does not include one insignificant horse road. t. This report does not include one 12 mile horse railway which was in the process of conversion to the cable system in 1890, and which earned about $250,000 during their financial year of 1890. u. One road reports capital liabilities, mileage and gross income ($895,000) only, but calculations are carefully made with due allowance therefor, and the resulting statistics are "true." v. One road operating partly by horses and partly by cable does not return its horse railway statistics of operation. w. This report does not include three small suburban roads and one horse railway operating 22 cars. x. This report does not include one 10 mile road commencing cable operation in 1890, and with capital liabilities of $1,300,000. z. Approximate.

DISCUSSION OF FIVE SYSTEMS SHOWING A PASSENGER INCOME OF FROM $5.00 TO $5.50 PER CAPITA PER ANNUM.

Case No. 116 was an imperfectly developed horse and electric railway system in 1890. This was one of the first cities to adopt electricity, the original apparatus was defective, and the percentage of operating expenses to passenger income in 1890 was 78, in spite of the large proportion of electric mileage. The net earnings were equal to 7.7 per cent. on a moderate capitalization, $41,600 per mile of track. Since 1890 the entire system has been completely transformed, and the physical condition and service now rendered are all that could be desired. The passenger income and net earnings have both increased enormously, although, unfortunately, exact figures cannot be obtained for all of the roads. It is worthy of note that, on certain important through lines in this city, electric

SERVING FROM 100,000 TO 500,000 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
102	105,000	....	2,300	.....	6-30-1890	3,615,000	34.5	493,150	11,000	.136	4.70	377,880	.105	76.7	116,155	.032	23.5	8.9	102
	105,000	....	.....	.....	12-31-1891	.....	.....	689,413	.....	....	.6.56	.....	...	.....	.....	...	...	...	
103	*107,000*	....	*1,500*	.....	n *1890*	.....	.....	*1153,578*	*16,500*	....	*10.74*	*820,409*	....	*71.3*	*341,756*	....	*29.7*	*4.0*	103
	107,000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	...	...	...	
m 104	*133,000*	....	*2.300*	.....	n *1890*	*11,598,004*	*87.2*	*1743,729*	*30,000*	*.150*	*13.08*	*1292,851*	*.111*	*74.1*	*498,758*	*.043*	*28.7*	*4.1*	m 104
	133,000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	...	...	...	
105	133,000	....	5,300	.....	6-30-1890	3,146,716	23.7	523,254	20,700	.166	3.93	373,954	.119	71.5	147,427	.047	28.1	2.1	105
	133,000	....	*2,500*	.....	*12-31-1892*	.....	.....	*869,449*	*16,200*	....	*6.53*	*656,020*	....	*75.5*	*254,102*	....	*29.2*	*2.6*	
106	134,000	....	3,500	.....	6-30-1890	.....	.....	578,658	16,200	....	4.32	425,359	....	73.4	156,145	....	26.9	2.2	106
	134,000	....	*3,400*	.....	*6-30-1892*	.....	.....	*730,040*	*18,500*	....	*5.45*	*483,029*	....	*66.1*	*252,775*	....	*34.6*	*2.9*	
107	161,000	....	3,500	.....	6-30-1890	2,927,278	18.2	q 896,685	19,400	.306	5.57	722,934	.247	80.6	185,828	.063	20.7	10.3	107
	161,000	....	3,300	.....	6-30-1892	.....	.....	1068,179	21,800	....	6.65	975,415	....	91.1	112,047	....	10.5	4.9	
108	161,000	....	1,900	.....	6-30-1890	7,099,498	44.1	958,741	11,400	.135	6.00	644,882	.091	67.2	320,486	.045	33.4	6.4	108
	161,000	....	*2,000*	.....	*12-31-1892*	*9,248,831*	*57.5*	*1270,827*	*15,700*	*.137*	*7.89*	*789,450*	*.085*	*62.1*	*481,378*	*.052*	*37.9*	*4.1*	
109	165,000	....	2,800	.....	6-30-1890	3,293,905	19.9	732,426	12,600	.222	4.44	547,421	.166	74.7	180,427	.055	24.6	2.3	109
	165,000	....	*2 700*	.....	*12-31-1892*	.....	.....	*1267,208*	*20,000*	....	*7.70*	*816,633*	....	*66.4*	*460,825*	....	*36.3*	*4.4*	
110	186,000	....	.....	.....	12-31-1890	.....	.....	1136,524	.....	....	6.13	.....	...	.....	.....	...	...	...	110
	186,000	....	.....	.....	*12-31-1892*	.....	.....	*1352,365*	.....	....	*7.26*	.....	...	.....	.....	...	...	...	
111	217,000	....	4,000	.....	6-30-1890	.....	.....	944,939	17,300	....	4.35	768,213	....	81.4	190,159	....	20.1	9.5	111
	217,000	....	3,600	.....	6-30-1892	.....	.....	1141,641	19,120	....	5.25	1034,275	....	91.2	125,030	....	11.0	5.0	
112	230,000	....	5,400	.....	n 1890	6,772,090	29.0	1329,821	31,000	.196	5.78	1110,609	.164	83.4	284,695	.042	21.4	8.7	112
	230,000	....	.....	.....	n *1892*	.....	.....	i *1606863*	.....	....	*7.00*	.....	...	.....	.....	...	...	...	
p 113	242,000	....	2,200	.....	6-30-1890	9,233,950	38.1	1531,727	13,900	.166	6.32	1109,277	.120	72.6	448,807	.049	29.4	7.2	p 113
	242,000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	...	...	...	
114	254,000	....	5,400	.....	n 1890	r 4,412,339	17.4	1213,067	25,600	.263	4.76	887,499	.190	72.5	331,169	.075	27.4	8.6	114
	254,000	....	4,800	.....	12-31-1892	.....	.....	1399,841	26,300	....	5.51	.....	...	.....	.....	...	...	...	
115	256,000	....	6,100	.....	6-30-1890	.....	.....	765,645	18,100	....	2.99	624,059	....	81.5	141,586	....	18.5	8.3	115
	256,000	....	*4,200*	.....	*6-30-1892*	.....	.....	*1043,546*	*17,200*	....	*4.06*	*754,915*	....	*72.6*	*313,072*	....	*30.1*	*2.8*	
t 116	*273,000*	....	*4,100*	.....	n 1890	.....	.....	*1422,625*	*21,100*	....	*5.18*	*1114,452*	....	*78.2*	*415,288*	....	*29.2*	*7.7*	t 116
	273,000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	...	...	...	
117	298,000	....	3,600	.....	6-30-1890	6,440,621	21.6	1255,680	15,100	.196	4.23	921,375	.143	73.1	327,854	.051	26.0	2.2	117
	298,000	....	*2,600*	.....	*12-31-1892*	.....	.....	*2136,657*	*18,800*	....	*7.18*	*1472,653*	....	*68.6*	*714,927*	....	*33.4*	*3.6*	
u 118	*299,000*	....	*4,500*	.....	*6-30-1890*	*11,077,722*	*37.1*	*3985,502*	*60,400*	*.278*	*13.35*	*2225,722*	*.201*	*72.6*	*882,560*	*.080*	*28.6*	*5.3*	u 118
	299,000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	...	...	...	
119	*344,000*	....	*5,600*	.....	n *1890*	.....	.....	*2012,236*	*32,500*	....	*5.84*	*1264,162*	....	*62.7*	*877,827*	....	*43.7*	*5.4*	119
	344,000	....	*3,300*	.....	n *1892*	.....	.....	*2781,238*	*27,000*	....	*8.08*	*1971,091*	....	*70.9*	*970,731*	....	*34.9*	*3.6*	
v 120	373,000	....	4,300	.....	6-30-1890	9,796,964	26.3	1960,397	22,700	.200	5.25	1359,307	.144	71.6	561,693	.059	29.6	5.6	v 120
	373.000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	...	...	...	
w 121	434,000	....	4,600	.....	6-30-1890	8,675,114	20.0	1839,043	19,600	.212	4.24	1526,713	.176	83.2	342,959	.040	18.6	3.7	w 121
	434,000	....	.....	.....	l	.....	.....	*2365,822*	.....	....	*5.46*	.....	...	.....	.....	...	...	...	
x 122	452,000	....	4,400	.....	6-30-1890	.....	.....	2645,736	25,700	....	5.86	1983,617	....	74.7	721,860	....	27.2	6.4	x 122
	452,000	....	.....	.....	*12-31-1893*	.....	.....	*4784,059*	y	....	*10.58*	.....	...	.....	.....	...	...	...	

i. Does not include earnings of one road which probably approximated $35,000. l. Latest returns. m. This report does not include about 15 miles of miscellaneous and newly constructed tracks. p. This report does not include one insignificant horse road. q. One cable road included in this report commenced operation Jan. 1, 1890, and operating statistics are for six months only. r. The car mileage of one road is not given and its operating returns are subtracted from the totals before figuring returns per car mile. t. This report does not include one 12 mile horse railway which was in the process of conversion to the cable system in 1890, and which earned about $250,000 during their financial year of 1890. u. One road reports capital liabilities, mileage and gross income ($895,000) only, but calculations are carefully made with due allowance therefor, and the resulting statistics are "true." v. One road operating partly by horses and partly by cable does not return its horse railway statistics of operation. w. This report does not include three small suburban roads and one horse railway operating twenty-two cars. x. This report does not include one 10 mile road commencing cable operation in 1890, and with capital liabilities of $1,300,000. y. Based on passengers carried, at an average rate of $.05 each. This figure is probably slightly higher than the true passenger income. z. Approximate.

and cable roads parallel each other about two blocks apart, and the electric lines are so much more popular than the cable that there is serious thought of converting the latter to electricity.

Case No. 120 is a highly developed system giving excellent service to an important Eastern city. The motive power in 1890 was chiefly animal, although there were several cable lines on certain heavy grades within

the city. The car service (26 miles per capita), was reasonably large and brought about a passenger income of $22,700 per mile of street, $.20 per car mile and $5.25 per capita—results which compared very well with those of the other cities of the class for that year. The net income was equivalent to 5.6 per cent. on capital liabilities of $68,000 per mile of track. Although complete figures for 1892 are not available, there is no question that the passenger income at present exceeds $7.00 per capita per annum.

Case No. 106 serves one of the smaller cities of the class—bright, enterprising and prosperous, with important manufacturing interests. Its passenger income in 1890 was $4.32 per capita, which has been since increased, by improvements in service, to $6.38 (1893). The present excellent management is responsible for a steady reduction of the percentage of operating expenses to 66 in 1892, and to 60 in 1893, the net income being now equal to 4.1 per cent. on excessive capital liabilities of $100,000 per mile of track.

Cases No. 111 and 114 serve population centers of about the same size, with important suburbs. The similarity between the statements is quite marked, except in the matter of capitalization, which is in Case No. 111 but half that of Case No. 114. The cause of the great increase in the percentage of operating expenses to passenger income shown in Case No. 111 is not known to me.

Discussion of ten systems showing a passenger income of from $6.00 to $8.00 per capita per annum.

These ten systems represent the average earning power of the class as developed up to the present time, although the fact that nearly all of the systems are not yet fully converted to the more modern systems of motive power points to larger earnings per capita in the future when the change shall be complete.

With the exception of Cases No. 102 and 107, which are exceptional, the track mileage of the systems of this group ranges from about 100 to 150 and the street (or road) mileage, from 45 to 110. The development of Cases Nos. 102 and 107 has been retarded by serious difficulties with the city regarding franchises, and both cities are among the smallest of the class, the principal city of Case No. 107 being less than 140,000.

Excluding Case No. 107, which has no funded debt, and No. 117, which is a combination of Cases No. 105 and 109, the funded debt of the remaining eight systems ranges from $7,000 to $68,600 per mile of track, and the total capital liabilities from $28,800 (1891) to $175,100 per mile of track, the figure last named being for a city which is served chiefly by cable and electric systems. Case No. 107 had no funded debt in either 1891 or 1892, but is now burdened with $8,000,000 of 5 per cent. bonds, a load which may be found difficult to bear. Case No. 112 also shows reasonable capital liabilities per mile of track ($44,900) in 1890. The capital liabilities of Cases No. 102 and 113 will be greatly increased within the next two years. Larger capital liabilities per mile of track than have been found in the classes hitherto discussed are to be expected here for several reasons. In the first place, the cost of construction and reconstruction is greater, since the burdens imposed by the city in the matter of paving, together with the cost of labor, etc., are greater than in the smaller cities. Again, the magnitude and earning power of the properties offer greater temptation to overcapitalization of costs, and these temptations have in few instances been resisted.

The passenger income reported ranges from about $14,000 to $31,000 per mile of road and from $.14 to $.22 per car mile, Case No. 107 showing $.31 in 1890.

The operating expenses range from $.085 to $.166 per car mile (Case No. 107 showing $.247); and the percentage to passenger income ranges from 62.1 to 75.5 for those systems which are equipped chiefly by electricity and cable, from 73 to 83 for three roads operating chiefly by horses, while Case No. 107 shows 91 per cent. in 1892 as against 81 in 1890. As before stated, the cause of the sudden drop in the net earnings shown in this statement is not known to me, but is probably due to exceptional causes which will not obtain in 1893 and thereafter.

The net income of all the cases is evidently sufficient to show a considerable margin over the fixed charges, but not enough as yet, except in three instances, to return a satisfactory dividend on the capital stock. It is probable that with the more complete development of the systems of this group will come a large increase in both gross and net income and it is to be hoped that this increase will be sufficient to justify the promoters of the various enterprises in the heavy overcapitalization of costs for which they are responsible.

Discussion of four systems showing a passenger income exceeding $10.00 per capita per annum.

These four systems represent the highest gross and net earning power of the class. All are cities west of the Mississippi River. In all the cable system was introduced prior to 1888, and electricity in its early stage of development. Their street railway systems are to-day, with but few exceptions, the most complete and perfect to be found among the cities of the world. Their people are liberal, careless of the little economies, and have always been "free riders."

Case No. 122 has the largest track and road mileage of the group. Its capital liabilities are enormous, being $139,500 per mile of track, of which the funded debt is nearly $57,000. Its large horse railway mileage in 1890 has almost entirely disappeared, and the passenger income for 1892 is nearly double that of 1890. No operating expenses are obtainable for 1892, but the percentage is probably between 60 and 65, which would leave a net income of perhaps $1,600,000, equivalent to somewhat less than 5 per cent. upon the capital liabilities. The industries of the city served by this system are so extensive and varied that the street railways are likely to be less affected by financial depressions than is the case with the others of the group; and to this extent this system is "safer" as an investment than at least two of the other three.

Case No. 103 is an excellent and highly valuable property, whose permanent value depends, however, rather too much on the continuing success of a few special industries. Nevertheless, the city is well located to serve as the capital of an extensive territorial area, and it is probable that its manufacturing and commercial industries will increase in extent and variety in the future. In this city, as in others previously noted, the introduction of electric lines has so seriously injured cable lines serving the same districts that much of the cable mileage has been converted to electricity within the last two years—of course, at an enormous loss of invested capital.

Case No. 104 showed remarkable results in 1890. The cable system of this city was then, and perhaps still is, the most perfect in the country. The city was the center of business and manufacturing activity and real estate was "booming" to an extent that seemed to put wealth within the reach of all. The street railways shared the general prosperity, and the gross and net receipts seemed to ensure handsome returns upon the very large capitalization. At the present time, however, this city is suffering from the effects of a collapse in values which, it is to be hoped, is but temporary, and the street railway properties are unable to more than pay fixed charges.

Case No. 118 deals with the largest gross and net income so far discussed. This was the first city in the world to adopt the cable system as a motive power, and its cable mileage is now very large. Its passenger income was, in 1890, equivalent to the so far unprecedentedly large figure of over $60,000 per mile of road, to nearly $.28 per car mile, and to $13.35 per capita. The operating expenses were larger than is usually the case with the cable system, owing chiefly to the heavy grades encountered in the city, and perhaps also to the faults of the early apparatus, some of which is still used. The net income was equivalent to a return of 5.3 per cent. on capital liabilities of $157,000 per mile of track—the largest capitalization of the class.

Discussion of six systems operating chiefly by horses in 1890, and by electricity and the cable system in 1892.

One of these systems was in operation entirely by horses in 1890, two were in operation almost wholly by

horses with but small electric mileage, in one about 80 per cent. of the mileage was animal and the balance steam, and in two somewhat more than 50 per cent. of the mileage was animal. In 1892 the entire system of three cities was in operation by electricity and the cable, two cities had equipped about three-fourths of their mileage by electricity and the cable, and one was operating by horses and electricity in about equal proportions. The total track mileage was increased from 512 (395 horse, 54 electric, 40 cable and 23 miscellaneous) in 1890, to 694 (160 horse, 500 electric and 34 cable) in 1892. The funded debt in 1890 was $28,500 per mile of track, and in 1892, $48,500; while the total capital liabilities, which were $79,800 in 1890, were $113,500 in 1892. All these figures represent heavy overcapitalization of costs and of the present value of tangible assets, and there is, in several instances, more or less serious overcapitalization of earning power, although the fixed charges do not seem to be yet in danger.

The passenger income of these five roads in 1890 was $5,570,960, equivalent to $18,100 per mile of road and $4.68 per capita. The passenger income in 1892 was $7,962,308, equivalent to $20,000 per mile of road and $6.69 per capita, an increase of 43 per cent.

The operating expenses in 1890 were 69.7 per cent. of the passenger income, and in 1892, 68.7 per cent., the reduction being unimportant. The net income in 1890 was $1,823,898, and in 1892, $2,732,883, an increase of 50 per cent. The return on the capital liabilities was 4.4 per cent. in 1890, and 3.5 per cent. in 1892. The net income was also equivalent to 12.5 per cent. upon the funded debt in 1890 and 8.1 per cent. in 1892.

WHAT ARE "OPERATING EXPENSES"?

Before drawing the usual general conclusions, it may be well at this point to discuss certain features of "operating expenses," which are not always borne in mind by investors, and which will serve to explain the somewhat conservative character of the criticisms and conclusions which have been arrived at in these papers.

The operating expenses of steam or street railroads are usually separated into four general divisions, "General Expenses," "Transportation," "Maintenance of Way and Structures" and "Maintenance of Equipment." The first two divisions represent direct expenditures and are easily understood. The last two—which, for present purposes, I shall consider as consolidated into one general "Maintenance" account—represent not only the direct expenditures for repairs, which are always, of course, charged up against the business of the year in which they are made, but also a more or less uncertain and variable allowance for "depreciation" of plant.

The physical condition of electric railway road and equipment, as we find it to-day, is, in general, good. The properties are, for the most part, reorganized and reconstructed horse railways, with important and recently constructed extensions. Both roadbed and equipment are therefore comparatively new and—except where mistakes of construction have been made—the serious effects of depreciation have not yet come to light. The electric railway industry being hardly six years old, and the equipment of a majority of the electric railways of the country being less than three years old, it is probable that the direct expenditures for repairs ("wear and tear") during the past three years, is somewhat less than will be the average cost of such repairs for a period of ten, fifteen or twenty years. True, the defects of the early apparatus and the inexperience which has led to imperfect construction of track, have had a serious effect on the repair account, and roads which have suffered greatly from these troubles are now effecting such economies and gradually introducing new apparatus to such an extent as perhaps to reduce, rather than increase, their repair accounts. As a general rule, however, the repair account for the first few years of electric operation is not a fair criterion for judgment. It is probable, therefore, that unless economies are effected in other directions (which can easily be done by a large majority of American street railways) the "operating expenses" of many and perhaps most of the roads will gradually increase from year to year until an equilibrium is reached, as has been the case with steam railroads.

Now in addition to the ordinary "repairs" (or "wear and tear") of street railway roadbed and apparatus, we ought, with new roads at least, to determine upon some method of annually charging off an allowance for "depreciation" so that we may be certain that our so called "net earnings" are properly applicable to returns upon the investment, and are not, in part at least, deferred operating expenses. In other words, there will come a time—ten, fifteen, perhaps twenty years hence—when it will be impossible to patch up and further repair cars, motors, track, etc. They must be *replaced*—money must be found to replace them—and the problem of finding this money may be serious indeed.

Perhaps the best method of anticipating these necessary expenditures for renewals is to establish, early in the life of the reconstructed properties, a "Depreciation (or Reserve) Fund" into which shall be passed every year, out of the apparent net earnings, an amount which, accumulating at compound interest, will eventually reach a sum sufficient to replace the different sections of the plant at the end of their estimated life. For example, we may estimate that our motors, which cost us to-day $100,000, will last for ten years without renewals. The sum of $7,153 passed annually to the Reserve Account for ten years will, at 5 per cent. interest, amount to $90,000 at the end of that period, and this sum, added to an estimated salvage of $10,000 on the old motors, will repurchase new motors at that time. In the same way, a calculation may be made for car bodies and trucks, for roadbed, power station apparatus, etc. All sums passed to the reserve account should of course be charged to operating expenses. The funds in the reserve account may be used to purchase in open market the Company's bonds or other securities which will yield the required rate of interest, and the sale of these securities, when necessary, will provide the funds for renewals.

Now it may be urged that steam railroad properties have not found it necessary as a rule to establish such reserve funds. The answer to this is that the most conservatively managed railroad corporations, even in this country, have special funds under one name or another for just such purposes, and that a much larger proportion of foreign railroads make a special point of so providing for renewals or for other similar contingencies. At the same time it is true that the necessity for such a fund is not so great with old established properties which have been in operation long enough to have ascertained their average renewals during a period of years as it is with such properties as are now under consideration, where we are working largely in the dark.

It is clear therefore that since the "operating expenses" of many, and perhaps most of the street railway statements discussed in these chapters do not include an allowance for "depreciation" beyond the direct expenditures for "wear and tear," the resulting "net earnings" are too great and, if paid out in dividends, may imperil the permanent solvency of such companies as are "running close to the wind."

In the light of the above discussion it is now possible to draw the following

GENERAL CONCLUSIONS.

1. The magnitude of the interests involved in handling the street railway properties of this class will insure the continued employment of the best managing ability obtainable, and the interests of the security holders will be, in this respect, carefully and thoroughly protected.

2. Animal motive power will soon disappear entirely in the cities of this class and will be replaced chiefly by the overhead electric system, unless further improvements in the science of transportation be made. Existing cable lines will continue in use on streets where the density of traffic is very great, but it is possible that little or no additional cable mileage will be built, on account of the large initial cost of construction, as compared with that of the electric system.

3. When the process of conversion to improved systems of motive powers shall have been completed in the cities of this class, a few exceptional street railway systems will be able to earn from $10 to $15 per capita by the cultivation of traffic in every possible manner; nearly all of the remainder will develop an earning power of from $7.50 to $10 per capita; and few will fall below $7.50 per capita.

4. Many of these properties have been slow in adopting new rapid transit methods and are fortunate in profiting by the experience of those earlier in the field. The electric railways may hope to operate, therefore, at from 65 to 70 per cent. of the passenger income, and the cable railways at a somewhat smaller ratio, owing, not so much to a lower cost of operation per car mile, as to a larger passenger income per car mile.

5. A net earning power of from $2.75 to $3.50 per capita, with occasional figures slightly larger than these may be expected.

6. Such net earnings are equivalent to a return of from 15 to 25 per cent. on the actual net cost of duplicating the tangible assets of the railway systems under consideration. The cost of track construction and paving in the crowded streets of these cities ranges from $15,000 to $30,000 per mile of track, according to the amount of paving required by the city. The investment required for equipment is proportionately larger on account of the greater number of cars per mile of track necessary for properly handling the traffic, and the actual cash cost of building and equipping new electric railway systems in these cities will rarely be less than $50,000 per mile of track and may easily be somewhat more. The cost of building and equipping cable roads varies within wide limits on account of interference with water and gas pipes, etc., but is rarely less than $100,000 per mile of track. Bearing in mind, then, the statements previously made that these systems are operating from 100 to 150 miles of track, it is seen that, while capital liabilities of from $15 to $25 per capita are not unreasonable, larger amounts may well be regarded with suspicion.

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 100,000 TO 500,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
MILES OF TRACK.				
No. of miles operated	1503.0	722.6	764.0	2176.9
FUNDED DEBT PER MILE OF TRACK.				
No. of miles not reporting	.....	.....	.....	314.1
" " having no funded debt	255.0	.....	141.5	.....
" " " an indebtedness less than $20,000 per mile	584.2	128.4	229.1	235.8
" " " " " from $20,000 to $30,000 "	343.8	.....	.....	.....
" " " " " " 30,000 to 40,000 "	228.4	.....	.....	195.6
" " " " " " 40,000 to 50,000 "	112.5	233.1	81.3	1210.5
" " " " " " 50,000 to 69,000 "	88.4	251.8	.....	533.0
CAPITAL LIABILITIES PER MILE OF TRACK.				
No. of miles not reporting	.....	.....	.....	314.1
" " capitalized at less than $30.000 per mile	329.5	.....	80.0	.....
" " " at from $30,000 to $40,000 "	59.3	.....	290.6	.....
" " " " 40,000 " 50,000 "	222.4	128.4	.....	.....
" " " " 50,000 " 75,000 "	543.7	120.5	81.3	235.8
" " " " 75,000 " 100 000 "	256.5	.....	.....	885.3
" " " " 100,000 " 150,000 "	200.9	260.0	.....	665.9
" " " over 150,000	.....	104.4	.....	387.9
POPULATION SERVED PER MILE OF STREET.				
No. of roads not reporting	1	.....	2	9
" " serving less than 2,000 inhabit. per mile	1	1	.....	.....
" " " from 2,000 to 3,000 " "	3	1	.....	4
" " " " 3,000 " 4,000 " "	3	.....	2	2
" " " " 4,000 " 5,000 " "	4	2	1	1
" " " " 5,000 " 6,000 " "	3	1	.....	.....
" " " over 5,000 "	1	.....	.....	.....
CAR MILEAGE PER CAPITA.				
No. of roads not reporting	5	3	5	15
" " giving a service of less than 20 car miles per capita	3	.....	.....	.....
" " " " of from 20 to 30 " " "	5	.....	.....	.....
" " " " " 30 " 40 " " "	2	1	.....	.....
" " " " " 40 " 50 " " "	1	.....	.....	.....
" " " " over 50 " " "	.....	1	.....	1

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 100,000 TO 500,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
PASSENGER INCOME.				
No of roads not reporting	.....	.....	1	5
" " earning less than $500,000 gross per annum	1	.....	.....	.....
" " " from $500,000 to $750,000 gross per annum	3	.....	1	1
" " " " 750,000 " 1,000,000 " "	4	.....	.....	1
" " " " 1,000,000 " 1,250,000 " "	2	1	2	1
" " " " 1,250.000 " 1,500,000 " "	2	1	1	3
" " " " 1,500 000 " 2,000,000 " "	3	1	.....	1
" " " over 2,000,000 " "	1	2	.....	4
PASSENGER INCOME PER MILE OF STREET.				
No. of roads not reporting	1	.....	2	9
" " earning less than $15,000 per mile	4	.....	.....	.....
" " " from $15,000 to $20,000 per mile	6	1	1	5
" " " " 20,000 " 25,000 "	2	1	1	1
" " " " 25,000 " 30,000 "	2	.....	1	1
" " " over 30,000 "	1	3	.....	.....
PASSENGER INCOME PER CAR MILE.				
No. of roads not reporting	5	3	5	15
" " earning less than 15 cents per car mile	2	.....	.....	1
" " " from 15 to 20 " " "	4	1	.....	.....
" " " " 20 " 25 " " "	3	.....	.....	.....
" " " " 25 " 30 " " "	1	1	.....	.....
" " " over 30 " " "	1	.....	.....	.....
PASSENGER INCOME PER CAPITA.				
No. of roads not reporting	.....	.....	1	5
" " earning less than $4.00 per capita	2	.....	.....	.....
" " " from $4 00 to $5.00 per capita	7	.....	.....	1
" " " " 5.00 " 6.00 "	4	2	2	2
" " " " 6.00 " 7.00 "	3	.....	2	1
" " " " 7.00 " 8.00 "	.....	.....	.....	5
" " " " 8.00 " 9.00 "	.....	.....	.....	1
" " " " 9 00 " 10.00 "	.....	.....	.....	.....
" " " over 10.00 "	.....	3	.....	1
OPERATING EXPENSES PER CAR MILE.				
No. of roads not reporting	5	3	5	15
" " operating at less than 10 cents per car mile	1	.....	.....	1
" " " from 10 to 15 " "	5	1	.....	.....
" " " " 15 " 20 " "	4	.....	.....	.....
" " " over 20 " "	1	1	.....	.....
PERCENTAGE OF OPERATING EXPENSES.				
No. of roads not reporting	1	.....	3	9
" " operating at less than 65 % of pass. income	.....	1	.....	1
" " " from 65 to 70 % " "	1	.....	.....	3
" " " " 70 " 75 % " "	8	3	.....	2
" " " " 75 " 80 % " "	1	1	.....	1
" " " " 80 " 85 % " "	5	.....	.....	.....
" " " " 85 " 90 % " "	.....	.....	.....	.....
" " " over 90 % " "	.....	.....	2	.....
NET EARNINGS.				
No. of roads not reporting	1	.....	3	9
" " earning less than $100,000 net	.....	.....	.....	.....
" " " from $100,000 to $200,000 net	7	.....	2	.....
" " " " 200,000 " 300,000 "	1	.....	.....	2
" " " " 300,000 " 400,000 "	4	1	.....	1
" " " " 400,000 " 500,000 "	1	2	.....	2
" " " " 500,000 " 750,000 "	2	.....	.....	1
" " " " 750,000 " 900,000 "	.....	2	.....	.....
" " " over 900,000 "	.....	.....	.....	1
PERCENTAGE OF NET EARNINGS TO CAPITAL LIABILITIES.				
No. of roads not reporting	1	.....	3	9
" " earning less than 2½ % on capital liabilities.	4	.....	.....	.....
" " " from 2½ to 5 % " "	1	2	1	7
" " " " 5 " 7½ % " "	4	2	1	.....
" " " " 7½ " 10 % " "	5	1	.....	.....
" " " over 10 % " "	1	.....	.....	.....

The Trolley Wire in a New Role.

The value of the trolley wire as a weapon was demonstrated recently in a dispute which occurred in Brooklyn, over the right of one of the street railway companies of that city to string wires over the Grand Street Bridge crossing Newtown Creek. The railway employes arrived on the ground early in the day and commenced their work. Just before reaching the bridge, one of the workmen connected a live wire with a loose coil lying in the bottom of the wagon.

Deputy Sheriff Meyer tried to stop the work when the wagon reached the bridge, but one of the street railway men seized the end of the live wire in his rubber encased hands and jumped down from the wagon. There was an immediate retreat on the part of the deputies, and as the man with the wire approached nearer, the retreat was turned into a rout. No further interference was made on the part of the sheriff, and the bridge is now equipped with overhead wires.

Receipts and Expenses Per Car Mile.

The following tabulated statement shows the receipts and operating expenses, in cents, per car mile on seven street railway systems which are operated by electric power in the same number of cities, and by the same syndicate, the books of each being kept in about the same manner.

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
Receipts	17.03	16.91	20.36	19.67	18.45	41.00	25.45
Expenses.							
Maintenance of way	.79	.36	.83	.27	.57	2.83	1.23
Maintenance of equipment	.68	1.67	1.21	1.59	2.24	1.51	2.08
Transportation	4.88	4.88	5.56	6.52	5.38	10.98	7.60
Power, including coal, oil and salaries of engineers and firemen	.91	1.33	1.12	1.50	2.18	2.59	2.45
General expenses	1.67	1.32	1.58	2.20	2.13	1.91	2.40
Total expenses	8.93	9.56	10.30	12.08	12.50	19.82	15.76
Net earnings per car mile	8.10	7.35	10.06	7.59	5.95	21.18	9.69
Per cent. of expenses to receipts	52	56	50	60	67	48	61

In the case of No. 6, large eight-wheel cars are employed to a considerable extent.

The price of coal per ton, delivered at the station, in the cases above quoted is as follows:

No. 1	$ .90	No. 4	$2.10
" 2	1.25	" 5	2.75
" 3	1.80	" 6	3.30
No. 7	$3.77		

Percentages of Operation and Maintenance on a Southern Street Railway for 1893.

We are permitted through the courtesy of the management of a street railway in a Southern city to present the following detailed statement of expenses for 1893. The line is operated by electric power mostly.

OPERATING EXPENSES.

		Percentage of gross earnings.
Cost of operation of cars, including salaries of conductors, motormen, car expenses, etc.	$48,385.53	or 24.55
Operation of engines, boilers and dynamos, including salaries of engineers and firemen, coal, oil, etc.	29,514.89	" 14.98
Insurance, taxes and damages	11,438.00	" 5.81
Attractions, band, and advertising same	6,901.58	" 3.46
Office expenses, including printing and stationery	835.03	" 0.42
Feed, shoeing, and cars of live stock	1 839.11	" 0.93
Track expenses, including oil, labor, etc.	1.571.81	" 0.80
Fuel and light	1,850.37	" 0.94
Miscellaneous expenses, gratuities and rents	2,278.80	" 1.15
Salaries of officers and clerks	6,270.10	" 3.19
Total	$110,885.32	" 56.23

MAINTENANCE OF PROPERTY.

		Percentage of gross earnings.
Cars and motors	$7,773.88	or 3.94
Buildings	88.69	" 0.05
Power station, including engines, boilers, dynamos, etc	3,543.80	" 1.79
Track, including overhead line	4,630.95	" 2.35
Miscellaneous repairs	1,008.38	" 0 51
Total	$17,045.70	" 8.64

Operating expenses	56.23 per cent. of gross earnings.
Maintenance of property	8.64 per cent. of gross earnings.
Grand total	64.87 per cent of gross earnings.
Total miles run	1,136,856⅞
Gross earnings per car mile	$0.17.35
Gross expenses per car mile	$0.11.26
Net earnings per car mile	$0. 6.09
Total number of passengers carried	3,994,123
Expense per Passenger carried	$0.03.¼
Net earnings per passenger carried	$0.01.¾

John Walker Goes to Chicago.

John Walker, founder and, until February 12 last, vice-president and general manager of the Walker Manufacturing Company, of Cleveland, O., has been appointed general manager of the Fraser & Chalmers Company, of Chicago and London, extensive manufacturers of engines, mining machinery, etc. Mr. Walker has licensed the Pennsylvania Iron Works Company, of Philadelphia, Pa., to manufacture under his cable patents for the Atlantic States, and the corporation of Fraser & Chalmers, of Chicago, for the Middle States and Pacific States with the exception of California, Oregon and Nevada. The licensees of these states are the Union Works Company, of San Francisco, Cal. Fraser & Chalmers, Ltd., of London, will manufacture under the same patents for Great Britain and all the British colonies and possessions. Mr. Walker has served notice on the Walker Company to refrain from further sale of the patents in question, some nineteen in number, and including differential drums, struts, U frames, cable friction clutches, etc. Mr. Walker is a prominent member of a number of the leading engineering societies and clubs in the country. Chicago is to be congratuated upon having secured him as a resident.

Electric Railroad Construction in Baltimore.

Baltimore is to-day one of the most active electric railroad centers in the country. During the last two or three years about $15,000,000 have been invested in the construction of electric and cable lines, and about eighty miles of additional road are now under construction or will be built this summer. Perhaps no other city in the United States can show such a record of activity and so many lines built and projected as Baltimore.

A list of the new roads proposed or under construction in and around Baltimore, recently appeared in the *Manufacturers' Record* of that city. It included the following:

The Baltimore, Middle River & Sparrow's Point Company intends building an electric road estimated at fifteen miles in length. George R. Willis and F. W. Trimble, of Baltimore, and several Philadelphia people, it is understood, are interested.

The Canton, Sparrow's Point & North Point Railway Company intends building an electric road from or near the terminus of the Central Railway in the city to North Point, at the mouth of the Patapsco River. The distance is ten miles. Pres. F. W. Wood, of the Maryland Steel Company, and T. Wallis Blackistone, of Baltimore, are among the members of this company.

The Baltimore, East Baltimore & North Point Company holds a franchise, which was renewed March 17, to build an electric line between the points named. It is learned that about five miles only will be built this spring, from the city limits to a resort called Keller's Pavilion. O. Hammond, of Baltimore, is associated with this enterprise.

The City & Suburban Railway Company is about to extend its Highlandtown branch a distance of two miles. Work will be completed by June 1.

The City Passenger Railway Company will also extend its Canton division one mile.

The City & Suburban Railway Company will also rebuild its Catonsville division, seven miles in length, for electric motors.

The Edmondson Avenue, Catonsville & Ellicott's Mills Company, which is a part of the company recently formed to construct an electric road from Baltimore to Washington, it is understood, contemplates building nine miles of its road west of Baltimore during the summer. George Yakel and Alexander Brown, of Baltimore, are interested.

The Baltimore Traction Company, has obtained permission to connect its Fremont and Ridgely Street lines and extend them to the southwestern city limits, with a possible terminus at Westport.

Work has commenced on the Walbrook, Gwynnoak & Powhatan, an electric road four miles long, extending from the terminus of the Walbrook division of the Lake Roland Elevated Railway system to Powhatan. The road is to be completed by June 1. F. H. Calloway is secretary of the company. Smith & Schwarz, of Baltimore, are also interested.

The Baltimore Traction Company is completing an extension of one mile to its Arlington division.

The Pikesville, Reisterstown & Emory Grove Company has been formed to build from the terminus of the Pikesville branch of the Baltimore Traction system, a distance of ten miles. Geo. R. Webb and John L. Cowen, of Baltimore, are prime movers in the project.

The City Passenger Railway Company is about to extend its Hall's Springs division to Lauraville, five miles.

All of these projects are backed by responsible parties, who are actually preparing to complete them. They embrace, all told, about eighty miles of electric road.

In addition, two companies have been formed to build electric roads from Baltimore to Washington, the routes being thirty-eight and forty-two miles long.

A BILL has been introduced in the Maryland legislature to charter the Maryland & Columbia Railway Company. The bill gives the company extended privileges, permitting it to construct any kind of a railway—steam, electric or a canal between the District of Columbia and the Pennsylvania line, through the counties of Prince George's, Montgomery, Howard, Baltimore, Carroll, Frederick, Harford and Cecil. The scheme is said to be backed by Senators Stephen B. Elkins, A. P. Gorman, Mathew S. Quay, Henry G. Davis and T. Edward Hambleton.

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

Address all communications to

Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

We Have Been Very Much Encouraged by the hearty support which our Financial Supplement has received. The plan of an authoritative source of information concerning street railway properties seems to have met with popular favor, and the general sentiment is clearly that a publication of this kind will prove of great value to both street railway companies and investors. The returns sent us show in many cases very interesting results, and the large number of excellent records made prove that street railway securities present excellent advantages to investors. When these become better known the market for such securities will become broadened, and in consequence there will be a decided increase in the amount of general street railway investments by the general public.

The Agitation of the Question of Electrolytic Action as an agent in the deterioration of water and gas pipes and metallic cable coverings is working both to the advantage and disadvantage of electric street railway companies. It is of advantage so far as it induces the employment of an adequate return conductor, for this results in the saving of power, but when it leads to the institution of claims for damage on the part of the owners of these substructures it causes direct loss and militates against the present method of electric traction. That water and gas pipes deteriorate rapidly in certain cities and in certain soils is admitted, but that any great damage has resulted in any particular case by the action set up by the street railway current is a question that may require very thorough investigation to settle. Pipes deteriorate in cities where there are no electric railways, and were also known to fail from corrosion in many places before the advent of electric railways. Time and the character of the soil are features in every case that must be considered in studying the cause of failure, and in many cases these features are probably more responsible for pipe deterioration than the current. The danger is not one-half so great as the alarm might lead people to suppose.

Metropolitan Rapid Transit as embodied in the New York Chamber of Commerce Bill had a long fight in the New York State Legislature, and at one time it seemed as if its life were greatly in jeopardy. On April 26, however, a few days before the day set for the close of the session, it passed the Senate and Assembly, and was forwarded to the Governor for signature. The bill as amended provides for the appointment of a non-partisan board of railroad commissioners, consisting of John H. Starin, William Steinway, Seth Low, John Claflin and Alexander E. Orr, and permits the people of the city to vote at the next election in November on the question, "Shall the city of New York itself construct a rapid transit railroad?" The introduction of the referendum clause, it is said, makes the bill unconstitutional. But whether this is so or not, it is hard to see any good reason for submitting a financial question of this moment to popular ballot, since the number of those voters who have practically nothing at stake vastly exceeds those directly affected by the result. It is to be hoped that the evils of political jobbery, so closely associated in the popular mind with large undertakings under municipal control, will not be allowed to enter into this affair. Fortunately the commissioners named possess the confidence of the public and can be relied upon to prevent, so far as lies in their power, any abuses and favoritism in a work of this character. Should the bill pass and receive the Governor's sanction, all action, of course, would have to be postponed until the popular vote on the question shall be taken, which will not be until next November. After that there must necessarily be another delay to complete organization, drawing up of plans, etc., so that it seems hardly possible that any active work will be begun on a rapid transit system in New York for two years yet.

The Long Distance Transmission of Power by electrical means is something new in street railway practice. Electric railway engineers are familiar, in their daily work, with the transmission of railway currents for distances up to six miles from the power station, and, in many instances, even farther away from the station than this. But until last month, when the Norwich-Taftville three-phase plant, described elsewhere in this issue, was put into operation, there were no special plants in this country for the long distance transmission of power for street railway uses. Although this branch of electrical research has, during the past decade, received a fair share of attention from electricians of the highest rank, little has been done in the line of practical construction. It was freely predicted by prominent engineers, five years ago, that in 1894 immense strides would have been made in utilizing a large amount of the horse power then, as now, running to waste in many rivers which flow near manufacturing districts. But these predictions have not been verified, though, it is true, a few plants have been installed in mining districts where fuel is expensive, and cheap and practically inexhaustible water powers are close at hand. The street railways are increasing consumers of power, and if any methods are to be developed to secure this at a lower rate than at present, the solution of the

problem possesses a vital interest for them. All engineers are looking forward with great interest to the results to be secured at Niagara. The advantages and defects, if such exist, of the long distance transmission of power can be studied in that plant on a large scale, and the success which will undoubtedly be attained at Niagara will be an encouragement to develop the powers at other points. In the meantime we must extend congratulations to the little plant at Norwich and Taftville upon being the first to enter the street railway field.

Excellent Records in Operating Expenses per Car Mile can often be made by skillful book-keeping, and in comparing the financial reports of street railway companies a knowledge of the system of accounting employed is necessary to a full understanding of the results secured. The operation of roads by electric power is of such late date that there are many expenses which experience has not yet shown us how to classify. Most roads are at present following individual elaborations of old horse car methods, which themselves were not more systematic than the needs of a relatively smaller business required. Fortunately street railway accountants are not obliged to work unaided in this field, for the classification of transportation accounts has been carefully studied by the steam railroad companies. One important element in systematizing the accounts of these roads has been the Interstate Commerce Commission. This commission, in prescribing the form for reports to it from railroad companies, adopted the general theory of classification decided upon at the Convention of State Railroad Commissioners at Saratoga, June, 1879. According to its latest report on classification just issued, this commission now recognizes four general divisions; maintenance of way and structures, maintenance of equipment, conducting transportation, and general expenses, these heads being altogether divided into fifty-three sub-accounts. Although the system of this commission has been frequently revised in the past, the commissioners feel that they have now evolved such a sufficiently complete system, that in their report just issued (to take effect July 1, 1894) they announce that there is no reason to expect changes in their standard of accounts for a considerable number of years. Another most important element in systematizing and simplifying this department of operation has been the Association of American Railway Accounting Officers, which includes among its members most of the auditors and many of the comptrollers and chief clerks of the principal railway lines. Much of the work accomplished by this association is equally pertinent to street railway affairs, and of great value from the fact that the ground covered by this association will not have to be gone over again by street railway accountants.

The Rights of the Bondholders of a company under reorganization have recently been clearly set forth by Messrs. Evarts, Choate & Beaman, of New York, in an opinion expressed by them on the rights of the holders of the second consolidated mortgage bonds of the Erie Railroad. The managers of the reorganization scheme for this railroad some time ago decided to issue a new series of consolidated bonds, and owners of outstanding prior bonds, according to the plan proposed were invited to deposit them, and receive new securities therefor. This is the common method of reorganizing companies, and to be successful, must be acquiesced in by the holders of outstanding bonds, which are prior liens on the property. Should any such holder object to the exchange, however, there seems to be no legal method of compelling acquiescence. In other words, the rights under any mortgage apply just as completely to the holder of a single bond as to the holders of the rest of the issue, and such person cannot be deprived of his rights without his consent, even though the success of the reorganization depends on the consent of all the bondholders to agree. In the case of most street railway companies, the value of the bonds depends principally on the income of the company, and not on the real estate or other property owned. For this reason, a common method of compelling the dissenting minority of bondholders to co-operate in a reorganization is to tire them out by ceasing to pay interest on the bonds for so long a time that they will come into the plan of reorganization. Of course, if any considerable number of bondholders should continue to refuse their assent to the conversion of their property, the purposes of the reorganization are defeated and the scheme will fall through. Commercial reasons, therefore, should dictate compliance with the conditions, and if the terms are fair the reorganization is generally successful. At the same time, the fact remains that by holding out persistently, an obstinate bondholder can sometimes secure much better terms than the majority, by compelling the latter to buy him out, or, as in the case with a number of bondholders in the reorganization of the Central Railroad, of New Jersey in 1887, can have their securities considered as part of the new bonded indebtedness by the reorganizing committee.

The Chronic Agitation of Rapid Transit, which has gone on for many years in the Massachusetts General Court, has continued with vigor during the present term of the Legislature. At the bottom of the whole discussion are the geographical features of the situation. In most cities there is a district containing the great retail stores, the hotels, depots, theatres, etc., that is the natural focus of street railway lines and riding. In Boston, Beacon Hill and the Common, on one side, and the Charles River and the Harbor, on the other, so reduce the general business area that this particular district is restricted to the narrowest limits. Its length is only one and a quarter miles, its maximum width is only 1,500 ft. and the minimum width is only 700 ft. The broadest streets are only sixty feet in width, and the narrowest are only ten. Within this section railway tracks are laid on forty-three streets. All told, there are sixteen miles of single track. No wonder there is congestion. The West End Company has done as much as any surface road can do to meet and overcome the difficulties in the case. Its equipment is all that money, expended by liberal intelligence, can buy, and its service all that experienced management can give. Unfortunately, however, the cars have not wings. They cannot fly. When they come from all parts of the vast system into the worm like lanes and narrow streets of this "congested district," they have to thread their way as best they can. In the meantime the Bostonion finds out that to be between Beacon Hill and the Harbor is much the same as being between the devil and the deep sea. Three remedies for the trouble have been suggested: To go through the air, to go under the ground, to go across the Common; that is, to have an

elevated road, or a subway, or a surface line across Beacon Hill, and the Common. The last scheme encounters sentiments and traditions whereof the mind and memory of the Boston man runneth not to the contrary. It has no prospect of success. The first two plans have been welded together in a bill just submitted by Mayor Matthews to the Committee on Rapid Transit. It provides that, under a commission, a subway shall be built under Tremont Street and the "congested district," and an elevated section, to be operated in connection with it, and to be extended to Charleston, in one direction, and to Franklin Park, in another. By the terms of this bill, the city is to build the subway and purchase the right of way for the elevated to Franklin Park, and also to build a bridge across the Charles River to Charleston. The subway is to contain four tracks, two to be leased to the surface road and two to be used by the elevated road. The elevated sections are to be built and operated for a term of years by a private corporation under competitive bids. The purpose of this measure is to unite rapid transit in the outlying district with relief to the crowded streets in the heart of the city. The principal protest, thus far, comes from persons doing business or owning property on Tremont Street, which, they contend, will be materially affected during the construction of the subway. Another scheme strongly urged has been the Meigs elevated. This system once obtained a charter, but it was heavily saddled with conditions that prevented the construction. The Boynton bicycle road has been vigorously presented. In the various discussions of the season the West End Company has taken little or no part. Its attitude is said to have been one of "inquiry and observation." Possibly their large experience with the difficulties of the case leads the directors and officials of this company to be silent and count the cost while others do the talking.

Oscar T. Crosby.

Oscar T. Crosby—one of the ablest and best known electrical engineers and business men of the country—has severed his connection with the General Electric Company, and will on May 1, as previously announced, enter into business with J. G. White, under the corporate name of the White-Crosby Company, a new corporation organized to continue the electric railway construction business built up by Mr. White under the firm name of J. G. White & Company. Mr. Crosby's prominence in street railway circles, and his connection with much which is now historical in the industry, warrants a somewhat extended review of his career. He was born in Louisiana, but his boyhood was spent chiefly in Brookhaven, Miss., from which state he was appointed to the United States Military Academy in 1878. He was graduated four years later, second in rank in a large class. On receiving his commission as an officer in the Engineer Corps, he was stationed at Willets Point, N. Y., and two years thereafter was sent to New Orleans, La., for river and harbor duty.

In May, 1887, he obtained a six months' leave of absence for the purpose of asssisting Mr. Sprague in important and original work in the field of electro-motive power. Becoming enthusiastic at results, he resigned his army commission, and joined the Sprague Electric Railway & Motor Company, originally assuming the duties of superintendent at the factory, from which position he was promoted to the general managership of the company, shortly before its absorption by the Edison Company. In 1890 he undertook, for the Weems Electric Railway Company, important experiments at Laurel, Md., on high speed electric railroading, and these experiments have attracted wide attention as conveying to engineers the only definite knowledge even yet obtained with respect to atmospheric train resistance at speeds of 180 miles per hour or more.

In 1891 Mr. Crosby was offered by the Edison General Electric Company the position of General Manager of its Southern department, and for several months he conducted its business in the South with marked success. He was then offered and ultimately accepted the position of General Manager of the Thomson-Houston Company's railway department with headquarters at Boston, and for the past two years has been the active head of the important railway interests of the Thomson-Houston and General Electric Companies. His influence in the engineering, manufacturing and business departments of these companies has been marked, and the extensive and varied interests of the General Electric Company have put him into close relations with the street railway managers of

OSCAR T. CROSBY.

the country. The value of his work as Chairman of the Committee on Standards of the American Street Railway Association for the past three years is universally recognized.

Mr. Crosby's official position in the Crosby-White Company will be that of chief engineer, instead of president, as originally intended, the change being made in consequence of certain independent technical work which he desires to undertake in connection with special electrical developments, and which will make it impossible for him to conform to the original plan, by which he was to undertake equally with Mr. White the details of the company's business management.

In an action by a city to enjoin a street railway company from constructing its railroad within its jurisdiction, it was decided in the Supreme Court of Pennsylvania, case of the City of Allegheny vs. Milvale E. & S. St. Ry. Co.:

1. That under Article 17 of the Constitution, providing that no street passenger railway shall be constructed within the limits of any city without the consent of such city, a city, as a condition to the grant of franchise to a street railway company, may impose a tax on the dividends to be earned, and fix the maximum rate of fare to be charged by the company.

2. As a city is authorized (Sec. 9, Art. 17 Const.) to impose conditions on its grant of a franchise, a company to which a franchise has been granted on its acceptance of certain conditions must accept all the conditions imposed before it acquires any right under the grant.

EDITORIAL CORRESPONDENCE.

NEW ORLEANS—PART II, GALVESTON, HOUSTON.

New Orleans—Part Two.

FRANCHISES AND LICENSES.

The present ordinances of the City of New Orleans require that all franchises for street railway shall be advertised for three months and sold to the highest bidder. Previous to this ordinance, however, nearly all the street railway companies were required to pay a certain sum into the city treasury as a compensation for the use of the streets. In the case of certain of the lines, preliminary to the introduction of electric traction, an extension of franchise for fifty years from the expiration of the original franchise has recently been sold at public auction, although the original franchise has not yet expired, so that because of the fact that some companies are operating under an old franchise and others under newer ones, there is considerable confusion regarding this subject. The lines controlled by the New Orleans Traction Company are now operated under a franchise secured at public auction, the grant giving an extension of fifty years from 1901 for the lines of the Crescent City Railroad Company, an extension for the same period for the New Orleans City & Lake Railroad Company from January, 1906. In the case of the latter company the ordinance provides that the amount paid to the city for the franchise shall be expended "for the purpose of inaugurating and securing an improved system of drainage and public permanent improvements for the city." A condition also provides that the city may take over the franchises and property of the company on the expiration of the grant on the payment of a certain sum, to be decided by arbitration.

FIG. 1.—BIRDS-EYE VIEW OF JACKSON SQUARE AND ST. LOUIS CATHEDRAL—NEW ORLEANS, LA.

New Orleans & Carrollton Railroad Company.

As early as 1833 the enterprise was inaugurated which has culminated in the splendidly equipped electric railway system which is now being operated by the above company, and which embraces about ten miles of double track construction. Although this is not at present the largest street railway system in the city, it is the only one as yet operated by electric power. The franchise of this company is one of the most valuable in the city, the tracks being located on one of the most desirable avenues, contiguous to a large population, and the system enjoys a liberal patronage, and the cars are run faster and on a shorter headway than any other line of equal length with which we are acquainted in the entire country.

On securing the permit for electric traction, the franchise of the company was extended for twenty-five years from 1908, for which the company paid the city $150,000, or rather agreed to expend that amount for paving one of the roadways on St. Charles Street with gravel.

The company is required to pay both city and state an annual license of about $2,000, which is based on the gross receipts, the maximum being limited to $2,500.

The line starts from Canal Street and continues along Baronne Street for a considerable distance, then turns to the left and enters St. Charles Avenue at Lee Circle and continues along the avenue which runs parallel to the river past the north line of the Audubon Park to Carrollton, where it turns into Carrollton Avenue and terminates in a loop through the car barn on Jeannette Street, six miles distant from the starting point. There are two branches, one on Jackson Avenue and the other on Napoleon Avenue, which terminate at the river, the cars starting from Canal Street, the power station being located at the head of Napoleon Avenue, near the levee.

The tracks, with the exception of the portion on Baronne Street and Jackson Avenue and the street connecting the latter with St. Charles Avenue, are located on a reservation or neutral ground, as it is here termed, in the middle of the street, where it is not subject to vehicular

traffic except at the crossings. St. Charles Avenue is 120 ft. wide between the property lines, and the neutral track is forty feet wide with roadways on each side thirty feet in width and sidewalks ten to fifteen feet wide. The roadways are paved with asphalt or Rosetta gravel, forming excellent carriage driveways. Napoleon Avenue is laid

FIG. 2.—INTERIOR OF PRESIDENT'S PRIVATE CAR—NEW ORLEANS & CARROLLTON RAILROAD.

out in about the same manner. On some portions of St. Charles Avenue are lines of shade trees, and the neutral ground is cultivated as a grass plot, with here and there an attempt at ornamentation with palms and shrubs. The avenue throughout its entire length is bordered by beautiful homes and public institutions, which are surrounded with green lawns and shaded by magnolias, live oaks, crape myrtles, orange trees and ornamented by palms (of which there are said to be fifty varieties), shrubs and flowers to an extent equaled by no other avenue that we have ever observed, making the ride over the route in the way of a combination of beauty, architecture, tropical plants, rare flowers, well kept lawns and sunny skies, beyond all question one of the most delightful to be found in the world.

TRACKS.

Although the electrical equipment of the system was understood to be first class in every particular, the track construction on the neutral ground has proved inadequate to the service imposed upon it, owing to the spongy condition of the soil. A forty-eight pound T rail is principally employed (except on Baronne Street and Jackson Avenue). This is spiked to the ties, which were laid in the soil without ballast, two feet centers. The heavy traffic in wet weather causes the ties to churn to a degree seldom experienced in street railway practice, making the track very rough and necessitating constant repairs. The trouble is being partially remedied by tamping the ties with cinders and gravel. In our opinion it will require a heavier rail and a gravel or stringer foundation to produce a durable track under the existing conditions. On Jackson Avenue the Duplex type of rail, weighing sixty pounds per yard, was employed, and the ties are laid on a gravel foundation. Notwithstanding this fact, the rail has failed to a greater degree than the T rail construction. On Baronne Street a seventy pound, six inch girder rail was employed, which rests on four inch chairs, and which is standing up reasonably well. The bonding consists of No. 0 galvanized copper wire, fastened with channel pins, and the track return is supplemented by an overhead return wire.

The overhead construction is supported on tubular center poles.

ROLLING STOCK.

Seventy closed cars with eighteen and a half foot bodies, and one vestibuled palace car, named "President," comprise the rolling stock. The cars are all manufactured by the St. Louis Car Company and are very handsome, being finished in mahogany and cherry with bamboo cushions and ornamental deck lights. They are mounted on McGuire and Brill trucks, there being sixty of the former, and all the trucks have a seven foot wheel base and thirty-six inch wheels, which are principally of Griffin's make or the New York Car Wheel Company's make.

The propelling equipment consists of No. 30 and

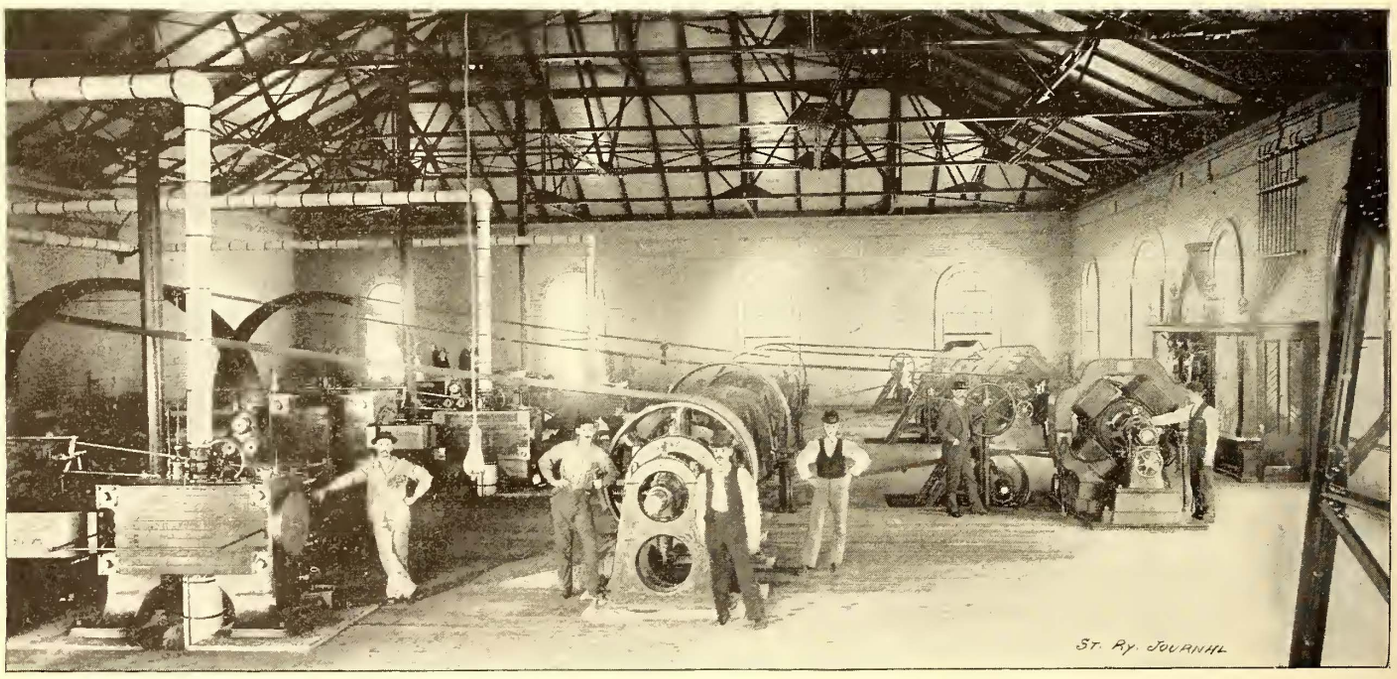


FIG. 3.—INTERIOR OF POWER STATION—NEW ORLEANS & CARROLLTON RAILROAD.

No. 50 General Electric motors of the W. P. type, each car having only one equipment, this being sufficient as there are no grades in the line.

POWER STATION.

As noted above, the station is located near the river at the head of Napoleon Avenue, and is practically at the center of the system, resulting in an economical use of feed wires. The station is of brick with steel truss roof support and slate roof. The boiler room is 110 × 60 ft., and the engine room 90 × 200 ft. There are three iron smokestacks. The steam equipment consists of four Babcock & Wilcox boilers which at 110 lbs. of steam pressure are rated at 125 H. P. each. These are arranged

in two batteries, but only one battery is required to operate the system. On special days when traffic is heavy, a steam pressure of 120 lbs. is carried. A Stilwell & Bierce feedwater heater with Worthington and Knowles pumps and Buffalo jet condenser complete the steam equipment. Each battery has a duplex set of water and steam pipes.

Pittsburgh soft coal, known as first pool, is employed, and is delivered on the levee, about 800 ft. from the station, direct from the mines, coming down the Ohio and Mississippi Rivers. From the barges the coal is transferred to the storage yard of the station on flat cars, and is brought into the engine room by hand barrows. Coal is measured by the barrel, which contains 180 lbs., and costs, at present prices, twenty-nine cents per barrel, or about $3.22 per ton of 2,000 lbs. The daily consumption is from 170 to 190 lbs. for operating fifty-seven cars, the average number daily run, an all-night service being maintained. The feedwater is obtained from artesian wells, of which there are three, two being 300 ft. in depth, and the other 800 ft. From the latter there is a natural flow, but in the others the water rises only to within twelve feet of the top. Water for condensing purposes is drawn by pumps from the river, and when the water is high it is syphoned over to the station, the water in the river being several feet above the street level. The water of condensation is discharged into the surface gutters and run in a direction away from the river.

Three Lane & Bodley tandem compound engines supply the power. These have eighteen foot, nineteen ton flywheels, from which the power is transmitted by belts to a countershaft, from which, in turn, it is led by belts to the three General Electric M. P., 200 K. W. generators. The engines are run at sixty-eight revolutions, and during part of the day all three are in service. Underside tightening pulleys are employed with the engine belts. The switchboard is provided with General Electric instruments, and General Electric lightning arresters are also employed. The average voltage carried is 525, and the current is led out over nine feed wires, the positive pole being connected with the trolley. The loss in the current at the extreme ends of the line is about 12 per cent. The station also furnishes current for lighting the car barn and office, and for an arc light at the starter's station near the head of Napoleon Avenue. The station in its appointments, equipment and management is a model in many respects.

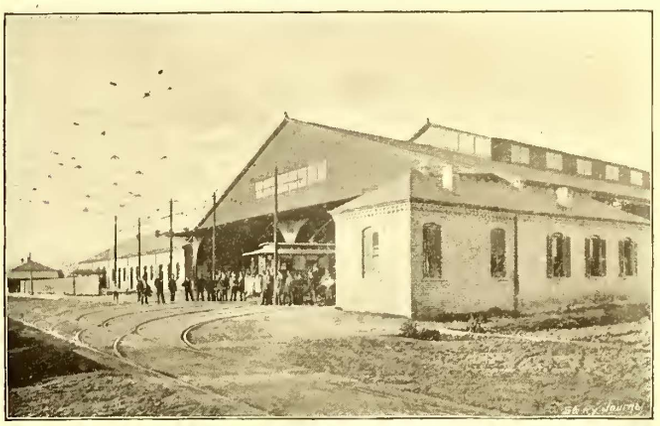


FIG. 4.—CAR HOUSE AND REPAIR SHOPS—NEW ORLEANS & CARROLLTON RAILROAD.

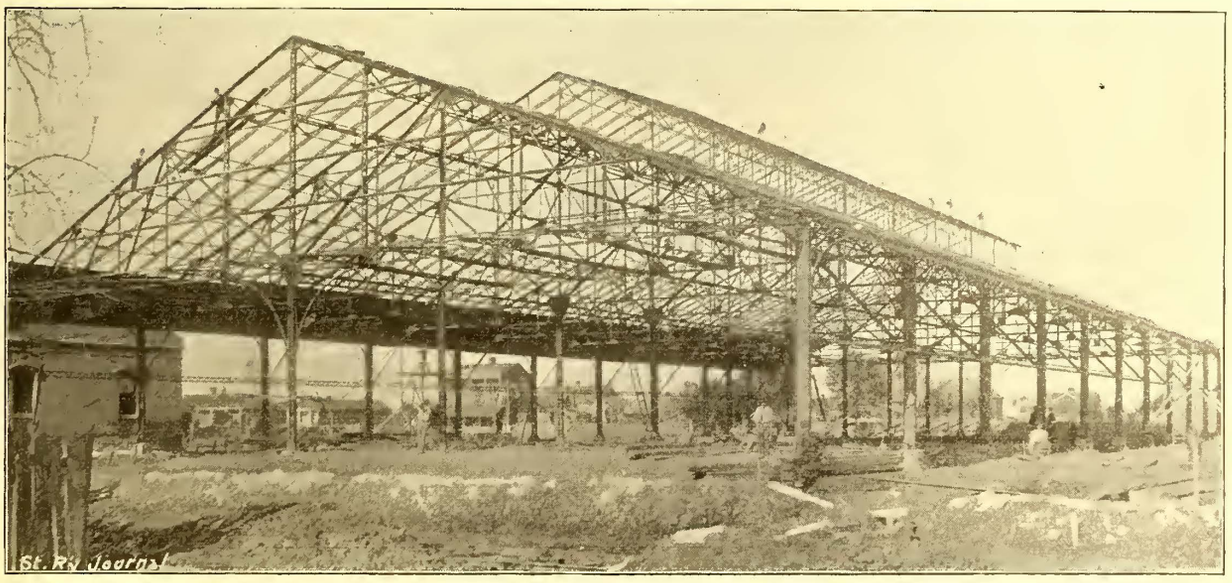


FIG. 5.—CAR HOUSE OF THE NEW ORLEANS & CARROLLTON RAILROAD IN PROCESS OF CONSTRUCTION.

CAR SHED AND OFFICES.

The car barn or shed and all of the buildings, except the power station, are located at the Carrollton end of the route, as before noted. The shed is a fireproof structure and covers a ground space of 265 × 128 ft. The framework is of steel with slate roof and corrugated iron sides which terminate ten feet above the ground, giving ample ventilation for warm weather, but too much exposure for cold weather. There are ten storage tracks, five of which are provided with pits, and there is one cross pit near the front end of the shed. There is no transfer table, both ends of the barn being provided with special track works to receive and discharge cars from each barn track. The pits are constructed with concrete walls designed to keep out the seepage water, but are not altogether successful in this respect. The cross pit, which is not as deep as the main pits, is kept reasonably dry.

There are two long, one story brick buildings located in the rear of the shed and at right angles to each end of it, in one of which are the offices of the company and in the other the repair shops and store rooms. The office building is 183 ft. in length and fifteen feet in width with a gallery or porch on the inside for the entire length, with doors and windows which provide for a free circulation of air, making them very comfortable in warm weather. The interior is finished in Georgia pine and divided into convenient offices with connecting doors. The receiver's office occupies the end next to the shed, and the others in order are for the secretary, directors, superintendent and electrician; there is also a store room and toilet room.

The shop building is 175 ft. in length and forty-two feet wide for a distance of 100 ft., and enlarged to sixty-two feet for the balance of its length. The chief electrician or master mechanic's office is next to the car shed, and in turn come a store room, winding room, iron repair shop, wood working department, erecting shop, paint shop. The power for operating the tools is furnished by a fifteen horse power stationary motor which occupies a

small fireproof vault near one end of the building, and from which the power is transmitted by belt to an eighty-four foot shaft which connects with the repair shops.

The iron tool equipment consists of one sixteen and one twenty-four inch lathe, a five foot planer, a drill press, a ten ton wheel press, together with emery wheels and other small tools.

In the wood working department there is a moulding machine, a pony planer, one circular saw and one band saw and one wood lathe. The blacksmith shop occupies an iron building located in the yard between the repair shop and office building.

CHRIS. V. HAILE,

GENERAL MANAGER AND SUPERINTENDENT NEW ORLEANS & CARROLLTON RAILROAD.

WALTER V. CROUCH,

SECRETARY AND TREASURER NEW ORLEANS & CARROLLTON RAILROAD.

All motor repairs are made in the company's shops, including making of new commutators. For this purpose forged or cast bars are purchased, and in the process of setting up the bars and mica insulation are pressed firmly together by means of a stout iron ring which is forced over the commutator with a pressure of twenty-five tons by means of the wheel press. In the most recent construction of commutators cast bars are employed, which are made by a firm in New Orleans, and which are warranted to outlast two sets of drop forged bars.

The repair shop is very complete in all its appointments, and seems to be well managed. The scrap heap of gears, wheels and motor parts is the smallest that we have ever found for a road that has been operated for the same length of time.

In the large yard bounded by the shed and brick buildings, are several out buildings, including an elevated water tank with a capacity of 20,000 gals., from which the water is drawn for washing cars and other purposes. The base of the tower, which supports the tank, is occupied as an oil and waste room.

The water supply is obtained from an artesian well located in the yard, and which is bored to a depth of 800 ft., in which the water rises by natural pressure through an extension of the tubing about ten feet above the surface of the ground. The water is forced into the storage tank by means of an hydraulic ram located in a basin at the foot of the stand pipe, to which the water is led by a vertical pipe tapped into the top of the stand pipe.

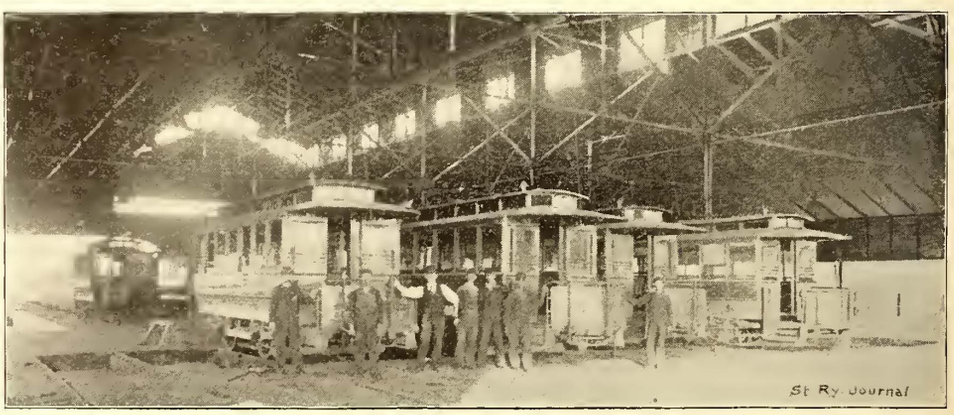


FIG. 6.—INTERIOR OF CAR HOUSE—NEW ORLEANS & CARROLLTON RAILROAD.

EMPLOYES AND FARES.

The regular car men number 160, and there are eighty-nine on the extra list. The power station force numbers fourteen, including chief engineer and assistants. The number of shop men is twenty-eight, including master mechanic, inspectors and laborers. There are twenty track hands, including foremen, and five line men. The starters, transfer agents and barn men number nine, and there are five office clerks besides the regular officers.

Motormen and conductors receive $50 a month, the master mechanic and chief engineer, $125 per month, laborers in repair shops from $40 to $75. track men (all colored), $1.25 per day. The fare is five cents, with transfers at Jackson and Napoleon Avenues, for which different colored tickets are provided at each station, and colors changed every day. The transfer tickets are issued by agents.

Policemen and employes ride on their badges, the latter as per the following rule which is copied from the rule book: "No. 12. Conductors and motormen will be allowed to ride free of fare when off duty, provided they are in uniform, and providing they render all assistance in their power in case of accident or trouble of any kind that may occur when they are on or near the car, and providing they are going to and from their work." City officials ard provided with a book of coupon passes.

The conductors and motormen are provided with a book of rules, which includes a folder containing a diagram of the entire route and branches, with all the cross streets named in their order.

Owing to the high speed allowed (15 miles an hour), but which is frequently exceeded, the cars make an unusual mileage, the average being 131 miles a day, while some make as high as 140 miles. The average for the month of September last was 131, and the receipts per car per day for the same month were $20.98; expenses per car, $11.58; receipts per car mile, 16.2 cts.; expenses per car mile, 8.11 cts. The headway on the Carrollton end is two and a half minutes, that on Napoleon Avenue four and a half minutes, Jackson Avenue three minutes. These cars con-

verge on St. Charles Street, on which the headway is one minute and less.

The coal consumption for the month of December, 1893, for operating an average of fifty-nine cars was $2.66 per hour, $64.92 per day, and $2,012.52 per month. The total power house expense for the month of December, including coal, oil and service, was $2,925. 52.

The conductors and motormen are employed and discharged by the president of the company. Until recently this duty was performed by a committee of officers; neither practice, in our opinion, conduces to good discipline.

It is proposed to extend the lines of the company in both directions in the near future; one extension will be on Canal Street to the river, and the other from the present terminus on a new avenue parallel with the river, a distance of 2,000 ft. This avenue is 180 ft. wide, with a neutral street ninety feet in width and thirty foot roadways.

A. Langstaff Johnson, of Richmond, was the chief engineer of the original electric construction.

HISTORY.

This is the pioneer street railway line in the city, having been organized in 1833, but not put in operation until 1834, only three years after the building of the Fourth Avenue New York Line, which was the first street railway proper in the world. The first section of the New Orleans & Carrollton Railroad open for traffic extended from Canal Street on St. Charles Avenue to the corner of Jackson Avenue, and the rolling stock consisted of double deck cars which were drawn by two horses driven tandem. In 1835 the road was extended to Carrollton, and in 1845 and 1846 the company operated a steam road over the same route from Lee's Circle to Carrollton, and from there to Lake Pontchartrain. The extension from Carrollton to the lake was abandoned after the war. In 1866 General Beauregard, then president of the company, invented an overhead cable system, and built an experimental line around two or three blocks opposite to what is now Audubon Park. In this experiment the rope was supported above the car on bracket poles, and was driven by two old locomotives placed at each end of the route. The grip was located on the roof of the car, and operated by means of levers from the front platform. The experiment, proving too expensive, was soon abandoned, although it served to identify the inventor as a pioneer in cable traction. Later General Beauregard became interested with Dr. E. Lamm in the development of ammonia motors, and soon after an attempt was made to operate a portion of the line with these motors. A printed prospectus was issued regarding this system, of which the following is a partial copy.

"Thermo-Specific Engine.

"Dr. E. Lamm, President of the Ammonia & Thermo-Specific Propelling Company, of America.

Estimate.

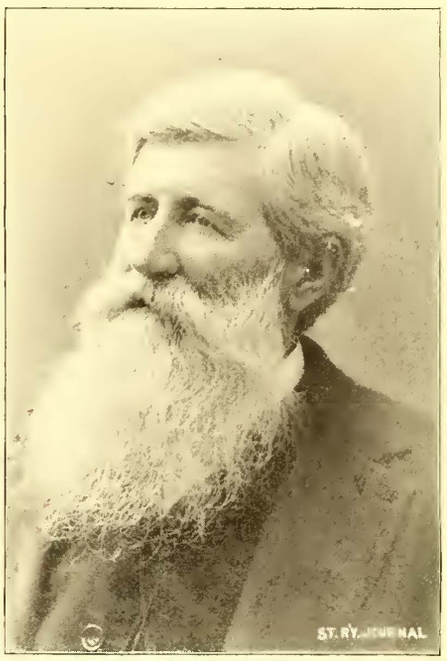
"Total cost of fifteen motors and machinery, $21,728.75. Total running expense of fifteen cars per year, $10,757.55; daily expense for fifteen cars, $29.47; daily expense for each car, $1.96. Emile Lamm, superintendent, G. T. Beauregard, president. Difference in cost per day in favor of new system, $3.13½; economy per annum $14,671.80."

During the experiment the inventor having discovered that the motor could be operated by stored steam, the ammonia experiment was abandoned and the motors were operated for a time with stored steam, primary boilers being erected at the main station. In 1889 the motors were provided with small furnaces and converted into regular steam dummies. Four years ago the dummy system was abandoned and the line operated by mule power until the introduction of electric power on February 9, 1893. The introduction of electricity was accomplished only after a prolonged effort and in the face of many difficulties. Soon after the opening of the Richmond electric road in 1888 the superintendent recommended the introduction of electric power, and the directors adopted the idea. It was not accomplished, however, until a committee of citizens, under the leadership of A. L. Abbott, undertook the work of securing the permits from the city authorities.

OFFICERS.

The system at present is under the management of Jos. Lennes, president, Walter V. Crouch, secretary, and Chris. V. Haile, superintendent. Mr. Lennes has recently succeeded to the presidency, following the resignation of John Numa Avegno. Mr. Crouch has been secretary and treasurer since 1877, and Mr. Haile entered the service of the company in 1872.

J. H. DE GRANGE,
SECRETARY CANAL & CLAIBORNE RAILROAD CO.



E. J. HART,
PRESIDENT CANAL & CLAIBORNE RAILROAD CO.

It will be noted from the above that this company was not only the pioneer street railway company in the city, but that it has always been in the front rank of experimenters for the development of electrical traction.

Canal & Claiborne Railroad Company.

The lines of this company run in a direction generally away from the river, while the lines of most of the other systems are on streets running parallel with the river. The two divisions of the system center on Canal Street, but diverge and penetrate the territory to the right and left of this street, passing through a thickly settled portion of the city, that to the right being mostly through what is known as the French quarter. The route is principally on neutral ground, and for a considerable distance on Claiborne Street there are two neutral strips, each shaded by a double line of live oaks. One of the drainage canals of the city is also on this route and lies between the neutral strips.

One of the most interesting features of the system is the economy which has been practised in track construction, the tram rails of which it is composed having been used in three positions, materially prolonging the life of the rail. On the neutral ground the rails, after being worn down in the ordinary position with the tram on the inside, were turned around and operated over in the new position until the outside of the head was worn down,

when the rails were taken up and set edgeways in iron chairs, which were cast with a groove to receive the fillet on the underside edge of the flange. The chairs were then slid into position from the end of the rail, and the rail being in position became virtually a girder rail, which made a better track than in either of the other positions. On the neutral ground two twelve inch planks are laid on the surface between the rails to provide a footing for the animals, but for a short distance each side of the crossings a cobble paving is provided to give a good foothold in starting. Only fourteen foot cars are operated, as noted in the previous article, but the headway is comparatively short, being five minutes during the principal portion of the day, and a very acceptable service is maintained.

The journal box employed on all the cars but one was invented and patented by the superintendent, Jos. H. De Grange, and is virtually a dustproof device which requires oiling only once in three or four months.

The average number of cars run is thirty-two, and the average daily distance traveled by each car is eighty miles. The live stock consists of 210 mules which are housed in two stables, one located at the terminus of one line on Lafayette Avenue, and the other on Tulane Avenue at the terminus of the second division. At the former station 120 animals are housed, and about ninety at the Tulane Avenue station. The stable and car house at the Lafayette Avenue station consists of long, story and a half, wooden buildings with slate roofs. There are also extensive sheds and yards into which the animals are turned at night in warm weather. The stalls of the stables are wide, have plank floors, and are kept in an exceptionally clean condition, no bedding being provided for the animals. An automatic hitching device is provided for each runway, so that in case of fire all the animals can be turned loose at once. Mules weighing about 1,100 lbs., and fifteen hands high, are generally employed, and their average life is five years. The daily mileage is from fifteen to eighteen, and in the stable economy each hostler grooms fifteen animals. The feed consists of Texas prairie hay, costing $12.25 per ton. This is cut and fed dry, but mixed with cracked corn and oats, the daily ration being ten pounds of hay, seven pounds of corn and seven pounds of oats, the proportion being varied in winter weather. Before the hay is cut, each bale is carefully weighed, as is also the grain, and the records returned to the company's office. A six horse power steam engine is employed for cutting the hay and grinding the corn. The hay cutter is provided with an endless chain elevator. The manure is sold for $80 per year.

The roofing of the stables is all steel, and every precaution is taken against fire, there being a number of water tanks in convenient positions and also Babcock fire extinguishers.

At the starter's stand is provided a time table, and near by a watchman's clock, on which the night watchman records his rounds.

The car repair shops of the system are located at the Tulane Avenue station, where are also the blacksmith's shop, harness shop and store room. Old cars are repaired, in some cases making them practically new, the posts and wood being purchased from the wood working mills.

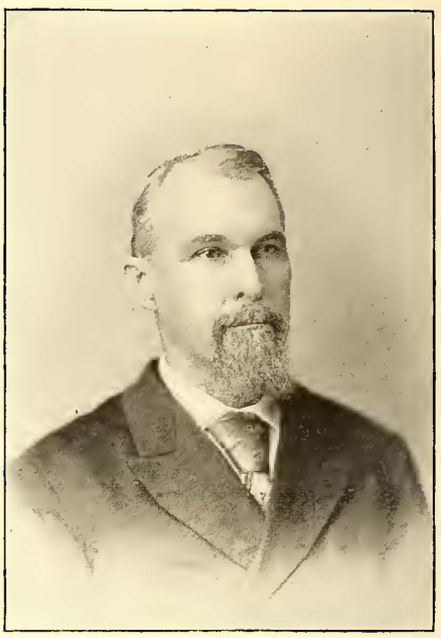
The financial and operating affairs of the company are controlled by E. J. Hart, president, and Joseph H. De Grange, who is secretary, general manager and superintendent, giving each department his personal attention. Mr. Hart is nearly eighty years old and apparently hale and hearty, and has been connected with the company a good many years, and president for twenty-five years, being one of the oldest street railway presidents in the country.

In the office duties the superintendent is assisted by his son. Mr. De Grange is prominently identified with the public affairs of the city, being president of the Board of Fire Commissioners and director of several financial institutions.

Although this is a comparatively small system, embracing only about thirteen miles of track, it is operated in an economical manner and apparently with good returns on the investment. The advisability of changing to electric traction is being discussed, and probably active measures will be taken looking to this end as soon as the lines of the Traction Company are put in operation electrically.

St. Charles Street Railroad Company.

This was the third street railway company to be organized in the city, following that of the New Orleans City Railroad Company, the charter having been obtained in 1865. W. H. McLellan was made president September 7, 1865, and the lines were put in operation in September, 1866. Alden McLellan, the present president, succeeded his father in 1871, having been secretary of the company from its organization. The present secretary is N. Riviere, who has also been for a long time in the employ of the company. The system is operated in three lines and embraces about twelve miles. The lines are nearly parallel to those of the other principal systems, but occupy the inside streets of the city or the streets farthest away from the river. The track construction is a side bearing, forty pound tram rail laid on stringers, and is maintained in excellent condition, being in this respect superior to any other line in the city.



ALDEN M'LELLAN,
PRESIDENT ST. CHARLES STREET RAILWAY CO.

N. REVIERE,
SECRETARY ST. CHARLES STREET RAILWAY CO.

In the original construction an English iron rail was employed, which cost $108 per ton. Stephenson cars only are employed, the company never having bought a car from any other builder. The sixteen foot bobtail cars in 1867 cost, f. o. b. New York, $1,211.96; this sum included the manufacturer's bill of $760 and premium on gold, which was then 51⅞, and the government tax of 5 per cent; to this should be added $100 for freight, all cars being boxed and shipped on sailing vessels. The line is noted as never having issued a pass nor a ticket. In regard to this matter the following rule is in force:

"No passenger, whether employe, director or other individual is to be permitted to pass over the road without

depositing fare, except the following named, who will be allowed to ride free: Firemen in uniform, going to fires; policemen (not to exceed one at a time) in uniform, on platform only; sisters of charity, not to exceed three at a time; the curve greaser of this company, when on duty with can and brooms."

The original incorporators of the company consisted of four persons who invested sufficient capital to build the road, and no stock was issued until the line was in operation. The present amount of capital stock is $1,000,000, and there are $105,000 of bonds outstanding. The conditions of the original franchise required the payment into the city treasury of nine sixteenths of a cent for each passenger carried. This the company found to be too large and it was afterwards reduced to one-eighth of a cent per passenger. In 1881, however, the franchise was extended for twenty-five years on the payment into the city treasury of $300,000 in cash. The conditions of the franchise require an annual license of $1,000, which is based on a certain amount of gross receipts. In the assessment for taxes the franchise is valued at $1,000,000. The company is also required to plank the streets between the rails and tracks and keep them in repair from curb to curb.

An application is now before the City Council for permission to adopt mechanical traction, and this will doubtless be secured. In this application no extension of the franchise is asked.

The average number of cars operated at present is fifty-four; two cars are run all night at intervals of sixty minutes, on which the fare after 12 o'clock is ten cents; the receipts on the owl cars, however, do not pay the expense of operation. The number of animals required for operating the system is 272, most of them being mules.

Drivers are paid $1.65 for twelve hours' work The drivers are required to carry $15 in change, which they purchase from the starters at either end of the route; the change is mostly nickels, and is put up in $1, 50 and 25 cent packets. For this purpose small envelopes are provided of different colored paper for the different amounts. The company claims to be the first street railway company in the city, if not in the country, to employ change envelopes, having been first used in 1866. The envelopes, as in the early days, were made in the company's office.

The secretary, with two assistants, acts as receiver and bookkeeper, and counts all the money received. The nickels, which are to be returned to the drivers in change, are first counted in dollar piles and placed in wooden trays or boxes having removable partitions, five piles of $5 occupying each position of the tray, and the tray holds $50. These are then passed to an assistant, a young man, who puts them up in envelopes, and at which he has become very expert. First he takes the dollar piles from the trays and places them upon the table with one nickel overlapping another, or in such position as they would assume by turning over the pile. He then takes up the envelope with the left hand and five nickels with the right, places them across the envelope, folds them over once and lays it on the table with others in parallel rows in such a position that the flaps can be moistened with a brush. He then seals two rows at a time, one with each hand, by closing the flap of the envelope. The packets are then tied in bundles of $50. The whole operation of taking the nickels from the trays and putting $50 in twenty-five cent packets, counting and tying the packets in bundles of $5 each, being completed in from ten to twelve minutes. From $800 to $1,200 of nickels are put up in this manner each day. The nickels that are to be deposited in the bank are first wrapped in $1 rolls, then put up in square packets of $50 each. In forming these bundles a three side wooden frame is employed, into which the wrapping paper, cut of a suitable shape and size, is first placed, then the packets are put in the frame, when the wrapper is fitted over and tied, making a neat, compact and convenient bundle.

The office and stables are located at the corner of Carondelet and 8th Streets, where the company owns two entire blocks, giving ample yard room for the stock and for other purposes. The buildings are chiefly of wood, one story or a story and a half in height, and are conveniently arranged. The stable proper, including the feed and care of the animals, is about the same as described for the Canal & Claiborne Railroad.

The water for the animals is obtained from an artesian well 800 ft. in depth, and is said to be medicinal in its effect, keeping the animals in excellent health; the condition of the animals bears evidence of this fact, and also that great care is exercised in the feeding and treatment.

The artesian wells of which we have spoken, in connection with the different street railway lines of the city, are usually from 700 to 800 ft. in depth and for the entire depth are said to be through an alluvial deposit until a bed of gravel is reached. In drilling some of these wells, logs of palm wood were encountered at great depths and there were other evidences that the entire region to a considerable depth had been formed from ancient flood deposits.

Orleans Railroad Company.

The lines of this company embrace ten miles of track, which are operated in four divisions, the longest run being five miles. They occupy an inside district of the city and connect with the city park and race tracks. A. Cassard, is president and P. Cougot, secretary. Twenty-one cars are regularly operated and the live stock consists of 155 animals, mostly horses, and the cars were built by Stephenson. Northern hay, costing $14 to $15 a ton, is employed for feeding. This is fed long with oats and corn, the latter being ground. The daily ration is fifteen pounds of grain and as much hay as animals will eat. The lines were built in 1867, and the franchise was extended for twenty-five years in 1887. Twenty-one regular drivers are employed and thirty men on the extra list. Drivers receive $50 per month. One of the cars is provided with a two blade propeller fan, located near the ceiling for the purpose of producing a circulation of air through the car. This fan is actuated by a belt from the front axle, which is lead up the front end of the car to a jackshaft, which passes through the end of the car and from which power is transmitted by a sprocket chain to the operating shaft, which extends along the ceiling to the middle of the car, where it is connected with the fan by means of beveled gear. We were not informed with what success this device was operated.

The switches on the lines of this company are operated by crank levers, which are located in a small house beside the track.

Nothing is being done regarding the introduction of electric traction on these lines.

Algiers & Gretna Railway Company.

The offices of this company are at the foot of Canal Street, New Orleans, but the line is located in Algiers, on the opposite side of the Mississippi River, and runs to Gretna, a distance of three and theee-quarters miles, where it connects with Jackson Street Ferry. Algiers has a population of about 8,000 and Gretna a population of 800. The towns skirt the river, and are protected by levees the same as New Orleans. There are extensive wharves which provide a landing for river and ocean steamers, and a considerable shipping business is conducted.

The street railway track is a narrow (three foot) gauge. Only four cars are run, and three are drawn by a single horse, and have fare boxes and fare conveyors. The stock consists of twenty horses, no mules being employed.

Drivers are paid $45 per month. The railway line is operated by the same company which controls the ferry privileges, and in connection with which nine steam ferry boats are employed, which are operated over six routes.

A. M. Halliday is president and general manager of the company and superintendent of the ferries; Capt. Thomas Pickles is vice-president, and Wm. Nagle, secretary.

Louisiana Electric Light Company.

The fact that this company is to furnish power to operate the lines of the New Orleans Traction Company

brings its operations into the street railway field, and makes it of interest in connection with these notes. The plant of this company is one of the largest lighting plants in the country, the total capacity being 2,000 arc lights and 21,000 incandescent, so that the city is one of the best lighted in the South, if not in the whole country.

FIG. 7.—EXTERIOR OF STATION—LOUISIANA ELECTRIC LIGHT CO.

The station is located near the river, on South Peters Street, between Richards and Market Streets, and consists of a two story brick building, the ground dimensions of which are 320 × 130 ft. The building is divided lengthwise by a brick partition, and the boiler plant occupies the side next to the river.

Water for condensing purposes is drawn from the river, but for feedwater it is taken from artesian wells.

The boilers are of the return tubular type, twenty-six of them being 72 ins. × 17 ft., and ten of them, 60 ins. × 16 ft., and were manufactured by the Bass Foundry & Machine Company, of Fort Wayne, Ind. A steam pressure of 110 lbs. is carried, and Alabama coal is employed as fuel; there are eight iron smokestacks, ninety feet in height, and sixty inches in diameter.

The total engine capacity is 6,000 H P., and is divided between four engines, two of them being cross compound, condensing Hamilton-Corliss engines, of 1,800 H. P. each, and the third a 1,200 H. P., cross compound, condensing engine, and one single cylinder engine which is also run condensing, and which was manufactured by the E. P. Allis Company, of Milwaukee. The latter engine was exhibited at the New Orleans Exposition in 1884. The flywheels of the large engines are twenty-eight feet in diameter, and weigh 110,000 lbs. The governors of these engines are run by sprocket chains instead of belts, as a precaution against slipping. The power is transmitted to the main shaft by means of a three-ply belt, six feet in width, the speed of which is 5,200 ft. a minute. The belt leads under a tightener which causes it to wrap the flywheel almost entirely around. The large engines are located at the extreme end of the station, and are belted direct to a main shaft which is 283 ft. in length. A second shaft on the opposite side of the building is also provided, which is 180 ft. in length, the shafts being belted together, and so arranged and equipped with clutches that either shaft may be driven from either engine, the clutches being of the Cuyahoga Falls and Beliot types. The belting was manufactured by Munson, Schieren and the Chicago Belting Company.

The lighting generators are located on the second floor, and consist of thirty-six sixty light wood machines, manufactured by the Fort Wayne Electric Company, and ten 1,200 light and three 3,000 light incandescent machines of the Slattery type, manufactured by the same company. There are also nine power generators of 500 H. P. Four new generators of the General Electric M. P. type are being installed for the railway work. These are located on the first floor, and two of them will be driven from one of the large engines by means of a jackshaft and clutches; an additional engine equipment of 3,000 H. P. will also be installed. Two of these new generators are of 200 K. W. capacity and two of 500. The installment has to be completed by June 1. The lighting circuit employs over 500 miles of wire, which is carried on 5,000 poles, the longest arc circuit being twenty miles. The service is so good and well managed that all the lights out will not average over 200 or 300 hours a month.

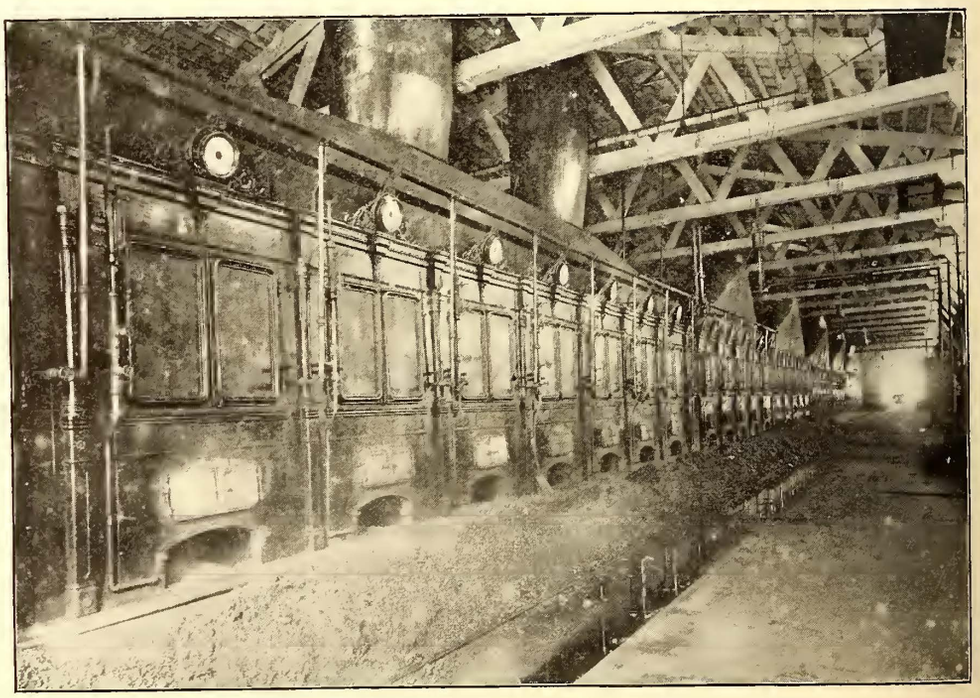


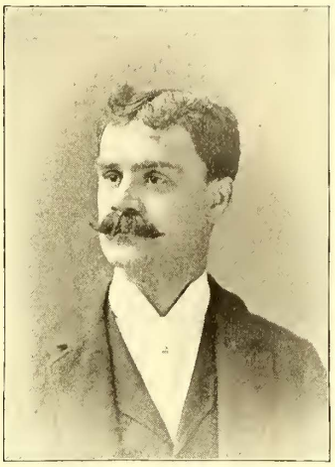
FIG. 8.—INTERIOR OF BOILER ROOM—LOUISIANA ELECTRIC LIGHT CO.

In connection with the generators there is a small air pump operated by a one horse power motor, by which air

is pumped into a receiver, from which pipes lead to different parts of the building, to which rubber hose can be attached for the purpose of blowing the copper dust out of the generators. About fifty feet of armored hose is employed, and the generators are cleaned once a day.

W. H. M'GRATH,

DESIGNER LOUISIANA ELECTRIC LIGHT PLANT.



W. H. HARDING,

GENERAL MANAGER LOUISIANA ELECTRIC LIGHT CO.

There are three switchboards, one for the incandescent, one for the arc and one for the power circuits. The incandescent lighting board is provided with revolving switches, as shown in Fig. 9.

In the office of the company and also in the engineer's office at the station a large blue print map of the city is

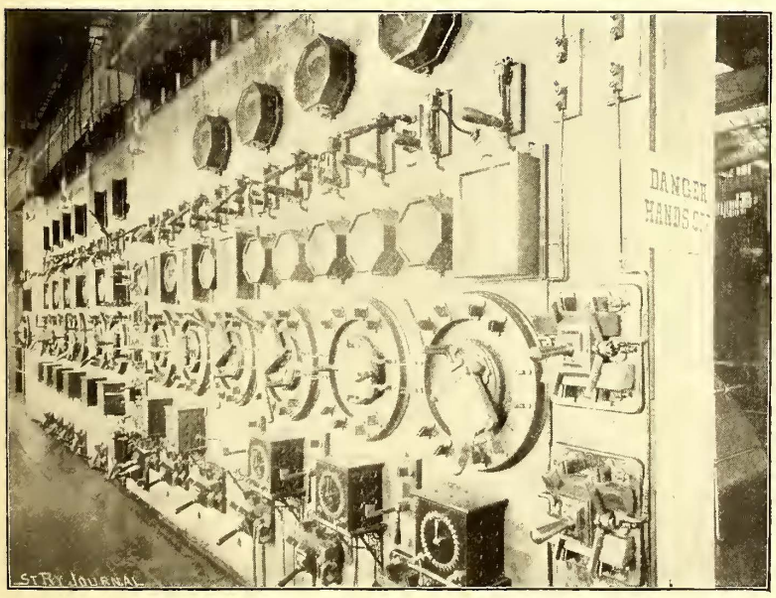


FIG. 9.—SWITCHBOARD—LOUISIANA ELECTRIC LIGHT CO.

provided, on which all the arc lights are located by means of head thump tacks or upholsterer's tacks, which are placed in position and numbered. The city is also divided into sections, so that the trimmers of each section can be located.

The affairs of the company are managed by the following officers: Brainard Rorison, president; Jos. Simon, vice-president; August Salaun, secretary and treasurer; Maurice J. Hart, general manager; W. H. Harding, general superintendent.

In the enlarging and construction of this plant, which was done about four years ago, very difficult engineering problems were met with. The soil being treacherous, a peculiar method of forming a foundation was resorted to. It being found by experiment that there was a layer of quicksand about three inches below the surface and that the formation was less and less dense as the depth increased, it was decided that the ordinary pile foundation would not answer for a support to the engine beds, consequently the surface was excavated to a depth of about three feet for about thirty feet square, when a foundation of four inch cypress planks in the layers pinned together was formed, the plank of each layer being laid in an opposite direction; upon this was placed a concrete bed of six inches in depth, and upon this the brick work for the engine frames, the foundation being so arranged that the principal weight of the machinery came in the center. After nearly four years of service the foundations are in perfect condition, showing that the construction was well planned.

The two M. P. 200 power generators will be run from one pulley, and will be direct driven from countershaft.

Texas and Some of Her Cities.

We left New Orleans on the morning of April 4, via the Southern Pacific Railroad, known as the Sunset Route, for Galveston and other Texas cities. The first day's ride brought us to Houston, where the night was passed. The next day a side trip was made to Galveston, after which by the same rail system Fort Worth was reached, then by the Texas & Pacific Railway Dallas and Texarkana.

On leaving New Orleans the river to Algiers is crossed via a steam ferry, and the traveler is landed beside the train which, should he wish, would take him to Portland, Ore. It was our privilege on another occasion to make a trip over one of the Western divisions of this system through the State of California, and it is in justice to the managers of the Southern Pacific Company to say that in all our travels we have never found a railway line seemingly better managed, or where the comfort of the passengers is more carefully studied, than by the employes of this extensive system.

The through trains are generally provided with buffet or sleeping cars, and even across the plains the eating stations are conveniently arranged, and in all cases a first class meal is provided at a very reasonable price. The roadbed is kept in exceptionally good condition, and in making a trip over the system one is treated to the greatest variety of scenery.

The route from New Orleans to Houston is exceptionally interesting, from the fact that it takes the traveler through the principal sugar region of Louisiana, and gives a fine opportunity for studying the method of cultivating and harvesting the cane and refining the products for market. One sees the typical Southern plantation home, surrounded by groups of negro quarters and shaded by magnificent magnolias and pecan trees. The plantations are seemingly boundless in extent, perfectly level, while the soil is black and apparently of wonderful fertility.

On approaching the Texas border, and for the remainder of the route to Houston, the line is through the most extensive rice fields to be found in the country, and the crop is cultivated very much as is the wheat crop in the North, the seed being sown broadcast and the crop harvested by reapers and threshing machines in almost the some manner as grain crops. The sluices and provisions for flooding the rice fields during the growing season are all interesting features of farming, which gives to the tourist visiting this region for the first time no end of entertainment.

We are accustomed to hear that Texas is the largest state in the Union, but this gives us little idea of its vast extent. It reaches, from north to south, a distance of 750 miles, and from east to west, 810 miles, and comprises 274,356 square miles, or 175,527,840 acres. Its vast area is better comprehended by comparing it with other sections of our country; for instance, it is 100,000 square miles larger than all of the Eastern and Middle States, including Delaware and Maryland, and more than six times as large as the state of New York.

The natural advantages of the state are unsurpassed, but there is no space to speak of her timber, mineral and agricultural resources. There are millions of acres of her

soil under a high state of cultivation, and millions more are awaiting the coming of enterprising and industrious settlers. All these conditions should be understood to obtain a correct idea of the state and its cities, and why they furnish such an excellent field for the growth and development of the street railway industry.

Galveston.

Galveston, now a city of about 50,000 inhabitants, is located on the extreme eastern end of Galveston Island, and contains in its area about six square miles.

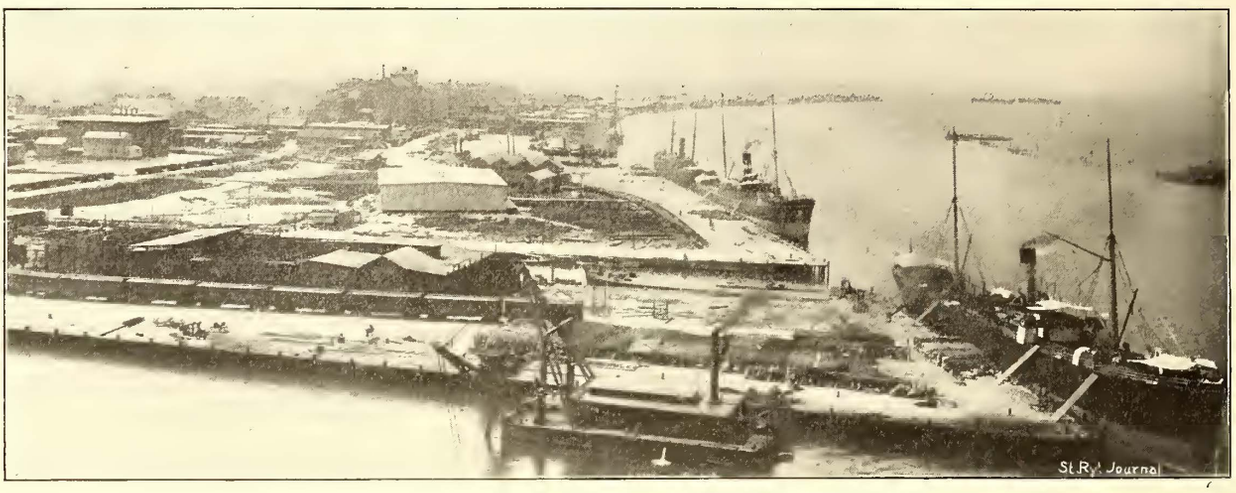


FIG. 10.—VIEW OF THE WHARVES—GALVESTON, TEX.

Galveston Island, which is composed of sea sand, is about thirty miles long and has an average width of two and one-half miles, with an elevation, where the city is located, above mean low water of from three to nine feet, but at a distance the city seems to rest on the water. The business portion of the city is only about one mile wide. The island is situated in the Gulf of Mexico off the southeastern border of the state, from which it is separated by Galveston Bay, which is about two and one-half miles in width. Access is had to the island from the main land by means of two railway bridges and a wagon bridge, which are located near together some distance west of the city. The railway bridges are supported on piles, while the wagon bridge is of steel with substantial stone piers, and is said to be the longest wagon bridge in the world. Each of the bridges is provided with draws for the passage of vessels. The bay is bounded by the island, and on the east by a spit, twenty miles long, known as Bolivar Peninsula. The channel through which connection is had with the gulf is between the east end of the island and the west end of the peninsula, and was formerly obstructed by an inner and outer bar, with not more than nine feet of water, but this has been deepened by means of jetties, which when completed are expected to give thirty feet of water at mean low tide. An appropriation of $6,200,000 has been made by the government for the completion of the jetties, and work has progressed until the wall of the south jetty has been completed, and that of the north is now out about five miles, but will be extended a mile or two farther. The contract for these improvements provides that there should be two parallel stone jetties about 7,000 ft. apart, extending about six miles into the gulf. These are constructed of sandstone riprap, which is faced with granite blocks weighing from five to ten tons each. The jetties are fifty feet wide at the bottom, and slant gradually to five feet above mean low tide and are thirty-five feet wide on the top, with a railway track running the entire distance. Galveston Harbor is from thirty to fifty feet deep, and of ample area to float the fleets of the world. Along the bay front of the city there are extensive wharves, all first class and equipped with all modern conveniences for loading and unloading vessels, including a grain elevator with convenience for unloading 200 cars of grain per day, and of loading four ships at one time at the rate of 80,000 bhls. per hour. Should the thirty foot channel be obtained on the completion of the jetties, Galveston will doubtless become the principal shipping port for the products of what is known as the Central Northwest, and the port of entry for foreign vessels from which goods consigned to China and Japan can be shipped to the Pacific coast over the line of the Southern Pacific system. This company, anticipating such a result, has recently constructed extensive wharves extending out two miles or more from the shore at Santa Monica, near Los Angeles, Cal., from which goods will be re-shipped to vessels sailing the Pacific ocean. Time will doubtless see Galveston one of the largest cities of the Gulf coast. It is already an important port of entry for fruit vessels from the West Indies and South American ports, from which the cargoes are shipped by special trains to Chicago and other Northern cities. Wheat, flour and other products in turn are exported to the West Indies and South American ports.

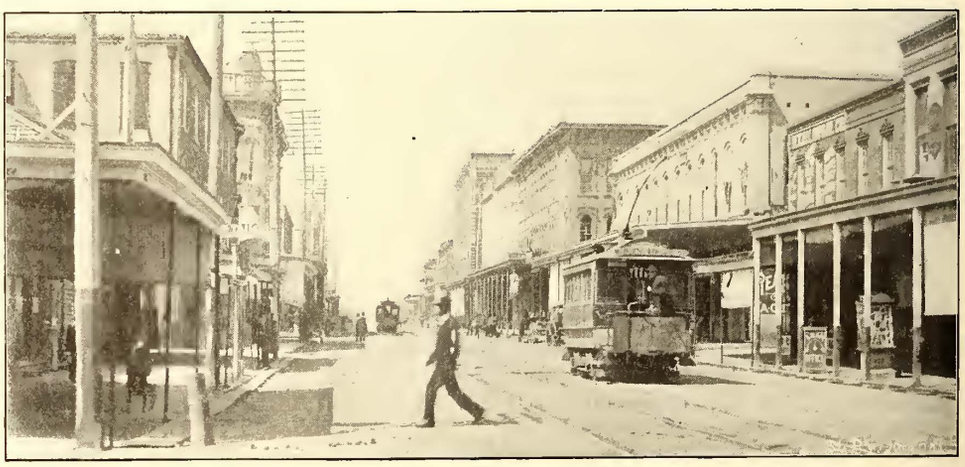


FIG 11.—VIEW ON TWENTY-SECOND STREET—GALVESTON, TEX.

The streets and avenues of Galveston are broad and laid out at right angles; the former are numbered from one to fifty-seven across the island, from North to South, and the avenues are designated by the letters of the alphabet and run east and west lengthwise of the city and island. Avenue J, or Broadway, is 120 ft. wide, with a neutral strip or esplanade through the center, on each side of which the street car tracks are laid, while the roadways

are outside the tracks. The founders of the city in laying out the streets and alleys devoted, as a public park, every tenth block through the center of the city from East to West, and three separate sites for public markets, also blocks for schools and colleges, while they gave convenient and valuable sites for churches of every Christian denomination. The public school buildings, eleven in number, are as fine as any to be found in the country. Two of them cost upwards of $100,000 each, and are gifts to the city by two public spirited citizens after whom they have been named, known as the Ball High School and the Rosenburg School. The churches are also models of architecture and are generally built of stone and are very costly. The business blocks and residences of its principal citizens are especially fine, the latter being surrounded with well kept lawns which are ornamented with a great variety of shade trees and shrubs, including those of semi-tropical and native growth. We do not remember to have visited any city where the streets are so level, so straight and so trim as are the streets of Galveston.

The climate of the location is both semi-tropical and marine, and the city has a most flattering health record, and is claimed to be the most attractive, coolest in summer, warmest in winter of any of the Gulf cities. The average per cent. of moisture in the atmosphere is 77, and the annual rainfall is 54.48 ins. The maximum temperature for a series of years has been 98 degs., and the minimum 32.

Galveston City Railroad Company.

Having noted the above features, we are quite prepared to find a street railway system equal in every way to the requirements of such a growing and prosperous city.

The street railway lines embrace thirty-nine miles of track, and are all under one management, and are nearly all operated by electric power, there being one mule line, which will soon be electrified. The affairs of the company are controlled by Wm. H. Sinclair, who is president and general manager; H. Kellner is secretary and treasurer, and Wm. H. Griffin superintendent. The same company operates the lines of the Gulf City Railway Company. The lines of the system are advantageously laid out, so that they communicate with every part of the city, and extend west to the new additions which are being opened up, and which provide for the growth of the city towards the west, the only direction in which it can grow. The cars of one line run past the Beach Hotel, shown in the center of group, on this page. This hotel is located on the south side of the city, directly on the beach, and which is a large, handsome structure, is owned and controlled by the same parties who control the street railway company, and is

SCENES ABOUT GALVESTON.

WHARF SCENE. SEALY HOSPITAL. BEACH HOTEL. VIEW OF BROADWAY. BALL SCHOOL.

kept open the year round. In front of the hotel are extensive bathing houses, while the beach, which extends the whole length of the island on the gulf side, is said to provide the most perfect natural roadway to be found in world, the sand being so hard that the shoes of the horses or buggy tires scarcely leave a mark in passing. The tracks are constructed with forty pound T rails, which are laid on stringers which in turn rest on ties which are firmly embedded in the hard sand, the natural formation making a very excellent roadbed. The streets of the city are paved principally with oblong cypress blocks, which have proved very durable in this locality, some sections of the pavement being still in fair condition after seventeen years of service. The blocks are laid on a natural foundation. Several streets have recently been paved with vitrified brick as an experiment, but it is doubtful if any material proves as durable as the cypress blocks. On some of the business streets the tracks are so close together that

WM. H. SINCLAIR,
PRESIDENT GALVESTON CITY RAILWAY CO.

there is not more than ten inches of space between the hand rails of the open cars in passing.

The rolling stock consists of both open and closed cars, the open cars having been run as early as the first of April. The cars were manufactured by Stephenson, the St. Louis Car Company, and by the Laclede Company, and are mounted on Bemis trucks which are equipped with both Thomson-Houston twenty-five horse power and Westinghouse thirty horse power motors, single equipments only being employed, as there are no grades in the line. The original equipment of the lines consisted of Rae motors and trucks which were afterwards discarded, and twenty-one of these old equipments are still stored in the company's barns. With the present equipment thirty-six inch wheels were formerly employed; now, however, the thirty-three inch wheel has been adopted, and these are purchased, for the most part, from A. Whitney & Sons, Philadelphia.

The power station and car barn are located at the corner of I and Center Streets, a short distance from the business center. The car barn and station are of brick, and the barn is the same structure that was employed for storing the cars before the change was made to mechanical power. The power station is a new structure, adjoining the barn, and has a ground dimension of 80 × 120 ft., while the original barn was 280 × 120 ft., and two stories in height, the second story being employed as a repair and paint shop. In place of repair pits, two sections of track are elevated to provide access to the motors.

The boiler equipment consists of seven Cooper return tubular boilers, of 120 H. P. each, arranged in two batteries, and two vertical Buckeye boilers, of 225 H. P. each, the latter having recently been added to the station. The smokestack is 170 ft. high, circular in form, having a twelve foot base, and being nine feet at the top. It rests upon a natural sand foundation. The feedwater is derived from three artesian wells, which are, respectively, 500, 800 and 1,500 ft. in depth, from which a bountiful supply of pure water is obtained.

Slack coal from the Indian Territory is employed for fuel and costs $3.10 per ton delivered in the boiler room, and it requires eleven and a half tons per day to operate the twenty-six cars, which is the average number run.

The engine equipment consists of three machines, one of them being a 400 H. P., tandem compound of the Cooper-Corliss type, and two Buckeye engines of 350 H. P. each, the latter having been but recently installed. The power is transmitted to a countershaft from which the generators are driven; these consist of two Edison machines of 250 H. P. each, which are located between the countershaft and engines, and one Westinghouse M. P. generator of 400 H. P., which is placed beyond the countershaft. There are also two General Electric lighting machines and two Rae generators of 100 H. P. each, which are employed as occasion may require. The belting employed was manufactured by the Chicago Belting Company, and the belt tighteners are of the E. P. Allis make. Hill clutches are employed on the countershaft.

EMPLOYES.

A sliding scale of wages has been adopted in paying the motormen and conductors. For the first three months of service the pay is $45 per month, after that, according to efficiency, it is $50, $55 and $60 per month. The men work from fifteen to seventeen hours per day, but are allowed to lay off every third day, so that they are required to work two days, and are off the third, being required to report the third day only to relieve the men on duty at meal time. This arrangement is said to be very satisfactory to the employes.

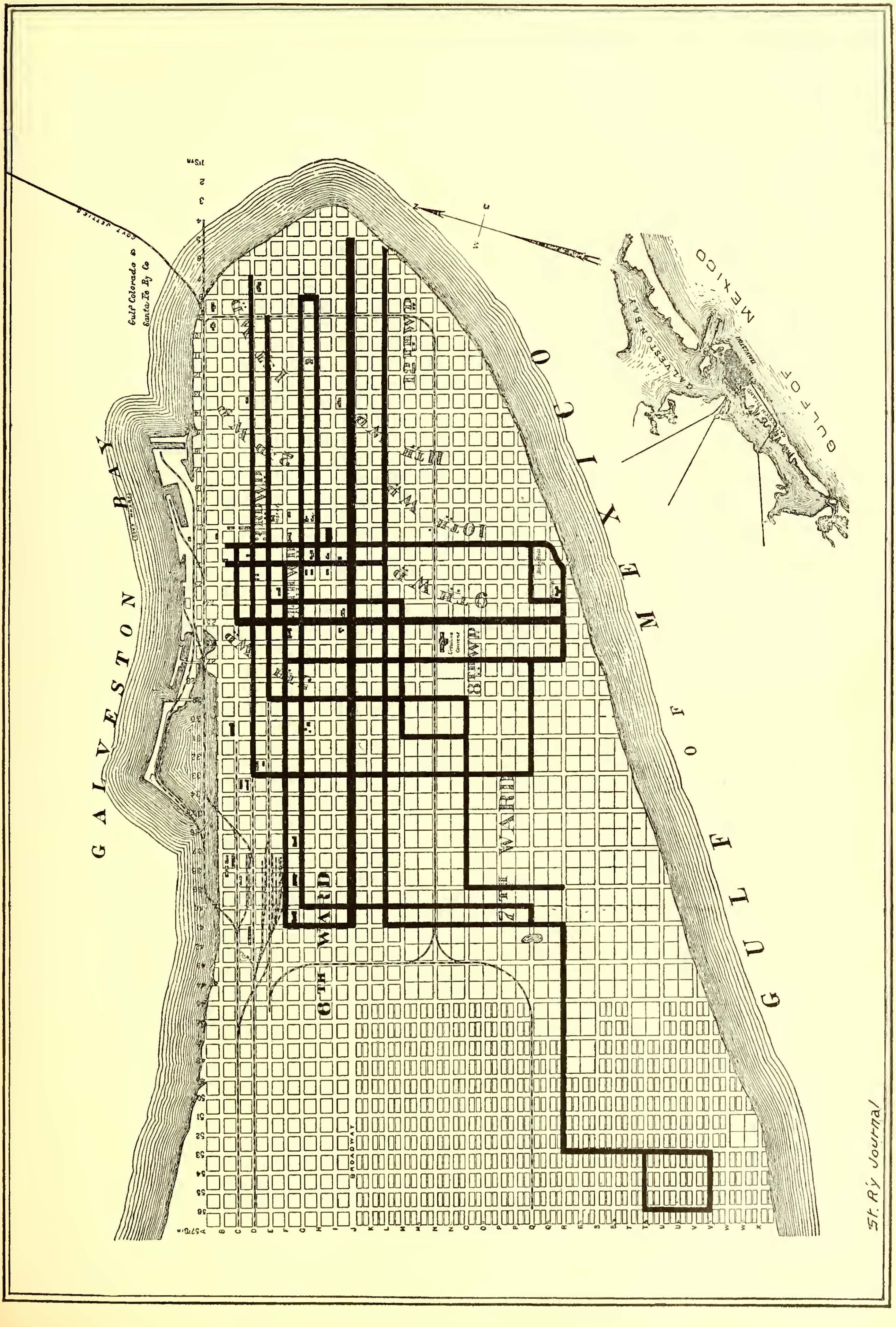
The fare is five cents and no transfers and no tickets. Coupon pass books are provided for city officials and newspaper men. During the summer months there are numerous excursions from all over the state to Galveston, conducted by the steam railways which offer special rates on certain occasions. This results to the advantage of the street railway company whose lines transfer them to the beach and other resorts, so that the lines carried last year over 4,000,000 passengers. We were treated to a run over the principal lines in a special car, which proved a very enjoyable trip, and were not surprised when we had seen the attractive features of the city that it was so popular with excursion parties.

Houston.

Houston is situated inland about fifty miles due north from Galveston at the head of the tide water of the Buffalo bayou, or river, a navigable stream for vessels and barges drawing not more than ten feet of water. It is the real tide water base of the Southwestern system of railroads, embracing thirteen lines, all of which connect here with the waterway. The city is an important manufacturing center, and the products from its mills include sash doors and blinds, brick in large quantities, while the city ranks first in the United States in the manufacture of cotton seed oil, meal and cake. There are also two refineries, and a half a dozen cotton compresses, one of them claiming to be the largest in the world, and three cotton pickeries. The water supply is obtained from artesian wells, twenty in number, ranging in depth from 200 to 850 ft. The water is clear and exceptionally pure and healthful. The pumping machinery is said to be the finest in the Southwest, and to have a capacity of 18,000,000 gals. per day. The streets of the city are laid out in a very irregular manner, although they are generally very wide and straight. The principal streets are paved, the material used being principally vitrified brick. Wooden block consisting of *bois d'arc* (Osage orange) are also extensively used, and there are many graveled streets. The soil is generally sandy, making a good foundation for the street railway tracks.

Houston City Street Railway Company.

This company controls all the street railway lines of the city, embracing thirty-five miles of track, the most of which was equipped with electric power three years ago.



MAP OF GALVESTON—SHOWING LINES OF THE GALVESTON CITY RAILWAY CO.

The lines are advantageously laid out, reaching over the settled portion of the city and extending to the principal suburbs, and the system is exceedingly well managed. One peculiarity of the system is that nearly every one of its thirteen divisions forms a loop, and all center at a given point at the corner of Travis and Prairie Streets, where are located the offices of the company, and by which all the cars pass.

The track construction of the street railway lines in the paved streets consists of forty-five pound T rail supported on chairs. On the Houston Heights division a thirty-five pound T rail is employed which is laid on 6×8 in. stringers having lapped joints and held to gauge by tie rods placed four feet apart; the stringers rest on 2×10 in. planks in place of ties, which in turn rest on a shell foundation of three or four inches in thickness, while the track is ballasted with the same material. The shells for ballast and for roadways are brought in great quantities from Galveston Bay.

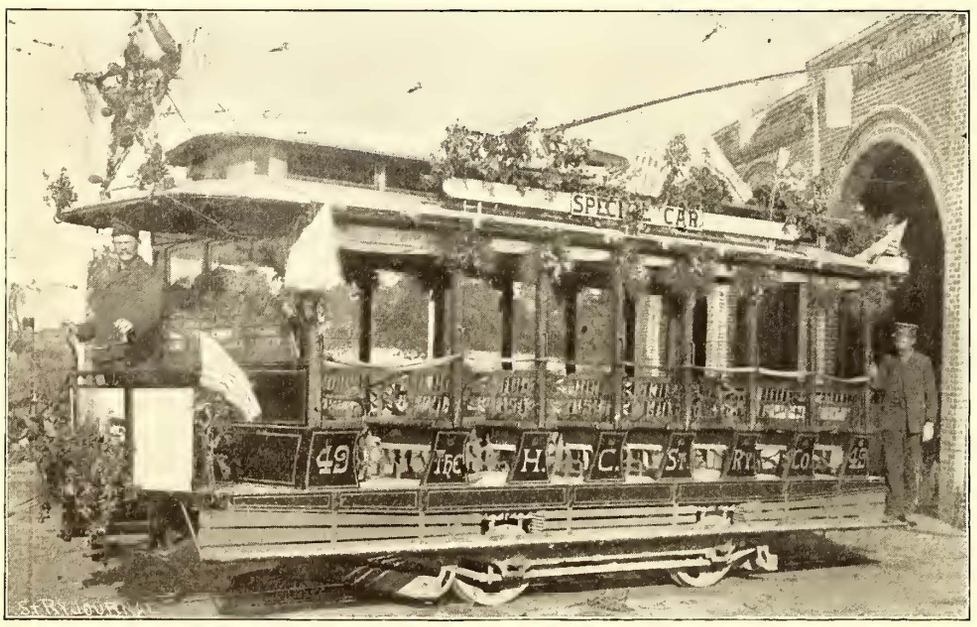


FIG. 12.—SPECIAL CAR—HOUSTON CITY STREET RAILWAY CO.

The power house and car house, which are of brick, are located on Buffalo bayou near Magnolia Street. The barn has a ground dimension of 250×100 ft. with a repair shop on one side 137×27 ft. The power station adjoins the car house and stands immediately on the bank of the bayou, from which water is obtained for the boilers and condensing purposes. The tracks make a loop through the car house so that all the cars come in at one end and pass through. There are a number of repair pits and other conveniences for the repair of cars and motors.

The machine shop is equipped with a number of iron working tools, including a wheel boring machine, a twenty-seven inch lathe, drill press and wheel press, all of Lodge & Davis make. A twelve horse power engine furnishes power for operating machinery. The company does its own armature winding, and also repairs and builds car bodies. The blacksmith shop occupies a detached brick building 24×40 ft.

The boiler equipment consists of three Babcock & Wilcox boilers of 160 H.P. each, which carry steam pressure of 140 lbs. The feedwater is so pure that no scales form in the boiler, and no trouble is had from this cause. There is one independent condenser and one jet condenser of the Reynolds type; there is also a Hoppes live steam purifier.

The fuel consists of Alabama and Indian Territory coal, costing delivered about $4.50 per ton, and it requires on an average seven tons per day to operate the thirty-three cars usually run. On Sundays and holidays from eight to sixteen extra cars are operated.

There are two compound, condensing Allis engines having cylinders 16 × 20-42, rated at 300 H. P. each, which are run at ninety revolutions. The power is transmitted by belts to a countershaft and back from the countershaft to the generators. Ordinarily but one engine is run, but on Sundays and other days when traffic is heavy both are employed.

The generator equipment consists of two General Electric M. P., eighty kilowatt machines and one M. P., 200 K. W. of the same make, also two eighty kilowatt machines of the Edison type. The switchboard is of marble and is provided with General Electric switches and meters. The station and machinery are kept in an exceptionally clean condition. Both open and closed cars, which are manufactured by the leading makers, are being run. Some new trail cars have recently been made which were manufactured in the company's own shops.

The cars are mounted on Bemis and McGuire trucks, there being thirty-five of the former and twelve of the latter. There are twenty-nine single equipments of General Electric 30 or S. R. G. motors, and twelve double reduction motors of the Edison type. Only six cars have double equipments, none of the grades being very heavy. A thirty-three inch wheel is employed, and these are purchased in the city from the Dixon Car Wheel Company, extensive manufacturers of steam car wheels. The home made wheels are said to be giving excellent satisfaction. The wheels are bored, fitted and pressed on in the company's shops. The motormen are provided with seats which consist of a circular stool attached by a hinge to a section of gas pipe which rests in a socket in the platform. The cars are equipped with the Meaker registers.

EMPLOYES.

From 120 to 130 car men are employed, and the pay is twelve and a half cents an hour for the first four months' service, after that fifteen cents an hour for twelve hours' work. In addition, a prize of $10 is given each month to the most efficient motorman and conductor, as an incentive to higher service, and is proving very satisfactory to both the company and employes. The prize is awarded at the end of the month by the three principal officers of the company, who watch the men while at work, and in granting the award efficiency, merit, promptness, neatness and freedom from accidents are the factors which govern. The parties receiving the prize cannot compete again until the third month. Trackmen receive $1.50 per day, aud the force consists of both white and colored men in equal proportions. The cars are run until eleven o'clock at night, except on Tuesday, Thursday and Saturday nights, when they run until twelve o'clock. The employes are furnished with a printed card, on which the routes and the headway are indicated. The headway is from nine to forty minutes, according to the importance of the route.

A NOVEL ADVERTISING SCHEME.

A plan for utilizing the trolley pole for sporting an advertising banner has recently been designed. The banner consists of a triangular frame formed of light strips of wood which is covered by canvass, being about eight feet long and two feet wide. The frame is supported from the trolley pole so that the lower edge is parallel with the roof of the car, and is left free to swing sideways.

Houston is the only city of which we have heard that has ever been treated to a street railway parade. Some months ago a parade of the street cars was improvised, the cars being collected from the different routes and moved one after the other over the different divisions of the line, one or two cars being left on each division for the accommodation of passengers. The cars were handsomely

decorated, the principal one having flags and a number of electric lights, one of the principal designs being a revolving star composed of colored lights. A bobtail car, in which a worn out mule was the only passenger, brought up in the rear, and which bore the legend "Our occupation is gone." The cars were crowded with enthusiastic patrons during the entire parade.

We were treated to a ride over nearly all the routes in the city, and must say that few cities present so many attractions of beautiful homes, fine lawns, ornamental shrubs and shade trees, and imposing business blocks as are to be found in Houston.

Officers of the company: O. M. Carter is president, H. F. McGregor, vice-president and general manager, C. A. McKinney, secretary and treasurer, and F. Mundes, superintendent. C. B. F.

Time Schedule for Running Cars.

We present herewith a time schedule for running cars, drawn up by James Bricker, of the Philadelphia Traction Company, which will be found explicit and compact. The form shows twenty-one cars, together with the starting time for each. The time per trip allowed is about an hour, and 325 trips are arranged for, the headway during the day being three minutes.

The conductor's trip card, or coupon, as it is known in Philadelphia, or way bill, as it is sometimes called, should be marked with the number of the runs before being issued. In this way the latter can find his cars and time as well as his relief for meals.

SCHEDULE.

Car Nos.	1	2	3	4	5	6	7	8	9	10	11	12	1	14	15	16	17	18	19	20	21
Time of Forenoon Cars.	5.30	.....	35	40	.....	45	50	...	55	**6**	.....	4	8	12	16	20	24	28	32	36	39
	42	45 × 48		51 × 54		57 × **7**		3 × 6		9 × 12		15 × 18		21 × 24		27 × 30		33 × 36		39 × 42	
	45	48 × 51		54 × 57		**8** × 3		6 × 9		12 × 15		18 × 21		24 × 27		30 × 33		36 × 39		42 × 45	
	48	51 × 54		57 × **9**		3 × 6		9 × 12		15 × 18		21 × 24		27 × 30		38 × 36		39 × 42		45 × 48	
	51	54	57	**10**	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51
	54	57	**11**	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54
Time of Afternoon Cars.	57	**12**	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57
	1	**3**	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	**2**
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	**3**	3
	6	9 × 12		15 × 18		21 × 24		27 × 30		33 × 36		39 × 42		45 × 48		51 × 54		57 × **4**		3 × 6	
	9	12 × 15		18 × 21		24 × 27		30 × 33		36 × 39		42 × 45		48 × 51		54 × 57		**5** × 3		6 × 9	
Time of Night Cars.	12	15 × 18		21 × 24		27 × 30		33 × 36		39 × 42		45 × 48		51 × 54		57 ×	**6**	4	8	12	.....
	16	20	24	28	32	36	40	44	48	.....	52	56	.....	**7**	4	.....	8	12	.....	16	.....
	20	24	28	32	36	40	44	48	52	.....	56	**8**	.....	4	8	.....	12	16	.....	20	.....
	24	28	32	36	40	44	48	52	56	.....	**9**	4	.....	8	12	.....	16	20	.....	24	.....
	28	32	36	40	44	48	52	56	**10**	.....	4	8	.....	12	16	.....	20	25	.....	30	.....
	35	40	.....	45	50	55	.....	**11**	5	.....	10	15	.....	20	25	.....	30	35	.....	40	.....

RUN GUIDE TO SCHEDULE.

Early Runs.	Forenoon Cars.	Afternoon Cars.	Late Runs.	Afternoon Cars.	Night Cars.	Swing Runs.	Forenoon Cars.	Night Cars.
1	1	9	14	1	9	22	14	1
2	2	10	15	2	11	23	15	2
3	3	11	16	3	12	24	16	3
4	4	12	17	4	14	25	17	4
5	5	13	18	5	15	26	18	5
6	6	14	19	6	17	27	19	6
7	7	15	20	7	18	28	20	7
8	8	16	21	8	20	29	21	8
9	9	17						
10	10	18						
11	11	19						
12	12	20						
13	13	21						

If the trippers are put on they will run in the positions marked × and while running the headway will be two minutes.

Electric Railways for Brussels.

The managers of the Brussels Tramway Company have decided to install the electric system on two of its principal lines, having an aggregate length of five and a half miles. The work of construction will be pushed rapidly forward. These two lines have each a comparatively important traffic, are double tracked, and have grades from 4.6 to 4.8 per cent., extending a distance of from a quarter to half a mile. The trolley system will be used.

The central station will be located on Rue Brognitz. The current will be supplied by five dynamos of 100 K. W. each, furnished by the Union Elektricitäts Gesellschaft of Berlin, which will install the entire plant. The engines will be of 160 H. P., and of the McIntosh & Seymour type.

THE plan of an electric railway between Philadelphia and Harrisburg is being rapidly pushed forward under the direction of the Pennsylvania Traction Company, of which J. J. Patterson, of Lancaster, is president. The roadbed will be of the best construction, a seventy pound rail will be used, and there will be no grades exceeding 4 per cent. The company is now in consultation with the electrical manufacturing concerns, in reference to the question of installing a number of power stations or long-distance transmission of power plants with motor generators.

Organization of a Connecticut Street Railway Association.

Representatives of several street railway companies of Connecticut met at the Tontine Hotel, New Haven, on April 3, for the purpose of forming a state association.

The matter of forming such an association has been considered for several months. Among those present were H. Holton Wood, of Derby Street Railroad, Derby; F. S. Wardwell, of Edgewood Avenue Railroad, New Haven; M. R. Smith, George Terry and A. M. Young, of Waterbury Street Railroad, Waterbury; J. M. Townsend, of Lake Saltonstall Railroad; G. A. W. Dodge, S. H. Wagner and David Corey, of New Haven Street Railway Company; R. A. Fosdick, of Stamford Street Railroad; E. S. Goodrich, of Hartford & Wethersfield Railroad, H. S. Parmelee, of Fair Haven & Westville Railroad; Israel A. Kelsey, of Winchester Avenue Company, and E. B. Hill, of Norwalk Street Railroad, Norwalk.

H. Holton Wood presided and R. A. Fosdick acted as secretary. It was voted to form an organization which will be incorporated as the Connecticut Street Railway Association. By-laws were then adopted, and the purpose of the organization, as set forth, is as follows:

"The object of this Association shall be the acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of street railways, and the diffusion of this knowledge among members of this Association, with the view of increasing the accommodations of passengers, improving the service, and the establishment and maintenance of a spirit of fraternity among the members of the Association by social intercourse, and the encouragement of cordial and friendly relations between the roads and the public; also to harmonize the interests of the street railway companies of Connecticut and to secure uniformity in regulating the construction and operation of such companies."

It was then voted to hold the annual meeting of the Association on the third Wednesday in November, and the headquarters will be where the secretary resides.

The following named officers were elected for the ensuing year: H. Holton Wood, president; Henry S. Parmelee, vice president; E. S. Goodrich, of Hartford, treasurer; R. A. Fosdick, of Stamford, secretary; A. M. Young, of Waterbury, G. A. W. Dodge and I. A. Kelsey, executive committee.

THE Metropolitan Street Railway Company, of New York, on April 17, received permission from the State Railroad Commissioners to cable its Lexington Avenue line

Practical Notes on Rope Driving—Part II.

By M. E.

Strength of Ropes.—The strength of rope necessarily depends upon the tenacity of the individual fibres of which it is composed, but at least only a relatively small proportion of the aggregate fibre strength is realized in the finished rope. This loss is, in the main, occasioned by the "twist" given to the strands in forming the rope, and which causes the individual fibres to lie in spirals, in which form they are obviously in a less advantageous position to resist tensile stress than if laid side by side. It will be clear that the harder the rope is twisted, the greater will be the angle which the fibres form with the direction of the axis of the rope; consequently, the stress on the fibres becomes more of a bending and less of a direct tensile character, thus diminishing the ultimate strength of the rope. And here it may be said that it is desirable to clearly distinguish between "hard" and "lightly" twisted rope *of the same diameter* on the one hand, and those formed *of the same number of yarns* on the other. Thus, as mentioned in the first article, a "hard" twisted rope is materially stronger than a soft or "lightly" twisted rope *of the same diameter.* But by hard twisting a lightly twisted rope, its strength is reduced, for the reason just referred to. In the first case, although each fibre is weakened by hard twisting, the greater number of fibres contained in a rope of given diameter more than compensates for the weakening effect of the twist. In the second case there is no such compensating influence.

The reduction of strength due to twist will be greater in those fibres or yarns farthest from the center of the strand, for if a definite amount of twist be given to a bundle of fibres of uniform length, it is clear that the outer fibres will lie in a much longer spiral path than those near the center of the bundle. Consequently, they will be subjected to a considerable initial stress, while they will also be much less effective in resisting the working stress on the rope. The larger the rope, the more pronounced will this unequal distribution of stress become; this no doubt accounts, to a large extent, for the lower strength, per unit of sectional, of large ropes as compared with those of smaller diameter.

TABLE I.

ULTIMATE STRENGTH OF ROPES.

Diam. of Rope	Hemp.	Manilla.	Cotton.
½ ins.	2,100 lbs.	2,000 lbs.	1,750 lbs.
⅝ "	3,150 "	3,000 "	2,650 "
¾ "	4,400 "	4,200 "	3,700 "
⅞ "	5,750 "	5,600 "	4,950 "
1 "	7,350 "	7,000 "	6,200 "
1⅛ "	8,900 "	8,600 "	7,500 "
1¼ "	11,000 "	10,500 "	9,250 "
1⅜ "	13,000 "	12,500 "	11,000 "
1½ "	15,500 "	14,900 "	13,200 "
1⅝ "	18,000 "	17,100 "	15,000 "
1¾ "	20,300 "	19,400 "	17,000 "
2 "	26,200 "	25,000 "	22,000 "

Various endeavors have been made to minimize the loss of strength due to twist, and in some methods of manufacture this has been accomplished by spirally winding around a central core, successive layers of yarn, until the full diameter of the strand is obtained. In this way the lengths of the yarns gradually increase as the diameter of the strand augments, and each yarn is thereby enabled to approximately take its share of the load. Recent tests have demonstrated the fact that by this method of construction the strength of cotton rope is very materially increased. It is also claimed for interstranded rope that it lasts longer, since the wearing away of the outer layers still leaves a complete, though somewhat smaller, rope to do the work. This rope is somewhat more costly to manufacture than the older construction, but the material advantages gained would appear to far outweigh this objection.

The strength of hemp, manilla or cotton ropes varies considerably and no very uniform results are obtainable, while, as previously mentioned, the ultimate strength per square inch of section is less in the larger sizes than in the smaller. Table I gives what may be taken as fairly representative values of the ultimate strength of ropes as deduced from the results of a number of experiments.

The mistake is frequently made of assuming that cotton rope is considerably weaker than either hemp or manilla. It is certainly the weakest rope of the three, so far as ultimate strength is concerned, but as the working stress is only a very small proportion of the ultimate, the difference in strength becomes insignificant. In any case it is probably wholly neutralized by the more pliable nature and better wearing qualities of the cotton rope. Henceforth, therefore, we will consider hemp, manilla and cotton rope to be of practically equal strength and that the maximum working stress to which they should be subjected should not exceed $200d^2$—that is, about 3 per cent. of their ultimate strength—for durability and satisfactory working. The following table gives exact and approximate values of the working stress for the sizes of ropes usually employed:

TABLE II.

WORKING STRESSES FOR ROPES.

d= Diam. of Rope. Inches.	Maximum Total Stress in lbs.	
	Exact.	Approximate.
½	50	50
⅝	78	80
¾	112	110
⅞	152	150
1	200	200
1⅛	253	250
1¼	312	310
1⅜	378	380
1½	450	450
1⅝	528	530
1¾	612	610
2	800	800

Friction, Tension, Rates, etc.—The principles involved in rope transmission are somewhat similar to those underlying belt driving, but with somewhat important modifications which call for careful attention. Considering the tension in an endless rope stretched over two grooved pulleys, from one of which power is to be transmitted to the other, it will be seen that when at rest the initial tension in each side of the rope, is the same in amount. When, however, the driver commences to rotate, the tension in the driving side is increased, while that in the following side is diminished by the same amount, the *average* tension remaining unaltered. This action continues until, should the conditions be favorable, the resistance of the load is overcome and the driven pulley rotated. It is obvious, however, that unless there is sufficient adhesion between the rope and the pulleys, the former will slip in the groove of that pulley which offers the least frictional resistance.

Without entering into an elaborate mathematical investigation of this part of the subject, it may here be sufficient to state that the resistance of a rope to slipping in the pulley groove depends: (1) upon the coefficient of friction, μ, existing between the surface of the pulley groove and the rope. (2) on the angle, φ, of the groove; (3) upon the arc of contact or portion of the pulley circumference embraced by the rope; (4) upon the initial tension, and (5) indirectly upon the velocity of the rope.

Experimental data are wanting as to the coefficient of friction between manilla or cotton rope and cast iron pulleys. Its value will obviously vary greatly under different circumstances and as regards the condition of the rope, its greasiness, etc. With dry hemp ropes a coefficient as high as .28 has been experimentally determined, but under the conditions of practice, and with the ropes sufficiently lubricated, it would not, in the writer's

opinion, be safe to count upon more than one-half of this amount.

Pulley Grooves.—The action of the wedge-shaped groove has next to be considered. The primary effect of this is to increase the resistance to slipping, since the friction coefficient has now to be multipled by the cosecant of half the angle of the groove, so that, assuming a real coefficient of .14, the virtual coefficients of friction become:

For Groove-angles of	Virtual Coefficient of Friction=
30 degs.	.54
35 "	.46
40 "	.41
45 "	.36
50 "	.33
55 "	.30
60 "	.28

The most suitable angle of pulley groove is still, to some extent, a mooted point, but the consensus of opinion points to an angle of 45 degs. for cotton rope as giving the best results in practice. It appears scarcely reasonable to suppose, however, that the most advantageous angle for cotton is necessarily also the best for manilla rope. The less yielding nature of the latter material would suggest that a somewhat more obtuse angle (of about 40 degs.) would be found more suitable, so far, at least, as regards durability. The most suitable angle of groove is that which ensures the maximum frictional grip being obtained while necessitating the least expenditure of work in releasing the rope from the pulley groove and causing relatively the least injury to the material. It appears evident, therefore, that the compromise between these somewhat conflicting requirements will be met at a different groove-angle for materials which differ so widely in their nature as do manilla and cotton.

Another effect results from the employment of fibrous ropes in V-shaped grooves; and one which is often completely overlooked. As mentioned above, the tension in the following side of a rope transmitting power is much less—perhaps one fourth or one-fifth—of that in the driving side. Now that portion of the rope which is for the moment entering the groove of the driven pulley, is subject to the slack side tension; but as it passes round the pulley, the stress in the rope gradually increases until when it leaves the groove, the tension is that of the driving side. Were the rope of an unyielding substance, no effect would result, but with a fibrous rope, the natural result of this gradual increase of tension is to cause the rope to sink deeper into the groove, as the point of release is approached. The contact line of the rope and pulley surfaces is, therefore, a spiral of small radial difference and it follows therefore, that before slipping can occur, not only the radial wedge effect of the groove, but also what the writer has called the *circumferential wedging effect*, must be overcome.

One other point deserves mention as being specially pertinent to the application of ropes to dynamo driving. Other conditions being equal, slipping will usually occur on the smaller pulley, since, in the absence of any arrangment to the contrary, it will have the smaller arc of contact. Two principal methods of increasing the resistance to slipping on the small pulley have been adopted in independent rope transmissions. The first is to increase the coefficient of friction by using other material than cast iron for the pulley surface. This has been done in some cases by using a cast iron pulley, the rim being covered with hard wood in which the grooves are formed. This affords a frictional grip about 30 per cent. greater than with iron pulleys, and the only objection to the device is the tendency of the timber to warp slightly, and also of the rope to wear the grooves to some extent. The second method consists in using more acute grooves in the smaller pulley than in the larger, thus increasing the frictional grip in compensation for the smaller arc of contact.* If the friction coefficient be taken equal in both cases, and a_1 and a_2 be the angles of the grooves of the large and small pulley respectively, while φ_1 and φ_2 represent the number of degrees in the corresponding arcs of contact, then

$$\text{Cosec } \frac{a_1}{2}\varphi_1 = \text{Cosec } \frac{a_2}{2}\varphi_2$$

Thus, if $\varphi_2 = \frac{2}{3}\varphi_1$ and a_1 is taken at 45°

$$\text{Cosec } \frac{a_2}{2} = 2.613 \times \frac{3}{2} = 3.91$$

and the value of a_2 required is thus found to be 30°; this therefore, is the angle of groove suitable for the small pulley. In most respects the latter of the two arrangements appears preferable; in some cases a combination of the two may be found advantageous.

In "continuous rope transmissions"—in which one long, endless rope is employed wound in successive coils alternately around each of the two pulleys—the requisite amount of grip on the small pulley can be readily obtained by using a "winder" pulley. In this arrangement the smaller pulley is wider and contains more grooves than the other, and the rope—after passing successively over the two pulleys until all the grooves of the larger and a similar number of the smaller pulley have been filled—is then led over an idle "winder" pulley, thence back to the smaller pulley and back and forth over these two pulleys, until all the grooves of the small pulley are filled. The rope is then passed over a tension sheave and recommences its circuit. It is questionable, however, whether some such arrangement as that devised by Mr. Miller, is not quite as efficient as this somewhat complicated system, while the former certainly has the advantage of lower first cost and smaller space occupied—ever considerations of importance in the dynamo room. As will be readily understood, the resistance to slipping could be much increased by increasing the initial tension, *i. e.*, by stretching the rope more tightly over the pulleys. This plan, however, leads to a greater loss of power not only by reason of the increased axle friction, but also by causing the rope to wedge more tightly into the groove than is desirable. Evidently both effects tend to impair the durability of the plant and to increase the risk of breakdown.

One other method of diminishing slip is by using a "binder" pulley, which by increasing the arc of contact of the rope with the smaller pulley, augments the frictional grip. The use of this device in belt transmission is common, but with rope driving the objection is that it results in contraflexure of the rope, which it is always very desirable to avoid. With wire rope it is found that reverse bendings of moderate amount reduce the life of the rope by from 15 to 20 per cent., and it seems only reasonable to suppose that a somewhat similar, though possibly not so great an effect will be produced in the case of fibrous ropes.

Horse Power of Ropes.—In order to obtain a rational estimate of the power transmitting capabilities of driving ropes, it will be necessary to revert to the tensions existing in the driving and following sides, and which has already been briefly referred to. Representing by T and t the tensions on the driving and following sides, respectively, it will be seen that since these are opposing forces, the net tension available for power transmission is $T-t$, so that if R is the resistance overcome at the circumference of the driven pulley, then $T-t=R$. The ratio of the tensions, $r\left(=\frac{T}{r}\right)$ depends upon the frictional grip of the rope in the pulley groove, and at the instant when stopping is about to occur, it can be shown that

$$\log r = 0.007578\,\mu\,\varphi_2 \quad . \quad . \quad . \quad . \quad . \quad (1)$$

μ being, as before, the co-efficient of friction, and φ_2 the number of degrees in the smaller arc of contact.

The resistance overcome at the circumference of the pulley when a given amount of power is being transmitted is

$$R = \frac{H\,P \times 33{,}000}{V}$$

in which H P is the horse power transmitted, and V the velocity of the rope in feet per minute. Then as $\frac{T}{t} = r$

*The use, in continuous rope transmissions, of sheaves of different diameters having more obtuse grooves in the larger than in the smaller, forms the subject matter of a patent granted to T. S. Miller of New York, (U. S. patent No. 444,919, Jan. 20, 1891.)

and $T-t=R$, it follows that

$$R=T\left(1-\frac{1}{r}\right)=T\left(\frac{r-1}{r}\right) \quad . \quad . \quad . \quad . \quad (2)$$

To facilitate calculations of this kind, the writer has calculated from (1) the values of $\left(\frac{r-1}{r}\right)$ given in the following table.

TABLE III.—TABLE OF ROPE POWER CONSTANTS.

$$c=\frac{r-1}{r}$$

Smallest Arc of contact in degs.	Virtual Coefficients of Friction.										
	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70
80	.242	.290	.337	.382	.425	.465	.500	.535	.567	.595	.622
84	.253	.305	.354	.401	.444	.484	.519	.553	.585	.614	.640
88	.264	.319	.367	.415	.459	.500	.535	.569	.601	.631	.658
92	.275	.328	.382	.431	.473	.514	.553	.587	.618	.648	.674
96	.285	.342	.394	.444	.490	.530	.567	.601	.633	.664	.690
100	.295	.354	.408	.456	.502	.545	.583	.617	.649	.678	.705
104	.305	.363	.418	.470	.517	.559	.597	.632	.663	.693	.719
108	.315	.375	.431	.484	.530	.572	.611	.645	.677	.706	.732
112	.324	.386	.444	.497	.543	.585	.624	.660	.691	.720	.746
116	.333	.398	.456	.509	.555	.598	.637	.672	.704	.732	.758
120	.342	.408	.468	.521	.567	.611	.650	.683	.715	.743	.769
124	.350	.418	.476	.532	.580	.622	.662	.695	.727	.755	.781
128	.359	.428	.490	.543	.591	.634	.673	.706	.737	.765	.791
132	.367	.438	.498	.553	.601	.645	.683	.718	.748	.776	.801
136	.378	.447	.510	.563	.612	.656	.694	.728	.758	.785	.810
140	.386	.456	.519	.574	.624	.666	.705	.739	.768	.795	.819
144	.394	.465	.528	.585	.634	.677	.715	.748	.778	.805	.827
148	.404	.476	.539	.595	.644	.686	.725	.758	.787	.813	.836
152	.411	.484	.550	.604	.654	.697	.734	.767	.796	.821	.844
156	.418	.495	.556	.614	.663	.706	.743	.776	.804	.829	.851
160	.428	.502	.569	.624	.672	.715	.752	.784	.812	.837	.858
164	.435	.512	.576	.632	.681	.724	.761	.792	.820	.844	.865
168	.444	.519	.585	.641	.690	.732	.769	.800	.827	.851	.871
172	.450	.528	.593	.650	.699	.741	.777	.808	.834	.857	.878
176	.459	.535	.603	.659	.707	.749	.784	.815	.841	.864	.883
180	.465	.543	.611	.666	.715	.757	.792	.822	.848	.870	.889

The method of determining the horse power of a rope by means of the table is as follows: Find from the table the constant corresponding to the number of degrees in the arc of contact of the smaller pulley and the virtual coefficient of friction, the angle of the groove, condition and material of rope, etc., being taken into account in selecting the latter value. Multiply the constant so found by the maximum tension allowable in the rope, according to size and material (see Table II.). The product multiplied by the velocity of the rope in feet per minute and divided by 33,000, gives the maximum horse power transmitted. As will be seen later, the effect of centrifugal force requires to be considered when high speeds are employed. If it be required to determine the number of ropes necessary to transmit a definite amount of power, the constant taken from the table is to be multiplied by the velocity of the rope in feet per minute and divided by 33,000 H. P. This will give the required aggregate tension on the ropes, and their diameter d and number N may then be selected as circumstances may dictate.

The foregoing is an accurate method of computing the power of ropes, but for ordinary conditions the approximate rules subsequently given will be found sufficiently correct for all practical requirements.

(*To be Continued.*)

The Thomson Welding Company has shipped a motor dynamo car to Brooklyn, N. Y. It was built for the Johnson Company, of Johnstown, Pa., and will be used in Brooklyn by the electrical department of that company for welding rails for the Nassau Electric Railroad.

The promoters of the new electric railroad between Rockford (Ill.) and Dixon recently held a meeting in the latter city, at which it was decided to build at once between Oregon and Dixon. J. S. Ticknor, of Rockford, is president of the company.

Notes From England.

(*From our London Correspondent.*)

The question of the price to be paid by local authorities on purchasing tramways from the owning companies under the terms of the Tramways Act is still undecided, for conflicting decisions of different courts of law call for a speedy judgment by the House of Lords, which is the supreme court of appeal for the United Kingdom. Since the London Street Tramways Company obtained a decision in favor of rental value, the London County Council has taken the case to the English Court of Appeal, where it has been heard, but judgment has not yet been given. In whichever way the case is decided, it is certain that an appeal will be made to the House of Lords. In Scotland the case of the Edinburgh Town Council and the Edinburgh Street Tramways Company has been decided in a totally different way. The Outer House judge in the Court of Session decided in favor of the Town Council, namely, that structural, not rental, value should be paid for the lines. On appeal this view was affirmed. With the promptitude which distinguishes Scotch law from English, the Edinburgh case has already been appealed to the House of Lords, and just at the time of writing I see it intimated in the official records of the House of Lords that the time for the lodging of the printed case for the appeal is fixed for a date not later than May 24. Thus it is probable that the final decision in the Scotch case will be first after all. In regard to Leeds, the litigation has not yet been opened. Until these cases are finally settled, the tramway companies and the local authorities will not know how they are to stand in the future.

Tramway men rejoice that the Leeds Town Council has definitely decided not to work the lines itself, but to let them to a company.

The Liverpool Elevated Electric Railway has been attracting a good deal of attention lately, as two exhaustive papers upon it were read recently at a crowded meeting of institution and civil engineers, and at two subsequent meetings the whole subject was exhaustively discussed by many of the foremost civil and electrical engineers in England. The equipment and operation of the line were highly praised, and it was mentioned as showing the excellence of the electrical arrangements and workmanship that the leakage does not exceed two amperes. Since the company took over the working on January 1, from the contractors, it has found the traction charges to be only about 7.5 cents per train mile. Previously the contractor was paid 8 cents. The train, with passengers, weighs about thirty-eight tons. For the half year ending December last, the total expenses were twenty-seven cents, and total receipts thirty-six cents per train mile. The 5 per cent. preferred dividends were paid, and 1 per cent. on the common stock.

The City & South London Electric Railway is not yet improving its position, as for the past half year the ordinary shareholders have to be content with a dividend of only ⅝ per cent. against ¾ per cent. in the previous half year. It is gratifying, however, that this result is not due to an increase in the working expenses, but to a falldg off in the number of passengers. This evil can only be temporary. The total working expenses per train mile were 31.62 cents, which is the lowest since the line opened. In the previous half year they were 33 cents, which was then the lowest on record. The receipts per train mile were 47.32 cents against 51 08 cents in the previous half year. The weight of the train is almost exactly the same as that on the Liverpool Elevated Electric Railway, so that it will be seen the advantage is with the latter so far as expenses are concerned, though on the other hand the receipts are also lower. The Liverpool line has the advantage, too, of having cost less than a third of the money per mile which was required for the London line with its deep tunnels.

Owing to a difficulty arising from the narrowness of the road at one point, it appears that the extension of one and a half miles of street of the Brixton cable tramway cannot be carried out. The extension will, however,

reach about three-quarters of a mile. It is probable that negotiations will be opened for widening the road so that the whole of the original scheme may be realized.

The issue to the public of preferred stock in the new Edinburgh & District Tramway Company, which has been organized by Dick, Kerr & Company, to supply capital for working the recently leased Edinburgh lines, has been a great success. The amount was £75,000 and though there was very little advertising, the second day the directors found that the capital had already been applied for twice over, and the lists were thereupon closed.

The prospectus has just been issued of the Hampstead & St. Pancras Railway, so that work may soon be started. This is one of the Greathead tunnel railways dealt with in the articles in the STREET RAILWAY JOURNAL on underground lines for London. It was expected that, as the grades are heavy, cable traction would be used, but the directors have decided to adopt electricity. The result will be interesting. The Waterloo & City Railway prospectus has also been issued, but not, I believe, to the public, as the stockholders of the London & South Western Railway Company, which is to work the new line, were prepared to take up the whole issue. A 3 per cent. guaranteed dividend is to be paid, with a proportion of any further profits to accrue.

All difficulties with the local authority in the way of adopting electricity on the Coventry tramways seem now to have been overcome, and it is expected that the work of conversion will shortly be commenced.

Gas Motors.

According to a report of United States Consul General Mason, at Frankfort, Germany, a great deal of attention is being paid at the present time by street railway engineers in Europe to gas motors. Practical trials have been made at Neufchatel, Switzerland, and at Dresden, with satisfactory results. Neufchatel cars run at an average speed of eleven miles an hour, at a cost for gas of 2 9 cents per car mile, with gas at $1.09 per 1,000 ft. Excellent results have also been obtained at Dresden.

Genett Improved Air Brake.

The desirability of having a more effective brake for street cars than that which can be operated by hand power showed itself early in the use of electric cars, and the greater weight of electric cars and the higher speed at which they are run, makes the question of stopping them an entirely different problem than when horse power was used as a motive power. The use of air for operating power brakes of this kind naturally suggested itself, owing to the extensive use of this style of brake for steam cars, and to the fact that it had shown itself superior to any other agent in many years of trial on these roads.

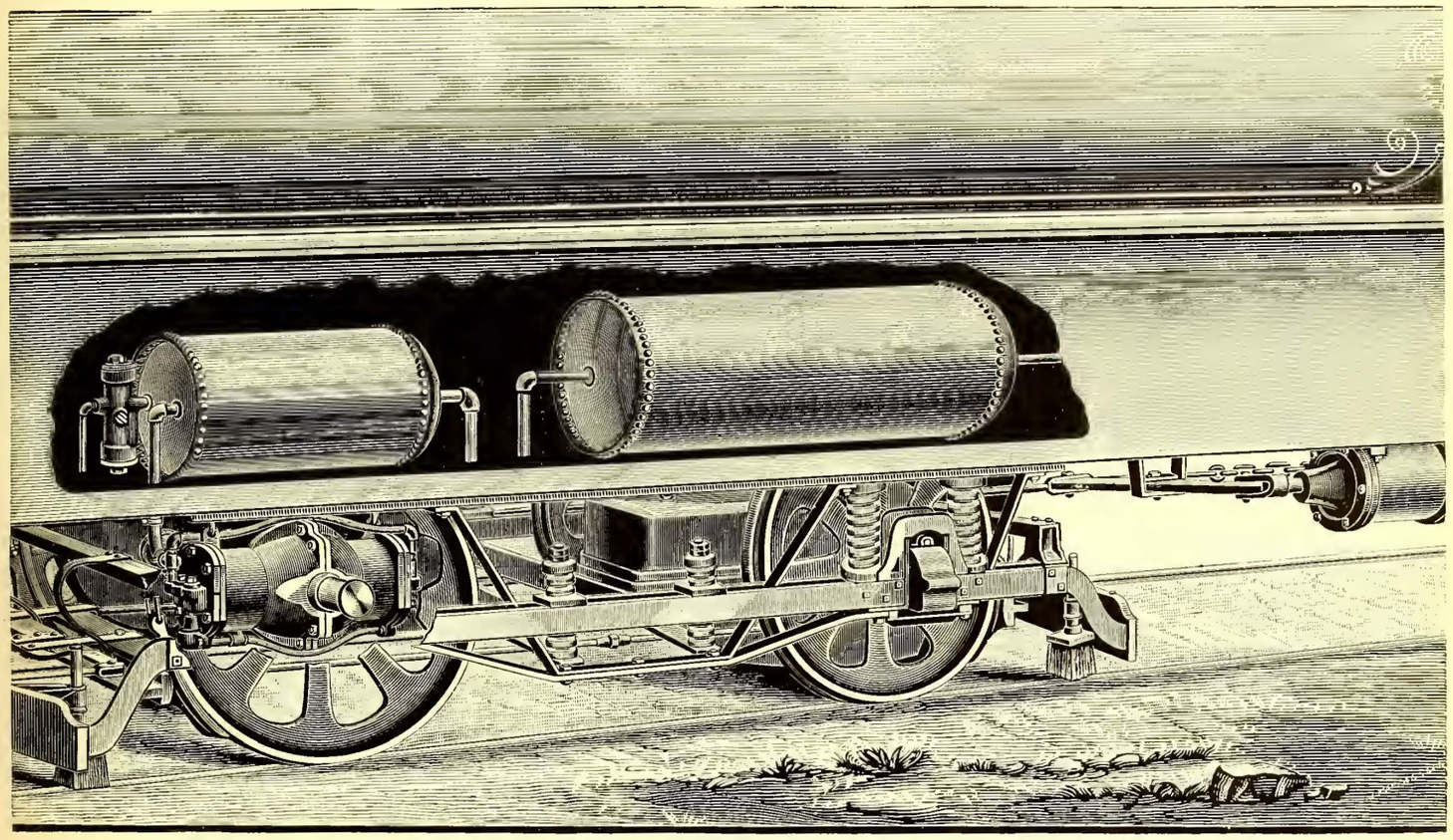


FIG. 1.—CAR EQUIPPED WITH GENETT DUPLEX AIR BRAKE SYSTEM.

Having these facts in mind, the Genett Air Brake Company of Chicago and New York, placed upon the market its system of air brakes, which has shown itself particularly well adapted to the exigencies of street car service.

We present on this page engravings showing the improved duplex system of air brakes of this company, which, for simplicity, durability and convenience commends itself to street railway managers. An important improvement adopted in this system is the encased air compressor (Fig. 4). The experience of electrical engineers in street railway work has demonstrated the desirability of encasing the electric motor and all moving parts located under the car. As will be seen, this idea has been closely followed in the apparatus illustrated.

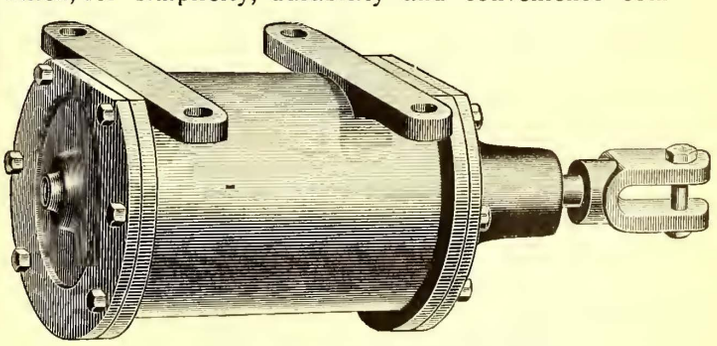


FIG. 2.—BRAKE CYLINDER—GENETT SYSTEM.

The compressor shown in Fig. 4 is just one quarter size, which makes the entire length less than twenty inches. It is double acting, is mounted directly on the axle, and is completely encased so as to entirely protect it from the dust and dirt of the street. This casing also makes the equipment entirely noiseless in its operation. The working parts of this compressor run in oil so that the amount of care required is reduced to a minimum, and the compressor will run without attention, except to keep a full oil supply. This type of compressor can be attached to all cable cars, and to any electric motor car where there is a free axle. Where the large type of motors are mounted on both axles, one of them can be shifted so as to get the combined axle space between motor and hubs of wheels. This has been done in a satisfactory manner on a number of lines which have been equipped. With the present tendency in building smaller motors, the required axle space on new equipments can be readily had.

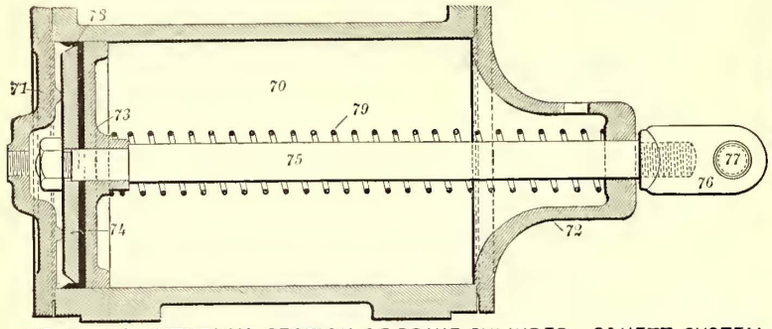


FIG. 3.—LONGITUDINAL SECTION OF BRAKE CYLINDER—GENETT SYSTEM.

In starting out, the compressor fills the reservoirs to a pressure of thirty pounds before the car has traveled 360 ft. In making a stop only two or three pounds registered pressure is required, and this the compresssor furnishes again before the car has traveled sixty feet. The reservoirs, however, have sufficient capacity so that they hold in reserve ten times the amount of air required to stop a car even without additional supply; hence the air reservoir is practically inexhaustible. After the reservoirs are filled to their proper pressure a regulator cuts off the connection between them and the compressor, so that no more air is pumped into them, and the compressor revolves without taking power from the axle. The regulator also operates so that the compressor does not commence to pump air into the cylinders until the car has attained a little headway. In this way there is no added load on the motors on account of the air brake at the time of starting the car.

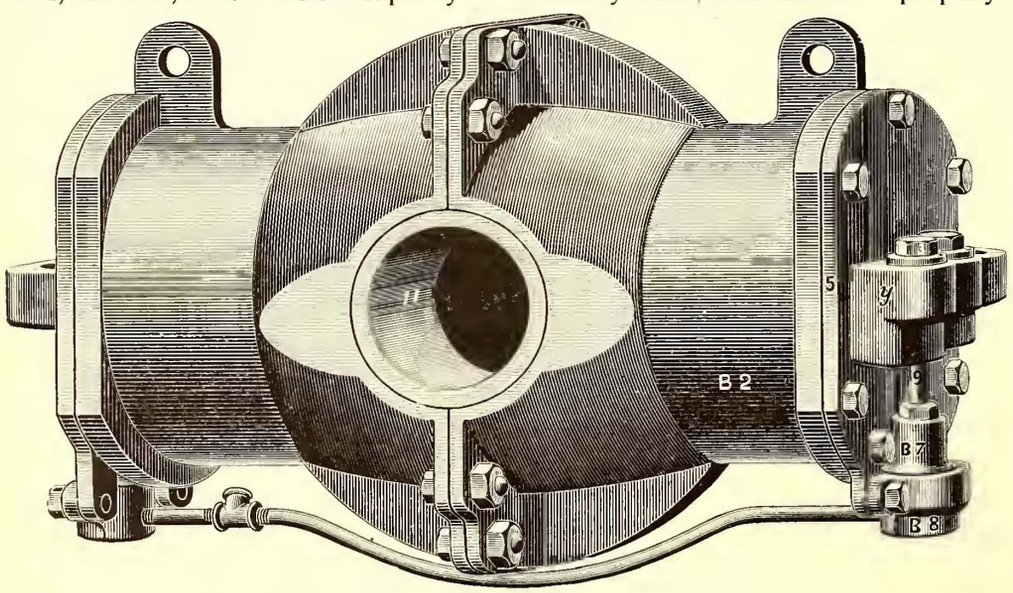


FIG. 4.—DUPLEX COMPRESSOR, ONE-FOURTH SIZE—GENETT SYSTEM.

A view of the controlling valve employed with the Genett air brake system is shown in Fig. 5 This valve is carried on the platform and completely places both the brake cylinder and air pump under full control of the motorman, and enables him to instantly apply the brake shoes either in a mild manner for slowing down the car or making a service stop or bringing the full pressure to the wheel when the emergency stop is wanted. The handle is detachable like the handle of the motor controller, so that when the motorman changes platforms at the end of a trip he can carry the handle with him and attach it to the controlling valve at the other end of the car. Where cars are operated in trains, the only apparatus required on the trail cars consists of the brake cylinder, hose coupler and the ordinary brake gear, the air being taken from the reservoir on the motor car. The brakes on the trail cars are set and released by the motorman simultaneously with the motor car, only one controlling valve being employed.

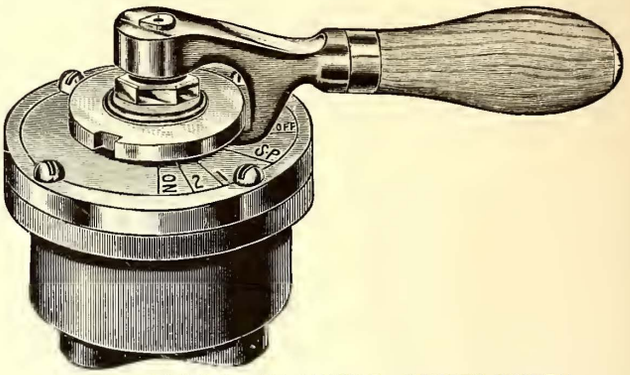


FIG. 5.—CONTROLLER HANDLE—GENETT SYSTEM.

In an action brought against the Little Rock and Augusta Street Railway Companies of Arkansas, February 10, 1894, for the death of a passenger, caused by a collision between a street car and a steam car, it was held that the court properly charged that the jury could find a verdict against the street car company from the mere fact of the collision, unless the presumption of negligence on its part was rebutted; but that, to justify a verdict against the railroad company, a preponderance of the evidence must show negligence on its part contributing to the accident.

Also, a request to instruct that the railroad men were justified in supposing that the street car driver would stop before going upon the railroad track, and unless they were guilty of negligence in not stopping their train quick enough after discovering the peril of the street car, the jury could not find a verdict against the railroad company, was properly refused, since the railroad men, before seeing the car, might have done or omitted some act which made it impossible or more difficult, to prevent the accident.

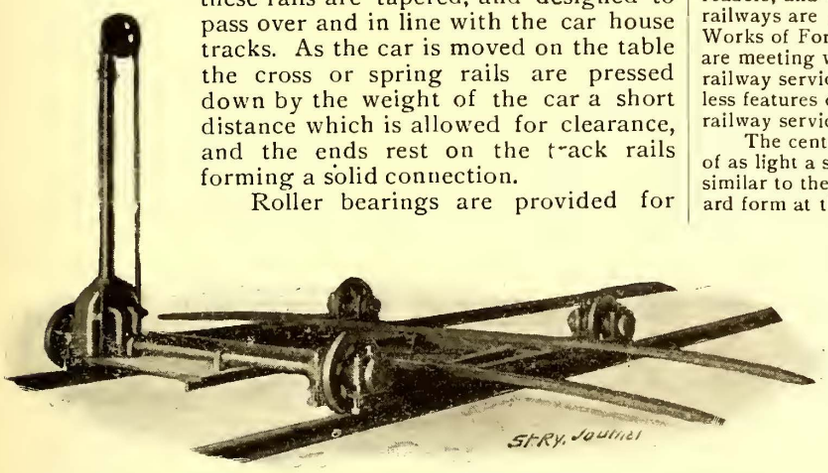
The two companies were sued jointly, resulting in a verdict for $25,000. Evidence that the street car driver had been guilty of negligence at other times when approaching this crossing was refused, because when a passenger on a street car is killed by a collision with a railroad train the negligence of the driver of the car will not be imputed to deceased. The judgment was modified and reduced to $20,000.

The electric railway between Bordeaux and Vousche, France, has proved so successful an enterprise that the company is extending its lines. American electric railway apparatus is employed.

Flush Transfer Tables at the Union Railway Car House, New York.

Our illustration shows a new flush transfer table recently constructed by the White Manufacturing Company, of New York, for the Union Railway Company, of that city. The transfer table is located on the second floor of the railway company's new car house at Boston and Woodruff Avenues. It is of special construction, and designed expressly for electric cars in places where it is undesirable to cut the floor. It is built of steel throughout; the cross rails are of spring steel about fifteen feet in length, and slightly convex in shape. The ends of these rails are tapered, and designed to pass over and in line with the car house tracks. As the car is moved on the table the cross or spring rails are pressed down by the weight of the car a short distance which is allowed for clearance, and the ends rest on the track rails forming a solid connection.

Roller bearings are provided for ease in movement. The table is mounted on T rails, but travels so close to the floor that it can be operated on ordinary center bearing rails.



FLUSH TRANSFER TABLE—UNION RAILWAY, NEW YORK.

An endless differential chain arrangement is provided for moving the table, and one man can easily and quickly shift a motor car to any part of the house, and readily stop the table at the exact point required, thus avoiding the backing and filling so common in the old style of transfer tables. This table avoids the building of expensive pits. All the tracks being flush, cars can be run in and out and across the transfer table tracks without using the transfer table. This gives more storage room, and in case of fire the saving of rolling stock makes it most desirable. With the use of this table insurance is reduced. These tables are in use at Scranton Traction Company, Scranton, Pa.; Union Railway Company, New York, N. Y.; North Shore Traction Company, Lynn, Mass.; Brooklyn City Railway Company, Brooklyn, N. Y.; Broadway Cable Railway, New York City.

Statement From St. Louis.

The reports of the various street railway companies in St. Louis were recently filed in the office of the City Register for the first quarter of 1894. They are as follows:

RANK.	ROAD.	TRIPS.	PASSENGERS.
11	Baden & St, Louis R. R.	5,620	95,450
5	Cass Avenue & Fair Grounds Ry.	153,000	2,192,323
7	Citizens' Ry.	134,000	1,598,776
10	Jefferson Avenue R. R.	45,000	298,792
2	Lindell Ry.	260,218	3,626,186
3	Missouri R. R.	281,570	3,311 403
9	People's Ry.	50,268	898,129
4	St. Louis R. R.	168,908	2,367,218
6	St. Louis & Suburban Ry.	27,009	1,714,489
8	Southern Ry.	77,400	1,024,079
1	Union Depot R. R.	265,332	3,826,926
	Total for 1894	1,446,615	20,953,831
	Total for 1893	1,469,513	21,485,054
	Decrease	22,898	531,223

The Baden & St. Louis Railroad, Cass Avenue & Fair Grounds Railway, and Lindell Railway are the only companies which show an increase over last year in passengers carried, amounting in the aggregate to 1,388,099. Of this number 737,169 were carried by the Lindell Company, which is in part explained by the fact that their new Compton Heights line was recently put into operation. The decrease in the total is, of course, due to the hard times.

Cushioned Car Wheels.

The principle of the cushioned car wheel is a familiar one to our readers, and wheels of this type which are in use on steam and electric railways are giving good satisfaction. The Bass Machine & Foundry Works of Fort Wayne, Ind., manufacturers of the cushioned car wheels, are meeting with an especially large demand for these wheels for street railway service, owing to the long life under severe service, and noiseless features of its wheels, qualities which especially fit them for street railway service.

The center of the wheel is constructed of either steel or cast iron, of as light a section as is consistent with safety, and in form somewhat similar to the ordinary spoke car wheel. The tire is of steel, of standard form at the tread, and is provided with the proper annular flanges for securing it to the wheel center, the connection being made by rivets. The cushion, which is interposed between the periphery of the center and the inner surface of the tire, is of dense combination rubber, and has its outer surface encircled with a shield of either sheet steel or No. 20 iron, which is provided for the purpose of preventing crimping of the cushion when pressing on the tire.

In point of safety it is found that these wheels are perfectly secure, as their extensive use on steam railway cars runningat high speeds shows.

The great merit claimed for the street car wheels, and especially for electric motors, lies in the fact that the cushion receives all the pounding and vibrations caused by low joints, crossings, uneven tracks, etc., and thus relieves the entire equipment of all jarrings and pounding. Moreover, by using these wheels tires can be renewed without the necessity of pressing on and off the center. A cushion steel tire wheel, it is claimed, will outwear five to six cast iron wheels, thus saving all this annoyance and expense.

Prizes Offered.

J. G. White, the well known street railway engineer and contractor, offers a series of money prizes for general descriptive designs of an inexpensive car barn for small electric roads owning from ten to fifteen cars; also for contributions detailing the best methods of developing excursion travel on electric roads by means of amusement parks.

There are two series, each consisting of eight prizes, the first prize in each series being $100, the second $50, the third $25, and the remaining five $5 apiece. The awards are to be made by a committee of five gentlemen who are well known in street railway circles, and whose experience will enable them to justly determine the merits of the various suggestions and plans submitted. The names of competitors will not be known to the awarding committee, and its decisions will therefore be absolutely free from any personal bias. The winning papers will be retained by Mr. White as his property. To insure their receiving consideration, competitive papers should be mailed on or before June 1, to Mr. White, 29 Broadway, New York. The awards will be announced in our July number.

Full particulars of the conditions governing the competition are printed elsewhere in this issue, or can be obtained from Mr. White's office in this city.

A Large Steam Heating Plant to be Constructed in Scranton, Pa.

The Economy Heat, Light & Power Company, of Scranton, Pa., has contracted with the American District Steam Company, of Lockport, N. Y., for the construction of a steam heating and power plant, with underground mains (Holly system), to cost $150,000. The officers of the company are: Wm. Connell, president; Lemuel Amerman, vice-president; Lieut. Gov. Watres, treasurer; I. H. Burns, secretary.

The Stanwood Manufacturing Company.

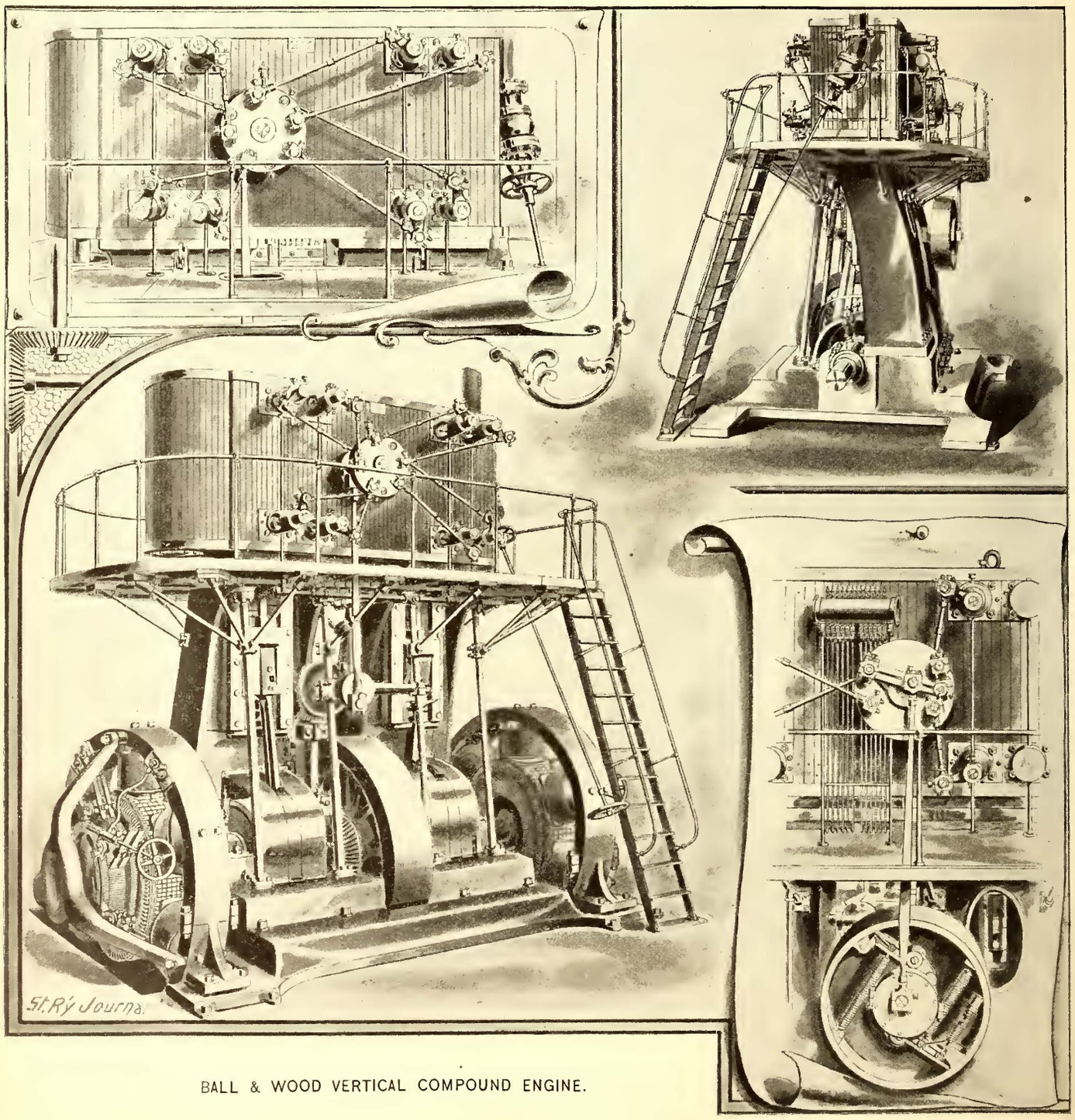
The Stanwood Manufacturing Company of 17th and Clark Streets, Chicago, has recently extended its business, and is now enjoying a large patronage. This company has been fortunate in securing the services, as superintendent of its electrical department, of Earl Atkinson, who has a wide reputation in electrical circles. Mr. Atkinson entered the service of the Edison General Electric Company in 1892, after having filled the position as foreman for three years of a department in the laboratory of Thos. A. Edison, at Orange, N. J. Mr. Atkinson is a good all-around electrical engineer as well as a thorough mechanic, having served an apprenticeship in the works of Inglis & Hunter.

The staff of this company also includes others of high mechanical and electrical reputation, and the company is well qualified to repair all kinds of electrical apparatus, which line of work is one of its specialties. The equipment of the company's shops is most complete, and all kinds of apparatus can be cared for.

A New Type of Vertical Compound Engine.

The development of the electrical industry has made repeated exactions upon the steam engineer. The first dynamos had to be run at prodigious rotary velocities, and required the utmost nicety of regulation. This demand was met by the single valve, high speed, automatic engine and shaft governor. The multipolar generator has made it possible to run the armature at a moderate rotative speed, so moderate that it can be attached directly to the shaft of a slow running, four valve, long stroke engine. Rotative speed, however, is still desirable as a means of decreasing the weight and cost of the directly attached electrical machinery. It is a fact, also, acknowledged even by the builders of the other types, that the four valve engine leads in economy, and there has been for some time a visible movement in the direction of controlling four valve engines through positive connections to a shaft governor instead of by means of the detachable connections which have been common to the type and which limit the number of revolutions which can be made per minute to about 100. Another property exacted by the variable nature of electric and cable railway work is the ability to cut off through a long range of the stroke instead of being limited to the first half with the alternative of carrying steam full stroke if cut-off does not occur during that time. In addition to the ever present demand for the highest efficiency, magnified in importance in electrical work by the relatively large proportion which the cost of power bears to the total operating expenses of an electric railway station, and by the increased size of the installations, has come a demand induced by the high cost of metropolitan real estate, upon which such stations must of necessity be situated, for the maximum amount of power in the minimum amount of space. Regulation, of course remains as important a factor as ever.

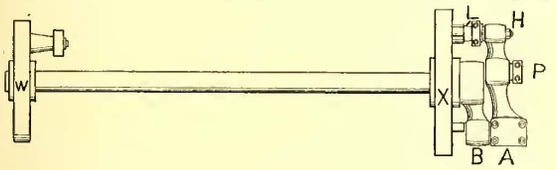
It is with a view of meeting these latest requirements that the engine under review has been designed by F. H. Ball, M. E., of the Ball & Wood Engine Company. It is an example of the tendency above alluded to, to avoid the restrictions placed upon the four valve engine by the releasing valve gear by bringing the steam valves under the control of a positively connected shaft governor; and it is in the original, ingenious and effective method by which this is done that the most distinctive feature of the engine consists. The general design and arrangement of the engine will be apparent from the accompanying engravings, for which, as well as for the data contained in this article, we are indebted to *Power*, New York.

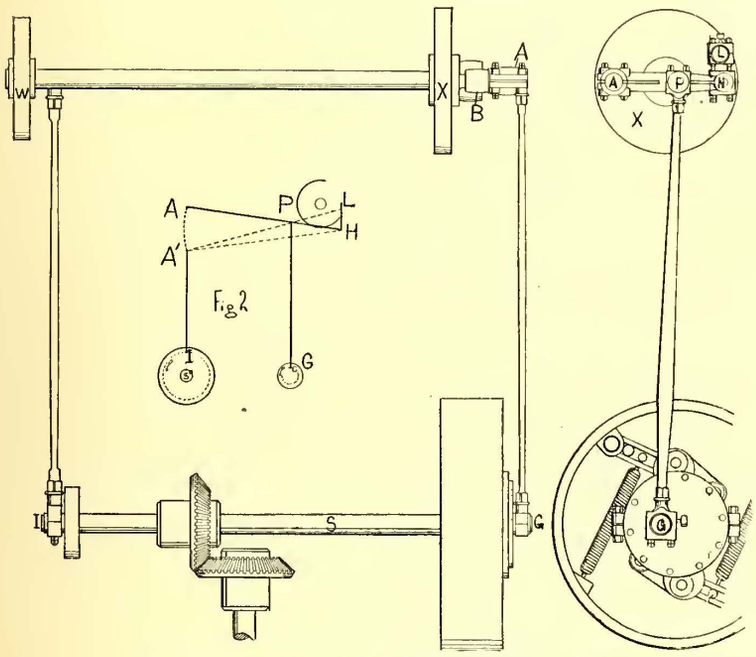


BALL & WOOD VERTICAL COMPOUND ENGINE.

It is a vertical cross compound with cylinders nineteen and thirty-one inches in diameter, twenty-four inches stroke, and designed to run at 150 revolutions per minute, at which speed it will develop 600 H. P., with 125 lbs. initial pressure, non-condensing. The valves are of the Corliss semi-rotary type, as will be seen by the section on the next page, all eight being driven from a single central wrist plate, as shown

in the front view. The situation of these valves in the cylinder heads reduces the clearance to between 3 and 4 per cent. Inside of the main steam valves are cut-off valves, operated by a separate wrist plate at the back of the engine, as shown in the lower right hand panel on the first page. The front of the main wrist plate receives its motion from the crank, *I* (see Fig. 1 on this page), upon a cross shaft, receiving its motion from the main shaft by gearing, as shown. All the connections between this wrist plate and the main shaft being positive, the steam and exhaust lead and time of closure for compression are constant, whatever the variations of load and pressure. The wrist plate, *X* (Fig. 1), from which the cut-off valves get their motion, is loosely mounted upon the same shaft as the fixed wrist plate, *W*, but at the back of the engine, and is connected to the governor in such a way as to receive a varying amount of motion in proportion to the





FIGS. 1 AND 2.—DETAILS OF VALVE GEAR.

load and pressure. Upon the back end of the cross shaft, *S*, is mounted a shaft governor so arranged that when the weights move outward they rotate the pin, *G*, about the shaft center, changing its angle with reference to the shaft and the crank pin, *I*, but preserving a constant throw or radius of eccentricity. The governor pin, *G*, is connected by a vertical rod to a pin, *P*, in the arm, *A*. The arm, *A*, is connected at one end to a pin upon the crank, *B*, which is keyed to the shaft, *t*, and is thus constantly vibrating through a fixed angle equal to that of the wrist plate, *W*, while the engine is in motion. The other end of the lever, *A*, is connected by a short link, *L*, to the variable wrist plate. Now in the little outline sketch marked Fig. 2, as the shaft, *S*, is rotated, the end of the lever, *A H*, is moved up and down through the arc, *A A'*, about the point, *H*, as a center, and there is no tendency to move the plate, *X*, about its center. This condition would continue if another connecting rod, *P G*, were attached to the lever, and the pin, *G*, moved in exact accordance with the pin, *I*, so as to make the upper end of its rod follow the movement of the point, *P*. If the pin, *G*, were held still, however, the lever, *A H*, would act over the point, *P*, as a fulcrum, and communicate motion to the plate, *X*, through the link, *L*, as shown by the dotted line in *A'PL*. The same effect would occur if the angular position of the pin, *G*, with reference to *I*, were changed, so that the pin, *P*, no longer moved coincident with *A*, the amount of motion imparted to *X* depending upon the difference in the angular positions of the two pins. It is upon this principle that the cut-off valve is operated in the engine under review. The crank, *B* (Fig. 1), is constantly vibrating through a fixed angle, carrying the lever, *A*, with it, just as we have imagined it to move in Fig. 2, where the lever, *A*, is represented by *B H*. It makes no difference in the result that the motion from *I* is taken up through *W* and *S* and *B*, as these connections are all positive and the effect just the same as though the connection were direct, as Fig. 2 shows it. When the governor is in the right position to move, the point, *P*, in accord with the movement which the lever, *A*, receives from the crank, *B*, which is when the weights are in their home position, the wrist plate receives no motion, the cut-off valve is inoperative and admission continues until the main valve cuts off at three-quarters stroke. As the weights fly outward the pin, *G*, is rotated, moving the pin, *P*, in a different phase from that of the crank, *B*, and the reaction thus set up between *B* and *P* is effective in moving the end, *H*, of the lever, and through the link, *L*, the wrist plate and cut-off valves. As these valves are under an unbalanced pressure only during the short interval between the cut-off and the point at which the main valve closes the port, the governor has little to do in operating them, and promises to be very sensitive and effective.

The gears by which the entire valve and governing mechanism is operated are something of an innovation in American practice, although they are much used abroad. One gear of each pair is of fibre; they run very smoothly and quietly, and furnish a positive connection between the piston and valve movements which nothing short of the breakage of the heavy gears can interrupt. If the gears become deranged it is not as though the governor belt broke on the usual engine, for although the moving power of the governor would be destroyed, that of the valve motion would cease also and the engine would come to a stop.

The main shaft is ten inches in diameter in the bearings, and carries at its ends the armatures of two 200 K. W. generators furnished by the General Electric Company. Another interesting little detail is connected with the bearing, and shown in Fig. 3. Upon the shaft just outside of the bearing is shrunk a cast iron disk, tapering toward the

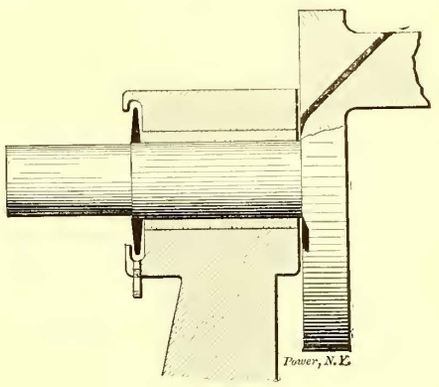


FIG. 3.—SECTION OF BEARING.

edge. The housing of this bearing is extended over the edge of this disk, forming a groove. When the oil working through the bearing and along the shaft reaches this disk it is carried outwardly by centrifugal force, and discharged into the surrounding groove, from which it is dripped as shown. The oil, which works out on the other side of the bearing, is caught in a similar groove cut in the crank disk, from which a channel leads it to the crank pin. The general oiling of the engine is accomplished from a tank at the back of the low pressure

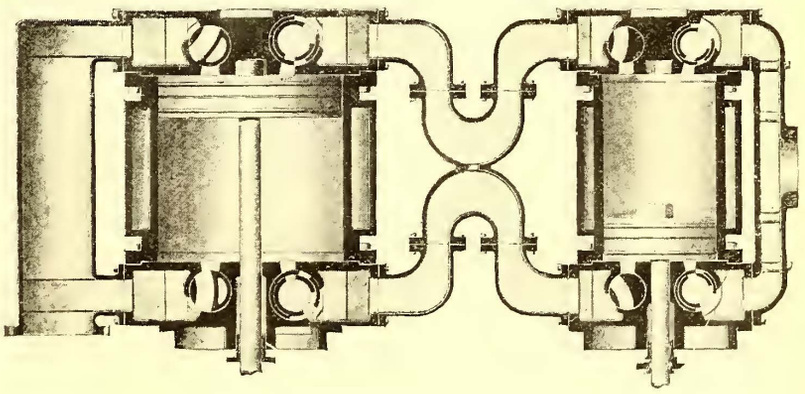


FIG. 4.—SECTION OF CYLINDERS.

cylinder, best shown in the panel illustrating the governor and cut-off wrist plate. This tank contains about two gallons of oil, and discharges through twelve sight feeds into oil tubes leading to the different points requiring lubrication.

Mr. Ball is a designer who is not content with following the highways of ordinary practice without exploring to an extent the openings which offer to lead to pathways of improvement and advantage. In the design of this engine he has struck such a trail, which promises to lead to some interesting developments. While some attention has in the past been necessarily paid to the momentum and inertia effects of the piston and its connections to the main shaft, it has not been considered what the effect of the momentum of the wrist plate and its connections might be on the quiet and easy running of the engine. With the heavy wrist plate and its eight connecting rods used on the engine under review, and at the rather high rotative speed contemplated, this factor assumes considerable importance, and Mr. Ball found by calculation that it involved a blow of more than half a ton on the wrist plate connections every time the direction of the valve mechanism was reversed. A simple means is at hand, however, to overcome the difficulty. Flat

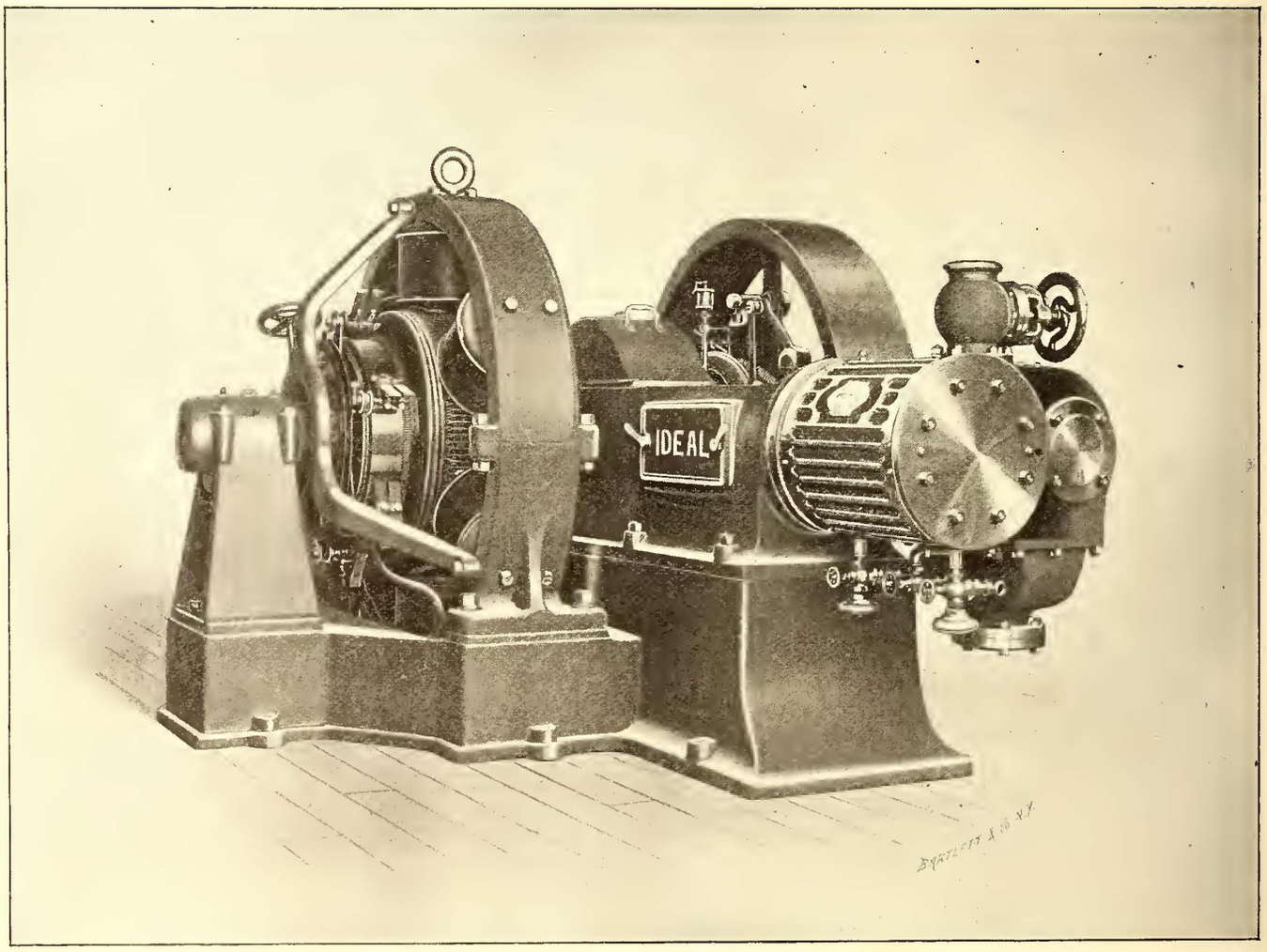
coil, or spiral springs are attached to the shaft which carries the wrist plate, one pair at each end, the springs forming each pair set so as to oppose each other and to hold the wrist plate naturally in its central position. As the wrist plate moves away from the center, its motion is opposed by the springs, whose increasing tension is thus made available to counteract the momentum of the system to bring it to rest and start it off on its return, the tension of the springs becoming zero when the wrist plate reaches the center, and the same action occurring on the other side. If forced to its extreme travel on one side and released, the wrist plate would vibrate back and forth under the action of the spring, like the balance wheel of a watch, until brought to rest by friction. The rod has simply to overcome this friction and keep the plate in motion, and is entirely relieved of the alternating and severe thrusts due to getting the heavy parts in motion and stopping them twice every revolution. The springs are beneath the lagging entirely out of sight. The engine, as a whole, presents a handsome and compact appearance. Heavy cast iron frames at the back and light steel columns in front support the weight of the cylinders and the thrust of the pistons. The cranks are set at 180 degs. apart, and a central flywheel is provided in addition to the weight of the armatures to insure steady running past the centers. The central bearing is vertically adjustable by wedges. No provision is made for detaching the wrist plate and working the engine by hand, as this would involve complications with the cut-off valve, which does not move with the main wrist plate, and the plate would move with difficulty against the action of the springs. Simple means are provided for barring the engine off the center, should it stop in this position. The style of guide and cross head is well shown in the large engravings. The exhaust valves are provided upon their back ends with relief valves of ample capacity, and all the valves have upon their front, or bonnet, ends gibs, by which the stems may be kept central and free from lost motion. This first engine is ordered by the Chicago Edison Company (Samuel Insull, president), for its Wabash Avenue and 21st Street station, and we anticipate that the reports of its performance will be interesting, and will confirm the good opinions expressed by engineers.

It is reported that an important consolidation has taken place in Kansas City, including the properties of the Kansas City Cable Railway Company, the Grand Avenue Cable Railway Company, and the Independence Rapid Transit Company. The new company will be known as the Kansas City Railway Company and will have a capital of $5,000,000. The officers will be Walton H. Holmes, president; Daniel B. Holmes, secretary; W. B. Clark, treasurer, and C. F. Holmes, general manager. The lines involved cover sixty miles of track.

Direct Connected Engine and Dynamo.

Almost every one directly or indirectly interested in steam electric engineering in these latter days is anxious to see the best combined arrangement of engine and dynamo showing most modern characteristics. We are pleased to be able to illustrate in our columns a direct connected steam electric combination which we feel sure will attract attention.

The engine is the "Harrisburg Ideal," self oiling pattern, cylinder twelve inches diameter by twelve inches stroke, manufactured by the Harrisburg Foundry & Machine Works, Harrisburg, Pa. The dynamo is the product of the General Electric Company, 50 K. W. capacity, speed 275 revolutions per minute, 420 amperes, 110 volts, and obviously of the multipolar type. There is an immediate impression of strength and solidity about this combination which at once strikes the eye, and simultaneously an appearance which a closer examination fully justifies, of compactness and simplicity.



DIRECT CONNECTED IDEAL ENGINE AND DYNAMO.

The self oiling, out-board bearing feature in the "Harrisburg" Ideal engine shown, is designed on a generous model, and has the latest arrangement of movable sleeve with ring oilers, being, except for increased weight and size, almost the same construction as the standard Edison bipolar dynamo bearings which have, by years of universally good service, proved the merit in them.

A test of the Ideal-General Electric combination made recently in New York City, in the presence of several gentlemen unusually well informed on steam and electrical matters, will be of interest to our readers: The engine, and of course the dynamo, was started in the usual manner under steam, and when running at the desired speed of 275 revolutions per minute, the brushes were adjusted and engine and dynamo prepared for undertaking the load. The switchboard was also arranged so that the entire current of power generated would pass through two switches side by side. A five cent nickel was balanced on edge on the outer end of the cylinder head, the engine running at "friction load." The two switches were then taken in hand and thrown in instantly, the meter showing 340 amperes. The switches were thrown out in seven seconds, then in and out again, thus throwing upon the engine practically the full load of the dynamo twice within fourteen seconds, during which the five cent piece remained balanced on the cylinder head, showing the combination to be operating absolutely without any vibration whatever.

There are now between thirty and forty Harrisburg Ideal electric direct connected combinations in successful operation, nearly every one of which was installed by the New York and New England representatives of the Harrisburg Foundry & Machine Works, W. R. Fleming & Co., 203 Broadway, New York, and 620 Atlantic Avenue, Boston.

An Anti-Concussion Motor Truck.

The accompanying illustrations give a good idea of an anti-concussion electric motor truck lately invented by Wm. Sutton, president of the American Car Company of St. Louis, and for which letters patent have been granted. A mere glance at the scheme of the truck will reveal the fact that it is the result of a great deal of thought and thorough experience on the part of the inventor. It has been built on independent lines with the idea of doing away with the oscillation of the car body without employing the familiar extended spring base feature.

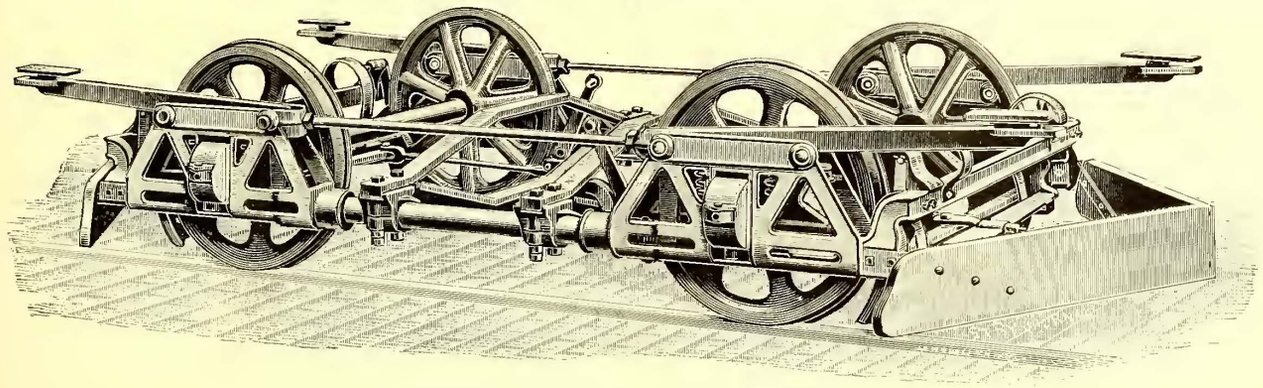


FIG. 1.—NEW TRUCK—AMERICAN CAR CO.

The car body rests directly on the four bellcrank, equalizing levers shown in the illustrations, a rubber cushion intervening between the end of each lever and the body, so as to ease off the lever action. The cushion has replaced a ball bearing which was at first employed. The fulcrum of each of the levers is on the inside of the pedestal and this is where the oscillation is prevented, and not by extending the spring base beyond the wheels, as in the ordinary non-oscillating truck. As the weight of the car depresses the levers, their vertical arms have a tendency to become horizontal, or, more properly, their motion is nearly horizontal, and thus they each press against a volute spring held in place by the heavy piece connecting the pedestals and supporting the motor hangers. There is a small spiral spring opposite each volute spring, and also joined to each vertical arm on the opposite side which takes up the recoil. When the front wheels of the car strike an obstruction the blow is thus changed from a vertical to a horizontal one by means of the horizontal motion of the vertical arm of each lever, as above described. In the ordinary extended spring base truck striking an obstruction is attended with complete lifting of the car body on account of the spring base being near the end of the car, while in the truck under consideration it is nearer the middle of the car, although the latter rests on the levers at its ends, the motion in encountering the obstruction being thus eased off gradually. The pedestals come in for strains from several directions, and are thus of the form shown. They are made of steel, and will stand a tensional strain equal to that of the best wrought iron.

The ends of the pedestals are circular, and bored for the pieces connecting the same. The pieces are nothing more than heavy gas pipe, and are filled with wood tightly packed under the same pressure as is used for pressing car wheels on to axles. The wood thus inserted deadens the vibratory sounds common to pipe. The motor hangers or carrying bars are clamped to the connecting pieces and held rigidly in place by strong brackets, which also serve to keep the truck square. The brake mechanism operates in the manner usual to motor trucks, but the brake beams and connections are hung to unusually heavy cross pieces, thus providing great strength. The fender has a tendency towards the cow catcher type without the height of the latter, yet possessing its advantages. The American Car Company's dust-proof box is used in connection with the truck.

In putting this truck on the market the inventor is not desirous of claiming the "earth" for it, but wishes the street railway fraternity to examine it carefully and intelligently in order to satisfy themselves as to its superiority. There are advantageous features in the practical running of the truck which we have not the space here to outline.

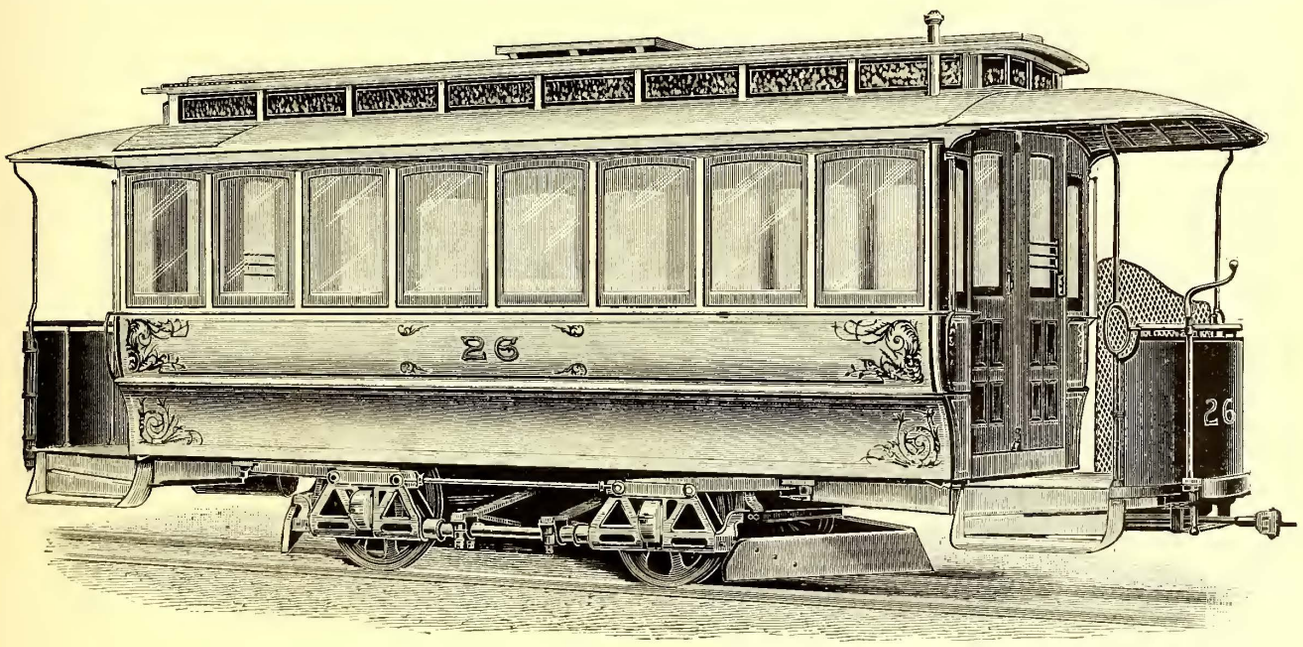


FIG. 2.—CAR AND TRUCK—AMERICAN CAR CO.

A New Fuel.

The following, according to C. W. Chancellor, United States Consul at Havre, is Maestracci's method of manufacturing petroleum bricks as fuel:

Mix one litre of petroleum, 150 grammes of triturated soap, 10 per cent. of resin and 333 grammes of caustic soda. Heat this mixture, being careful to stir it well meantime, until solidification commences—say about forty minutes. If the mixture should tend to boil over, pour in a few more drops of soda, and continue to stir until solidification has sufficiently progressed, then pour the semi-fluid material into moulds to form the bricks, and place these in a hot room or drying place for fifteen minutes; then remove them and let them cool. In a few hours they can be used as fuel.

To the three elements, which constitute the mixture, Mr. Maestracci recommends the addition of 20 per cent. of sawdust and 20 per cent. of clay or sand, which makes the bricks more solid and less expensive. Trials of these bricks as fuel have been made at Marseilles on several tugs, and it has been found that, weight for weight, they develop three times as much heat as the ordinary coal brick, and leave no ashes.

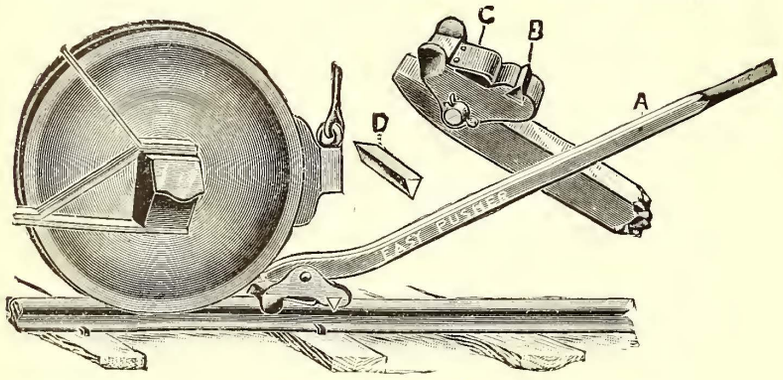
It is expected, with some slight changes in the furnaces, to arrive at still more perfect results, not only in the increased heat, but in the entire suppression of smoke, and on the most economical basis, one kilogramme of the solidified material being equal to four kilogrammes of coal. These experiments seem to be very interesting, and it is quite easy to understand that there is a double advantage in using such fuel, as they economize in both space and cost.

The Easy Car Pusher.

The car pusher shown herewith is manufactured by the R. Woodman Manufacturing & Supply Company, of Boston, Mass., and is in use on the lines of the Lynn & Boston Street Railway Company, the Erie Electric Motor Company, the Metropolitan Street Railway Company of Boston and other roads, as well as upon a number of steam railways. The bar is steel, and tempered at the point so as not to wear. The "heel" is malleable, and the triangular "bit" is made of the finest tool steel.

As shown in the cut, the heel has lugs extending downward on both sides of the rail so as to hold it firmly in position and prevent it slipping sideways, and the triangular bit or steel, marked "B," cuts into the rail when pressure is applied and prevents slipping backward, even though the rail is icy, greasy or wet. This bit can be inverted until the three points are dull and then sharpened. When the pressure is released the steel spring, marked "C," lifts the sharp steel bit from the rail, thus saving it from being dulled, by sliding over the rail when following the wheel.

The total weight of the pusher is twenty pounds.



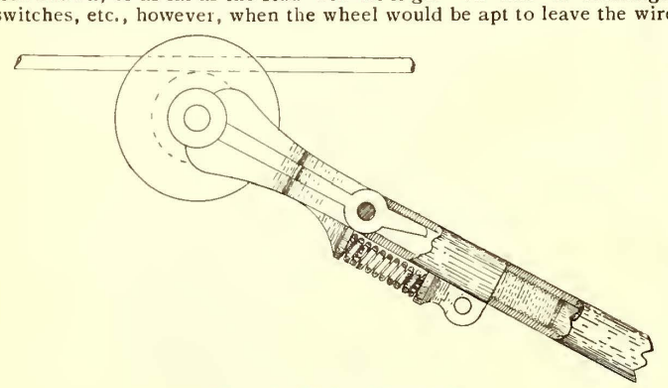
EASY CAR PUSHER

A New Trolley Head.

The trolley head shown herewith was invented by John E. Anger, of the Gilbert Car Manufacturing Company, and is intended to give a constant pressure against the wire, thereby preventing the trolley from jumping off. As will be seen, the harp is hinged at the top of the pole, the lower end of the harp being provided with a stud which moves inside a casing at the top of the pole. A small compression spring is carried at the top of the pole in the position shown.

When the pole is against the wire the regular trolley springs are so strong as to compress the small spring until the harp is in the position shown, or as far as the stud will let it go. In case of crossings, switches, etc., however, when the wheel would be apt to leave the wire on account of the trolley springs acting too slowly, the small compression spring will keep the wheel close to the wire, preventing its leaving the latter with consequent sparking.

The arrangement of the hinge, of course, keeps the upper part of the pole from vibrating sideways, while giving complete flexibility vertically.



SPRING TROLLEY HEAD.

Annual Meeting of the Brush Electric and Short Electric Railway Companies.

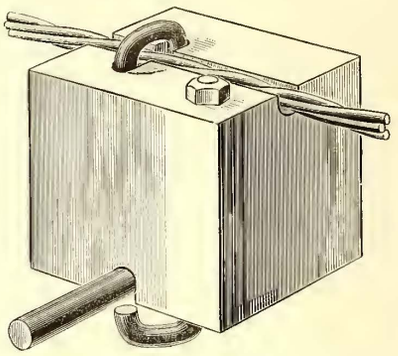
The annual meeting of the Brush Electric Company was held March 26, and the old board of directors elected. The officers elected were as follows: W. H. Lawrence, president; C. A. Coffin, first vice-president; S. M. Hamill, second vice-president (*vice* John S. Bartlett resigned) & general manager; B. F. Miles, treasurer; W. B. Bolton, general counsel; L. H. Rogers, assistant general manager; A. H. Hough, secretary, C. W. Phipps, superintendent; C. N. Black, assistant superintendent.

The Short Electric Railway Company the following day elected its old board of directors and the following officers: B. F. Miles, president; Bethune Duffield, Detroit, Mich., secretary and treasurer; S. M. Hamill, general manager.

Trolley Guard Insulator.

The accompanying engraving shows an insulator for trolley guard wires manufactured by the Hammond Cleat & Insulator Company, of Boston. This insulator is made of one piece of porcelain, and mostly for appearance's sake is japanned black. Of course, japan being also an insulator, it will be readily seen that the guard wire is thoroughly insulated. The illustration of this device shows it so well that further explanation of its uses is needless. It might be well to state, however, that the only metal part in connection with it, the hooks and nuts, are galvanized so as to withstand the weather. This insulator is made to serve the purpose of a strain insulator, if it should be necessary to put it to this use.

The managers of the West End Street Railroad Company, of Boston, Mass., have thought so well of this insulator that they have placed an order with the Hammond Cleat & Insulator Company for 1,000.

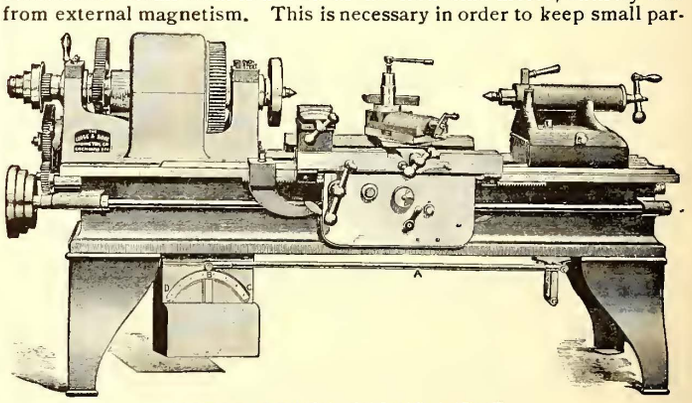


TROLLEY GUARD INSULATOR.

Motor Driven Engine Lathe.

We present herewith a view of a lathe, in which the design includes an electric motor, taking the place of the usual cone pulley. The lathe is reversed and the speed regulated by the movement of the rod, A. This with the back gears, arranged as usual, gives not only a much wider range of speeds than can be obtained by cone pulleys, but a much more finely graduated speed than can be obtained by cone pulleys; in fact, the speed may be anything from the highest to the lowest desired.

The armature is wound on a phosphor bronze spider with a carrier disk which revolves freely on a spindle as a cone pulley. It is surrounded by the pole pieces and entirely inclosed in housing. This construction forms what is known as an iron clad motor, entirely free from external magnetism. This is necessary in order to keep small particles of steel and iron from adhering to the lathe, and making it impossible to keep the same clean.



MOTOR DRIVEN ENGINE LATHE.

Among the advantages secured by the direct application of electric power are that tools may be placed independently of fixed conditions overhead, such as shafting, cranes, etc., and with regard to the arrangement best suited to handle the product most conveniently. The operator has also the best control of his machine, especially when a variable speed is necessary.

The lead screw is placed on the inside of the bed, directly under the front V, and is enclosed in a brass tube, protecting it from dirt and chips. In this position it takes hold of the carriage directly under the line of strain, and obviates that twisting tendency which is so common in lathes, where the screw is placed on the outside of the bed. All the feeds of the carriage can be thrown in and out or reversed from the front of the apron. This is a particularly desirable feature, inasmuch as the operator is not compelled to leave his work, and it does away with the complicated gearing in the headstock. The carriage is provided with a stop, which throws out the feed automatically, and may be set at any point along the ways. This is very convenient for turning or boring a given length, and also prevents the lathe from being damaged by any carelessness of the operator. The spindle is hollow and of large diameter; the boxes are made from the best phosphor bronze, and are provided for taking up wear.

The manufacturer, the Lodge & Davis Machine Tool Company, of Cincinnati, O., is giving special attention to equipping the various classes of machine tools it is building with electric motors.

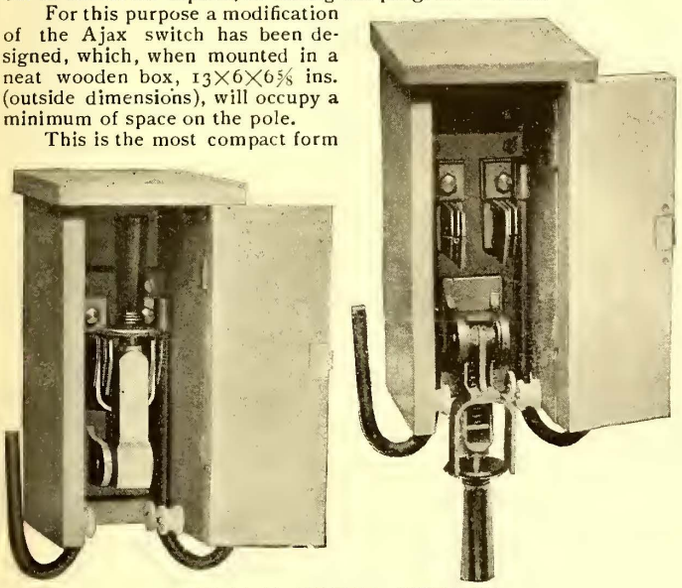
The motors, which are furnished by the Card Electric Motor & Dynamo Company, of the same place, are simple, substantial, and of sufficient capacity for maximum load, entirely free from complication and requiring very little attention in use.

Ajax Line Section Switch.

Many electric railways have been built and operated, without any means of disconnecting a part from the rest of the line, or of dividing the entire system into sections; but the operators have sooner or later discovered the convenience, or necessity of inserting section insulators and switches, so that certain sections of the trolley wire might be cut out of circuit for repairs, or during the progress of a fire.

For this purpose a modification of the Ajax switch has been designed, which, when mounted in a neat wooden box, 13×6×6⅝ ins. (outside dimensions), will occupy a minimum of space on the pole.

This is the most compact form



AJAX LINE SECTION SWITCHES.

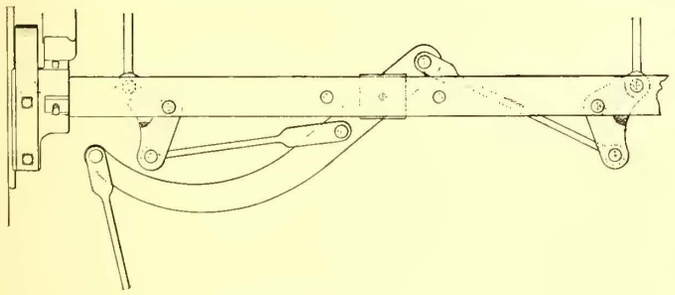
of the Ajax switch yet designed, and it is calculated to maintain the claims to superiority in conductivity and breaking capacity for which the Ajax switches are justly noted.

In some cities an ordinance compels the railway companies to so arrange their circuits that no section of trolley wire shall embrace more than two blocks of continuous conductor, and that each section shall be controlled by a switch placed within easy reach of the firemen.

Even where such provision for the convenience of the firemen is not compulsory, it often will be found an advantage to the railway companies to adopt such a system on thickly settled streets; for without the section switch at hand, the firemen will soon learn to use their clippers or axe to sever the wires, rather than work among heavily charged conductors, so that the section switch may be termed an economizer of repairs, as well as a preventative of delays to traffic. The types of line switches shown are manufactured by C. S. Van Nuis, of New York.

Floating Center Equalizing Brake.

The advantages resulting from equalizing the pressure of all the brake shoes on a street car truck have led to the adoption of the floating or sliding center shown in the accompanying engraving. This principle has been employed on steam railway cars, and by its means each



FLOATING CENTER EQUALIZING BRAKE.

wheel receives the same pressure as every other, regardless of the wear or thickness of the shoes, so that worn and new shoes can be used on the same brake. This brake, which has been brought out by J. E. Anger, of the Gilbert Car Manufacturing Company, has been in use for over a year on a number of trucks, with excellent results.

The brake head is also adjustable up and down, so as to bring the pressure square against the wheel. In this way the shoes are worn out equally, and for the full bearing of the shoe,

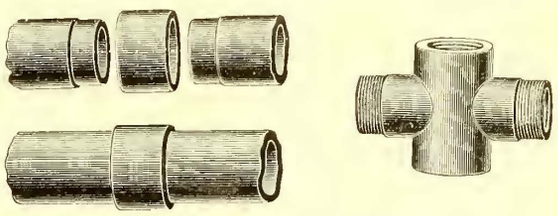
Fibre Conduits.

The Fibre Conduit Company, of New York, has recently constructed a mill at Orangeburg, N. Y., for the manufacture of fibre conduit for electrical purposes. All the machinery in the factory is operated by electric power, and the company intends to be able to supply promptly all the demand for material of this character.

Fibre conduit is made of wood fibre, treated with an insulating and preserving compound producing a hard and solid substance. It is made into tubes on a machine designed for the purpose by Prof. Henry Fairbanks and Howard Parker, of St. Johnsbury, Vt., the product and machines being protected by numerous patents. The tubes are completely saturated with a mixture which makes it acid and alkali proof.

The finished pipe is in five foot lengths, and is uniform in thickness, with smooth surfaces. Sections with connections are shown herewith. As the conduit is an insulator, there can be no danger of its decomposition by electrolysis, which has caused so much trouble in a number of cities where electric railways are in operation.

The conduit is also non absorbent, nor does it contract or expand with varying temperature; it is, therefore, free from the splitting and checking, corrosion and disintegration which injure wood and iron. It is also tough, elastic and strong. A standard three inch pipe will



PARTS OF FIBRE CONDUITS.

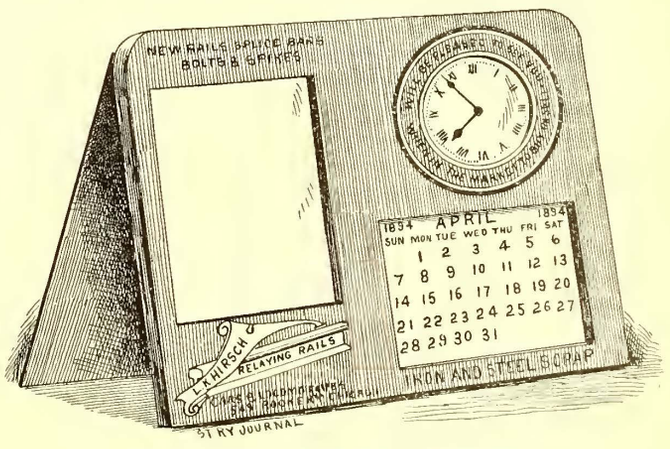
safely bear a crushing weight between two plane surfaces of 800 lbs. per lineal foot, and will stand a pressure of 450 lbs. at the center of a five foot length supported at both ends. Its bursting strength is over 125 lbs. per square inch. Its insulating properties are shown by the fact that a conduit seven-sixteenths of an inch thick has been tested on a 20,000 volt, alternating current without any perceptible effect.

Among the miscellaneous advantages claimed for it are that moisture does not condense on the surface as in metal pipes, and it will stand exposure to a temperature of 200 degs. F. without weakening, and will carry liquids at 150 degs. F. at considerable velocity without injury; it is easily cut with ordinary tools, and joints, fittings, etc., introduced at any point. The Fibre Conduit Company on May 1 moved to new offices at 257 Broadway.

A Calendar and Clock Combined.

A handsome souvenir in the form of a calendar has been issued by L. K. Hirsch, of the Rookery, Chicago, the well known dealer in rails, splice bars, cars, locomotives and all kinds of railway material

The souvenir is in the form of a desk tablet, covered with Russia leather, and containing a calendar, small clock and frame for a por-



CALENDAR AND CLOCK COMBINED.

trait. The calendar, of which we present an engraving, is stamped with Mr. Hirsch's name and address, and the request to correspond with him when in the market to buy or sell.

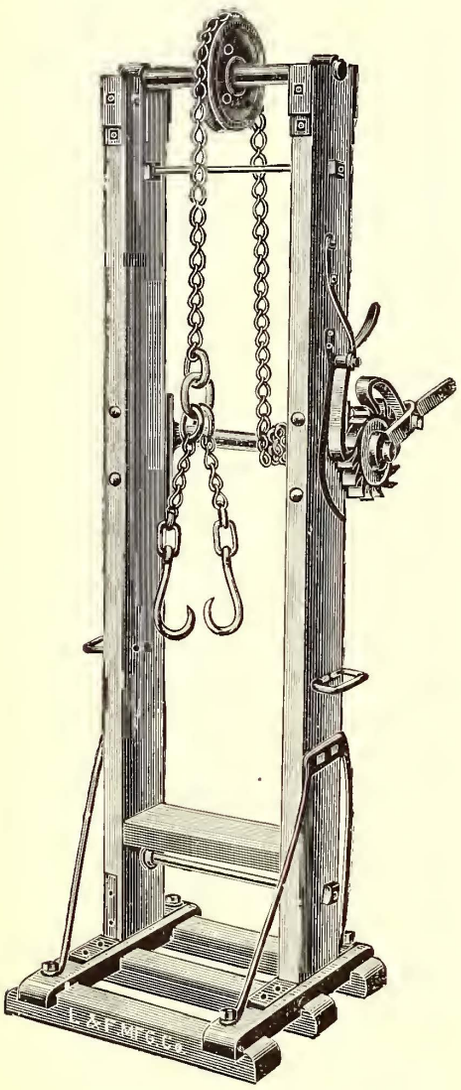
As a desk ornament and tasteful advertisement combined, this calendar is certainly a success.

AN officer of a Cuban street railway company, who was recently in New York securing bids for electric railway construction, was the shipper of the large cargo of arms and ammunition on the "Alert," intended for the Cuban insurgents. The ship was captured by the authorities of that island.

The "Acme" Car Jack.

A valuable part of the equipment of even the smallest street railway is a car jack, and repair shops of street railroads and hurry-up wagons are not completely equipped unless supplied with them. The jack shown herewith was manufactured by the Lewis & Fowler Manufacturing Company, for use in its own shops, and was found so very convenient that the company has decided to manufacture others for sale. They are equally well adapted for use in the shops, or anywhere along the line, and being capable of quick adjustment and action, they are time and money savers. The method of use is evident from the engraving.

The jacks are sufficiently powerful to lift the heaviest cars, yet are very easily operated, so that two men can raise a car quickly and safely with very slight effort. When raised, the jacks will hold the car firmly for any length of time required, without danger to those working under it. The construction is simple, and no part is liable to get out of order. Though easily handled and not unwieldy, the jacks are very strongly built.



"ACME" CAR JACK.

A Suspended Railway Bridge Across Niagara Falls.

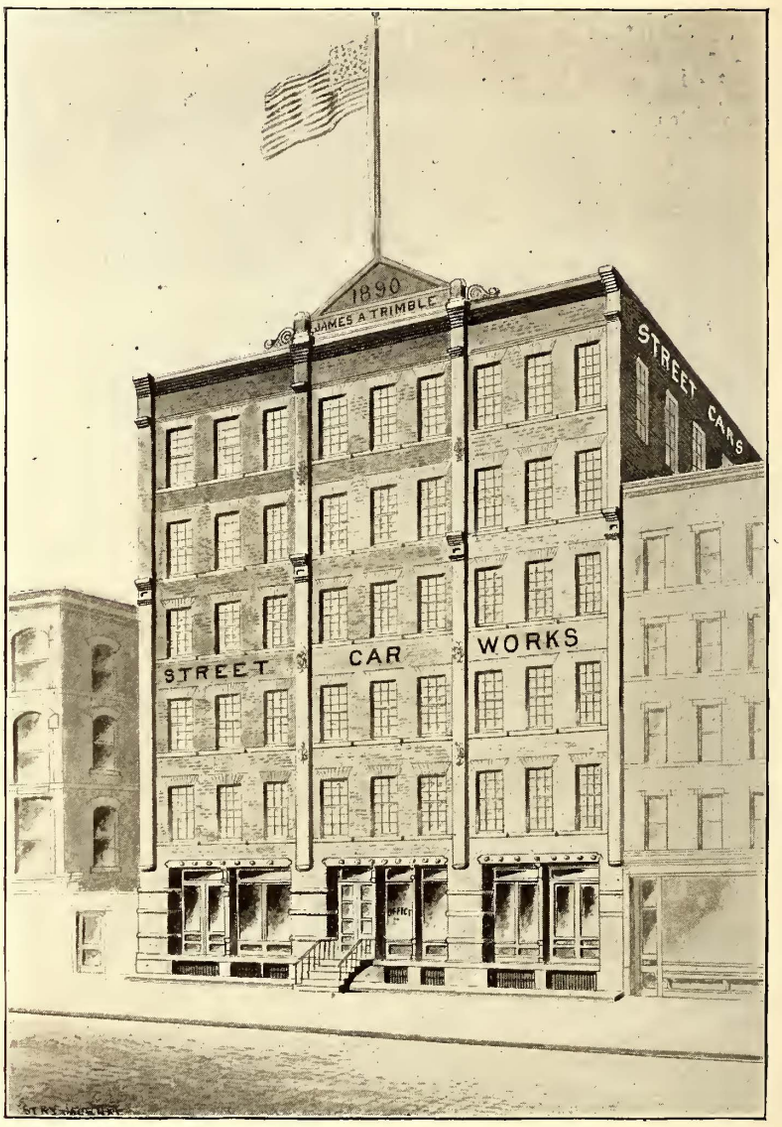
There is a possibility of the construction of a suspended railway bridge across Niagara Falls. The bridge, if constructed, will be stretched between the Clifton House on the Canadian side and the Davis Museum. It will be built by the Gagnier-Griffin Suspended Bridge Company, of Chicago.

This company is the owner of the patents granted to Barney J. Gagnier, of Detroit, Mich, for suspended railways, which supply a long felt want under many conditions. The system can be used for the transportation of passengers, teams, wagons, and all kinds of freight. For pleasure resorts, climbing mountains with small power at very little expense, passengers can be handled with facility and dispatch, and the system specially recommends itself as a park attraction for street railways, river bridge at street railway termini, etc.

The James A. Trimble Car Works.

The name of James A. Trimble is closely associated in the minds of street railway men with the subject of cars, and Trimble cars and car woodwork have a wide reputation for excellence of construction, durability and fine finish. The Trimble car works were started in 1869, in a small shop next to the present building, and were originally devoted to the manufacture of street car woodwork. The present works of Mr. Trimble are located in the handsome six-story building, Nos. 218 to 222 East 28th Street, New York, shown on this page. The building is of buff brick with stone trimmings.

The mill is located in the first story of the building and occupies that entire floor with the exception of about 20×25 ft., which is devoted to offices. The mill is completely equipped with the latest and most approved wood working machinery.



THE JAMES A. TRIMBLE CAR WORKS.

The second floor is used as a drafting room and pattern shop, also for light iron work machinery. On the third floor all of the cabinet work is done, and on the fourth floor is located the body erecting shop. The fifth and sixth floors, respectively, are devoted to painting, varnishing and finishing the products of the works.

The building is lighted on four sides by large windows, and all the ceilings are twelve feet in the clear, giving plenty of light and ventilation. The building throughout is equipped with the most improved machinery and appliances for turning out first class work. As only thoroughly seasoned wood is used, the equipment of the works includes a large stock, which is carried from year to year, so that the wood employed is from five to eight years old, and thoroughly seasoned.

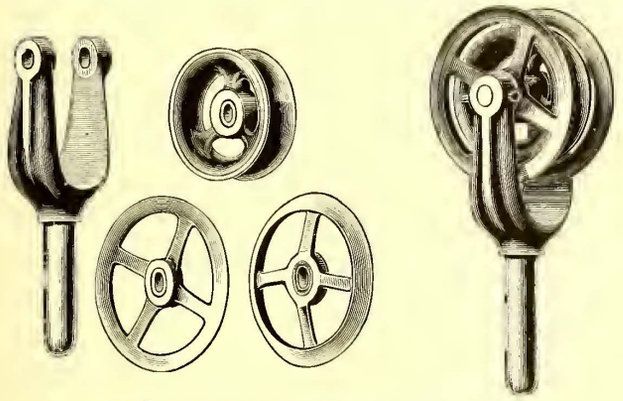
Mr. Trimble has been a prolific inventor, and has taken out patents for a number of improvements for street cars. Among these are a combination buffer and drawbar, a variable signal light, drop sash for high window cars by which a closed car can be made practically into an open car, a door sheave and a cam movement brake handle. All of Mr. Trimble's car work is interchangeable, facilitating its application.

Mr. Trimble is a native of New York, having been born in that city in 1847, and has had a large experience in street car building.

The McGuire Manufacturing Company, of Chicago, has decided to open a New York office.

The "Economy" Trolley Wheel.

We illustrate herewith a trolley wheel which has lately been put on the market by the Economy Trolley Wheel Company, of Chicago, Ill. These wheels have been in use for several years, during which they have gained a high reputation. The wheel is made in three parts, the hub and the two flanges, each of which moves independently of the other. The flanges are of steel and the center hub of brass. The latter of course receives the most wear, and can easily be renewed. When on the straight line nothing moves but the center pulley, which



THE "ECONOMY" TROLLEY WHEEL.

can be renewed for fifty-five cents, and four extra centers will last a year. The manufacturers state with confidence that this wheel will not spark.

It is now in use on the South Chicago Street Railway line, and also on the Calumet line, on both of which roads it is giving entire satisfaction. This company claims to save one third of the friction on the trolley wire by using this wheel, and that the wheel will wear three times as long as any other wheel in use; it contains a graphite bushing and is also a self oiler.

Second Annual Report of the General Electric Company.

The annual report of the General Electric Company for the year ending January 31, 1894, was presented to the stockholders of the company early in April. As was expected, the report shows a great loss during the year past in valuation of assets.

On January 31, 1893, the assets were examined and valued, and a report on the condition of the company was made to the stockholders at their annual meeting in April last. This examination was conducted under rigid instructions from the Board of Directors, that material on hand, stocks, bonds, customers' notes and accounts, etc., should be carefully scrutinized, and should be valued on a most conservative basis. The complex organization then existing, and the fact that the amalgamation of the various interests represented by the company had been so recent, made the task an especially difficult one at that time, but the statement made by those directly responsible to the board was that the instructions of the directors had been strictly carried out.

The company had inherited stocks of manufactured goods in the principal cities in which district offices were located, from Boston in the East and Atlanta in the South, to San Francisco and Portland in the West. Notes and accounts receivable, stocks, bonds and other assets were similarly distributed. Each district office had exclusive charge of, and was presumably familiar with, the value of its own assets, and was largely independent of the general office. This defective system, since abolished, rendered it exceedingly difficult to arrive at correct conclusions, and notwithstanding the efforts of the officers, it led to grave mistakes in the estimates of value of accounts, securities and inventories of merchandise.

The Edison Company, to a small extent, and the Thomson-Houston Company (the organization of which was mainly adopted by the company), to a greater extent, had been in the habit of doing more or less exploiting work, resulting in the acquisition of stocks and bonds of local lighting and railway companies. The Thomson-Houston Company had generally been very successful in marketing these securities at profitable figures. By the facilities which it had thus been able to afford to local enterprises, it was enabled to expand its business. The company at the time of its organization assumed a large number of such transactions which were in progress or contracted for. The general policy of the board, however, since the organization of the company, has been to curtail transactions involving the acceptance of stocks or bonds for anything other than license rights, except where for some special reason it has been deemed advisable to accept them, as in settlement of disputed or doubtful accounts.

Among the most important transactions of the character above referred to, were those with newly organized companies, and this class of business has been very extensive in the South and West. The financial and industrial collapse in these sections in the spring and summer of 1893 affected the company severely, and very many accounts, notes and investments assumed as good a year ago must now be recognized as of diminished value. The same is especially true as to the Northwest, where the company's output was sold through the Northwest General Electric Company, formerly known as the Northwest Thomson-Houston Company.

The Thomson-Houston Company had large interests in various construction and manufacturing companies, notably the above mentioned Northwest Company, the Fort Wayne Electric Company, the Brush Electric Company, and others; the whole standing on its books at about $5,500,000. At the time of the last annual report, statements were obtained from the officers of such companies, and it was estimated that something less than one-half of this investment was represented by patent rights and something over one-half by other assets. Unknown to the Board of Directors, some of these companies became unduly expanded during the winter and spring of 1892-3, and the stringency which began in April and culminated last autumn caused them to suffer greatly. The directors have reduced the company's entire holdings of Fort Wayne and Northwest stocks to a valuation of $1 each, exclusive of the amount carried in patents.

After protracted negotiations, the Northwest Company has been put in liquidation, and the territory controlled by it has reverted to the General Electric Company.

Reference is made in the report to the recent financial panic, and of the necessity for selling some securities to a syndicate, which organized the trust known as "The Street Railway and Illuminating Properties." An account is also given of the reorganization of the selling departments of the company, and its concentration at Schenectady.

The financial condition of the company has been greatly improved during the last six months, and the net amount of direct and indirect obligations, July 31, 1893, $8,734,000, was reduced by January 31, 1894, to $1,984,000.

While the liquidation of the debt has been going on, the company has also readjusted its basis for sales, either to cash or to short credits to desirable customers. In view of the extreme depression and the uncertainty as to the early future, the directors have not felt justified in any other course than that of adhering strictly to sales on this basis. It is believed by the directors that the company has lost little legitimate business in consequence of its curtailment of credit to customers. It intends to confine its business to this basis, and to accept smaller profits.

The directors state that they do not believe that it will be possible for some time to come to do as large a business as was done by the company prior to the panic, although a gradual improvement has been apparent during the last two months. The street railway business, which to a considerable extent was formerly done through syndicates and promoters, many of whom have become embarrassed, promises to be smaller than during the previous year. Arc lighting business is also reduced, largely because of the inability of local companies to secure capital with which to extend their business for the purpose of carrying out municipal contracts. The business of the company, with respect to incandescent lighting, which is to a great degree performed by strong and conservatively managed local companies, is in a more healthy condition, and has not suffered so severely. The business in plants for the distribution of electrical power is promising, and many important installations are in progress. The application of electricity to various mining purposes, such as hauling, hoisting, drilling, etc., is increasing. The future in this respect is promising. The increase in the number of local lighting and railway companies is shown by the following table:

	Feb 1. 1892.	Feb. 1. 1893.	Feb. 1. 1894.
Total number of local companies operating incandescent and arc lights	1,158	1,277	1,479
Total number of railway companies	214	435	541

PATENTS.

Substantial progress has been made during the year in the prosecution of suits against infringers of many of the more important patents belonging to the company. The "feeder and main" patent, which is of fundamental importance, particularly for the low tension lighting plants, has been sustained by the Circuit Court for the District of New Jersey.

The litigation on the incandescent lamp patent has been generally successful, although the most strenuous efforts have been made by infringers to defeat the patent or to devise some form of lamp that would be outside of it. In two instances the company has met with reverses in this litigation which have proved to be comparatively unimportant. In these instances they are advised there is a strong probability that they will ultimately prevail. The efforts to evade the patent by so-called "lamp repairs," and by injecting a harmless amount of inert gas into the bulb, have been defeated.

Owing to the inevitable delays of litigation, the important cases on patents for railway work, upon which the directors place great reliance, have not yet come to hearing. It is expected that many of these cases will be determined during the coming year.

No final decision has been rendered against the company on any patent. During the past year several such suits against the company have been decided in its favor, notably the suit on the patent for the hydro-carbon treatment of the filament of incandescent lamps, which has been disposed of in the company's favor by the decision of the United States Circuit Court of Appeals.

Upon the whole, the patent situation seems to be promising, and the directors believe that at the next annual meeting they will be in a position to report substantial progress.

All expenditures for patents and patent rights during the year under review, and all expenses of patent litigation, have been charged to operating expenses.

STATEMENTS OF ACCOUNTS.

The assets of the company include the following: Patents and franchises, $8,159,264.02; manufacturing plants, $3,941,128.98; other real estate, $323,685.23; stocks of manufacturing companies (schedule A), $2,767,470.58; stocks and bonds of local companies (schedules B

and C), $2,723,493.17; cash, $591,143.88; notes and accounts receivable (face value $14,984,697.42) $8,934,159.75; total, $9,525,303.63. Inventories; $4,834,792.62; work in progress, $1,198,343.58; profit and loss, $12,454,967 42; total, $45,928,449.23. The liabilities shown are: Common stock, $30,459,700; preferred stock, $4,251,900; total, $34,711,000; 5 per cent. gold coupon debenture bonds, $10,000,000; mortgages, $26,200; accrued interest on debenture bonds, $83,333.32; notes payable, $744 341,31; accounts payable, $323,084.82; sundry credits, $39,-889.78; total, $45,928,459.23.

(SCHEDULE A.)

STOCKS OF MANUFACTURING AND OTHER COMPANIES.

CORPORATE NAME.	ADDRESS.	PAR VALUE.
Brush Electric Co. (Pref)	Cleveland, O	$26,300.00
" " " (Pref. Guaranteed)	"	96,500.00
" " " (Com.)	"	1,995,200 00
Canadian General Electric Co	Toronto, Can	1,250,000.00
Electric Corporation (Subscription)	Boston, Mass	28,200.00
E. C. Morris Safe Co. (Pref.)	"	3,600 00
Excelsior Electric Co	Brooklyn, N. Y	387,000.00
Fort Wayne Electric Co	Ft. Wayne, Ind	1,921,850 00
Ft. Wayne Trust Securities (Series A.)	Boston, Mass	9,776.00
Ft. Wayne Jenney Electric Light Co	Ft. Wayne, Ind	365,000.00
Northwest General Electric Co	St. Paul, Minn	549,850.00
Otis Electric Co	Yonkers, N. Y	174,000.00
Pennsylvania General Electric Co	Philadelphia, Pa	468,000 00
Schuyler Electric Co	Middletown, Ct	50,000.00
Schuyler Electric Manufacturing Co. (Com.)	Hartford, Conn	84,000.00
" " " " (Pref.)	"	307,930 00
Swan Lamp Manufacturing Co	Cleveland, O	23,000.00
Shares of St. Ry. & Illuminating Properties	Boston, Mass	6,400.00
United Electric Securities Co. (Com.)		500,000.00
" " " " (Pref.)		23,100.00
Total (carried on balance sheet at $2,767,157.58)		$8,279,706.00

In addition to the above the company owns stocks of various other manufacturing, etc., companies of a total par value of $6,037,310.00, which are carried on the balance sheet at a total value of $313.00.

(SCHEDULE, B.)

STOCKS OF LOCAL COMPANIES.

CORPORATE NAME.	ADDRESS.	PAR VALUE.
Andover Electric Light Co	Andover, Mass	$2 000 00
Appleton Edison Electric Co	Appleton, Wis	15,000.00
Austin Electric Co	St. Paul, Minn	50,000.00
Buffalo General Electric Co	Buffalo, N. Y	260,000.00
Compagnie Francaise	Paris	20,072.12
Citizens' General Electric Co. (Pref.)	Louisville, Ky	12,300.00
Com. Anonima del Alumb. El de Puebla	Puebla, Mexico	15,000.00
Cambridge Electric Light Co	Cambridge, Mass	2,700 00
Citizens' Electric Light & Power Co	Dayton, O	1,790.00
Cleveland General Electric Co. (Com.)	Cleveland, O	200,000.00
" " " " (Pref.)	"	16,900 00
Chester Electric Light & Power Co	Chester, Pa	1,750.00
Chicago Edison Co	Chicago, Ill	2,666.67
Cooperstown Gas & Electric Co	Cooperstown, N. Y	2,250.00
Canton Electric Light & Power Co	Canton, O	12,200.00
Columbus Edison Electric Light Co	Columbus, O	23,100.00
Dillon General Electric Co	Dillon, Mont	40,000.00
Eastchester Electric Co	Eastchester, N. Y	$32,645.00
Edison Electric Illuminating Co	Paterson, N. J	31,500.00
" " " "	New York, N. Y	700,200.00
" " " "	Brooklyn, N. Y	8,300.00
" " " "	Cumberland, Md	8,500.00
" " " "	Newburgh, N. Y	29,650.00
" " " "	Altoona, Pa	10,000.00
" Electric Light & Power Co	Kansas City, Mo	14,200.00
" " " " "	York, Pa	13,200.00
" " " " "	Erie, Pa	14,400 00
Elgin City Railway Co	Elgin, Ill	40,000.00
Essex County Electric Co	Orange, N. J	5,000 00
Fargo Gas & Electric Co	Fargo, N. Dak	20,000.00
First Cincinnati Edison Electric Ill'g. Co	Cincinnati, O	8,700 00
Grand Rapids Edison Light & Fuel Gas Co	Gr. Rapids, Mich	29,000 00
Glens Falls Electric Light & Power Co., Ltd	Glens Falls, N. Y	550.00
Grinnell Electric Light Co	Grinnell, Iowa	1,000 00
Hackensack Edison Lighting Co	Hackensack, N. J	59,500 00
Hollister Light & Power Co	Hollister, Cal	250.00
Johnstown Electric Light Co	Johnstown, Pa	18,600 00
Kansas City Suburban Belt Line Railroad Co	Kansas City, Mo	4,080.00
Laramie, E. G. L. H. & Fuel Co	Laramie, Wy	16,500.00
Little Falls Electric Light & Power Co	Little Falls, N. Y	2,500 00
McKeesport, Light Co	McKeesport, Pa	8,900.00
Napa Thomson-Houston Light Co	Napa, Cal	33,500.00
Natick Gas Light Co	Natick, Mass	10,100.00
New Omaha T.H. Electric Light Co. (Com.)	Omaha, Neb	30,600.00
Newport Illuminating Co	Newport, R. I	36,700.00
Northwest Electric Co	Winnipeg, Man	20,000.00
Portland General Electric Co. (Com.)	Portland, Ore	527,800.00
Philadelphia Consolidated Co	Philadelphia, Pa	4,375.00
Roseburg Electric Light & Power Co	Roseburg, Wash	20,000.00
San Luis O. B. T-H. Electric Co	S. L. Obispo, Cal	800.00
Scranton Illuminating, Heat & Power Co	Scranton, Pa	42,000 00
Skowhegan Electric Light Co	Skowhegan, Me	4,300.00
Suburban Electric Ill'g, Heat & Power Co	Newport, Ky	16,415.00
Standard Light & Power Manufacturing Co	Montpelier, Vt	1,000.00
Stoughton Electric Light Co	Stoughton, Wis	1,200.00
Thomson-Houston Electric Light & Power Co	Quincy, Ill	2,200.00
Trenton Light & Power Co	Trenton, N. J	55,000.00
Union Elektricitats Gesellschaft	Berlin	163,000.00
Visalia Gas, Light & Heat Co	Visalia	14,700.00
Westboro Electric Light & Power Co	Westboro, Mass	1,620.00
Wilkesbarre Electric Light & Power Co	Wilkesbarre, Pa	10,100.00
Total (carried on the Balance Sheet at $1,362,294.62)		$2,750,313.79

In addition to the above the company owns stocks of various other local companies of a total par value of $3,713,717.03, which are carried on the balance sheet at a total value of $4,754.75.

(SCHEDULE, C.)

BONDS.

CORPORATE NAME.	ADDRESS.	PAR VALUE.
Asheville Street Railway Co	Asheville, N. C	$14,000.00
Atlanta Consolidated Street Railway Co	Atlanta, Ga	18,000.00
Bangor Electric Light & Power Co	Bangor, Me	64,500.00
Consumers' Light & Power Co	Little Rock, Ark	27,000.00
Chicago North Shore Street Railway Co	Chicago, Ill	94,000.00
Cumberland Electric Light & Power Co	Nashville, Tenn	100,000.00
Chattanooga Electric Light Co	Chattanooga, Tenn.	57,000.00
Chattanooga Electric Street Railway Co	" "	20,000.00
Central Market Co	Chicago, Ill	1,600.00
Columbian Intramural Railway Co	" "	250,000.00
Citizens' General Electric Co	Louisville, Ky	115,000.00
Charleston Light & Power Co	Charleston, S. C	25,000.00
Consolidated Electric Light Co	Birmingham, Ala	79,000.00
Covington Electric Light Co	Covington, Ky	7,000.00
Concord Land & Water Power Co	Concord, N. H	74,500 00
Dallas Electric Co	Dallas, Tex	1,000.00
Dayton Electric Light Co	Dayton, O	282,000.00
Georgetown Water Co	Georgetown, Ky	5,000.00
Greensboro Electric Light & Power Co	Greensboro, N. C	2,500.00
Hoosac Valley Street Railway Co	N. Adams, Mass	800.00
Jackson Light & Power Co	Jackson, Mich	83,000.00
Kingston Electric Co	Kingston, N. Y	7,000.00
Knoxville Street Railroad Co	Knoxville, Tenn	6,000.00
Lee Electric Co	Lee, Mass	11,000.00
Los Angeles Consolidated Electric Railway Co	Los Angeles, Cal	41,440 00
Metropolitan Street Railway Co	Macon, Ga	45,000.00
Manhattan Electric Light Co	New York City	52,000.00
Madison City Railway Co	Madison, Wis	22,000.00
Middleboro Gas & Electric Co	Middleboro, Mass	45,000 00
Milwaukee Street Railway Co	Milwaukee, Wiss	325,000 00
Monongahela Electric Light & Power Co	Homestead, Pa	15,000 00
Mobile Transportation Co	Mobile, Ala	100,000.00
Narragansett Pier Electric Light & Power Co	Nar. Pier, R. I	1,000.00
Natick Electric Co	Natick, Mass	17,500.00
North River Electric Light & Power Co	New York City	2,000.00
Ottawa Electric Street Railway Co	Ottawa, Ill	51,000 00
Ocala Light & Power Co	Ocala, Fla	10 000.00
Oskaloosa Edison Light Co	Oskaloosa, Wis	7,500 00
Oxford Lake Line	Anniston, Ala	175,000.00
Otis Electric Co	New York City	20,000.00
Public Works Co	Bangor, Me	35,000.00
Queen City Railway Co	Dallas, Tex	85,000 00
Queen City Electric Railway Co	Marion, Ind	5,000 00
Raleigh Street Railway Co	Raleigh, N. C	25,000.00
Sheffield Manufacturing Co	Saugerties, N. Y	900.00
Standard Plate Glass Co	Pittsburgh, Pa	1,600.00
Steubenville Street Railway Co	Steubenville, O	2,500.00
St. Cloud City Street Car Co	St. Cloud, Minn	5,000 00
Tacoma Railway & Motor Co	Tacoma, Wash	200,000 00
Town of Buena Vista	Buena Vista, Va	1,600.00
United Electric Sec. Co., 1st Series	Boston, Mass	1,000.00
" " " " 3d "	"	47,000 00
" " " " 7th "	"	41,000 00
Watertown Heating, Lighting & Power Co	Watertown, S. D	2 000 00
Weymouth Light & Power Co	Weymouth, Mass	39,000 00
Winona General Electric Co	Winona, Minn	20,000.00
Total (carried on balance sheet at $1,356,431.80)		$2,785,940.00

In addition to the above, the company owns bonds of various other companies of a total par value of $146,621.30, which are carried on the balance sheet at a total value of $12.

Theory vs. Practice on Electric Railways.

The following letter was recently received by a prominent manufacturing company of electrical apparatus:

Gentlemen:—Will you please excuse the liberty I am taking to address you. I am much interested in electric cars, and I have been surprised to see that PRACTICE does not always agree with THEORY.

I am a machinist, but devote my spare time and money to try to learn something more. I have bought a number of books on electricity and I find in one of them the following rules:

No. 5:—When ready to start, move the controller handle gradually but firmly.

No. 7:—In throwing the power on, move the controller handle step by step, allowing the car to gain headway under one, before advancing to the next step. Too sudden starting strains the machinery and wrenches the gears, etc.

No. 8:—In throwing the power off, move the controller handle gradually until nearly at the "off" stop, when it should be turned the rest of the way with a snap, and care should be taken that the power is off before setting the brakes.

No. 9:—The brakes should be set gradually, so as not to bring an undue strain upon the gearing.

No. 13:—Never stop a car on a curve, except in case of accident. Many breakdowns and troubles have resulted from unnecessarily stopping on curves. The extraordinary amount of current required to start a loaded car on a curve may endanger the insulation of the motors.

These rules seem to me very simple and very proper, and any man with a little conception of machinery will think the same. Any man with a little good judgment will know that we cannot start any machinery at full speed; the speed has to be gained step by step,

The motorman (at least the motorman of this city) is the only man trying to go against Nature's laws. Nature is advancing step by step. We don't see a tree covered with leaves, flowers and fruits in a few seconds. The child cannot run the first day. A racer cannot gain the full speed at the start. A sudden high flame in a lamp will break the chimney. To fill at once an overheated boiler means an explosion, etc. But the motorman is an exception, and he intends to start and stop his car at once.

I have paid much attention to the motormen of this city, and I see day by day that they pay not the least attention to the above rules. They throw on the power all at once and throw off the power with a single snap from the last step to the "off." As to curves, they pay no attention to them, and will stop on the middle of a curve as they would on a straight line. Putting the brakes on before the current is off, or throwing the power on before the brakes are released, are daily occurences in this city. It is well to add that many persons regret the old horse cars, as the new electric cars give us a very unpleasant ride, and with certain motormen and a car complete you reach home very sore.

I have tried to put me this question: Am I old and ignorant of any progress? It may be that in this age of wonders you have perfected the controllers in such a manner that the handle of the controller and the handle of the brakes are toys in the hands of motormen to play to suit themselves. Perhaps you have devised a new controller which will allow a sudden full power to flow to the motors without injuring the machinery. In purchasing the book I mention (second

edition 1893), I thought I had the latest, but it cannot be so. New improvements to go against laws of Nature must have found their way, otherwise the companies would put a stop to the reckless manner in which the motormen are running the cars.

It may be that the companies are more ignorant than I am, and don't say anything because they don't know any better. As I said, the companies must ignore these rules, or then I am of an old age, far away from improvements.

I come to you, gentlemen, merely to ask you if *the above rules are still good, or if since the publication of the book mentioned, improvements have been made to declare the said rules void?* If you can answer this question you will greatly oblige me; your answer would be an authority and much useful for a work I am preparing.

Destructive Effect of Electrical Currents on Subterranean Metal Pipes.

By ISAIAH H. FARNHAM.

Early in the summer of 1891, some lead covered telephone cable, removed from wooden ducts in Boston, showed some very marked, yet local, spots of corrosion. The cause of the corrosion was generally attributed to acetic acid contained in the wooden conduit which had, years before, caused corrosion on a few cables in certain sections of the city. In the case just mentioned, the corrosion was so severe, and located in spots only, that it led me to attribute the cause to electrolytic action from the railway currents.

Measurements were made between the cables in all manholes and the earth near the cables, for voltage and direction of current. It was found that within a radius of about 2,000 ft. from the Albany Street power house, cables were negative to the earth, ranging from zero to two volts, and that outside of this neutral line, they were positive to the earth from zero to twelve volts. This condition prevailed until a point was reached near the East Cambridge power house, when they again passed a neutral line, and became more and more positive as that power house was approached. The same conditions were found as the Allston railway power house was approached. On obtaining sufficient data, maps were drawn, showing voltage between cables and earth throughout all sections of the city. This is shown in the map (Fig. 1.).

In addition to the figures placed beside the several routes of cable conduits, showing the direction of current and its pressure, we have shaded such portion of the map where at that time we found the cables positive to the earth. We may call the shaded portion of the map the danger territory. These potential measurements, though taken for other purposes, incidentally furnished all the proof needed to convince one that the railway power was the source of the troublesome currents.

At the time the map was made, and previously, the railway was operating with the negative pole of the dynamo to the trolley, the positive side being to the rails.

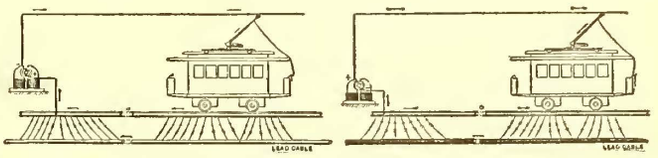
Fig. 3 is intended to illustrate this condition. It shows the passage of current from the dynamo to the rails, and the passage of a portion of the current from the rails to the cables within the neutral or zero line, and from the cables to the rails outside of this zero line. The danger of electrolysis is only where the current is leaving the cable or pipe through the moist earth; hence, the dangerous district was at this time outside of the zero or neutral line, as shown both on the map (Fig. 1) and in Fig. 3.

The remedies proposed were: First: To remove all cables from the wet bottom and sides of the so called manholes. It was found very difficult to place and retain cables free from the wet sides, and even could this have been accomplished, the action at the mouth of the ducts, and within them, would still have continued.

Second: To connect the cables to ground plates in the manholes, and so transfer the electrolytic action to these plates, and thus save the cables. This experiment was tried on an extended scale, but though many ground plates, having a surface of several square feet each, were connected with the cables over a large portion of the city, it was found that voltmeter readings taken between the cables and a point on the earth a short distance removed from the ground plate in any manhole, gave nearly the same pressure as before the ground plates were connected.

Third: Prof. Elihu Thomson suggested the placing of motor generators at different points along the railway line, wherever the cables and pipes are found to be in danger, the motor generators to be operated by the railway power current; the secondary current developed by these generators to be utilized to lower the potential in the cables and pipes to zero, with respect to the surrounding earth or rails. The motor generators would, so to speak, pump the current out of the cables, and force it into the rails whenever the potential of the former should rise above zero. This plan has not yet been put into operation, so far as I am aware.

Fourth: Insulating the cables and pipes from the earth was proposed. As some of the worst cases of corrosion of cables by electrolysis occurred where they were painted with asphalt, taped, painted again, and finally covered again with a heavy braiding, also saturated with asphalt, it was apparent that to insulate cables sufficiently to protect them would be difficult and expensive if, indeed, practically possible. To protect water and gas pipes by a sufficient insulating jacket was seen at once to be impracticable.

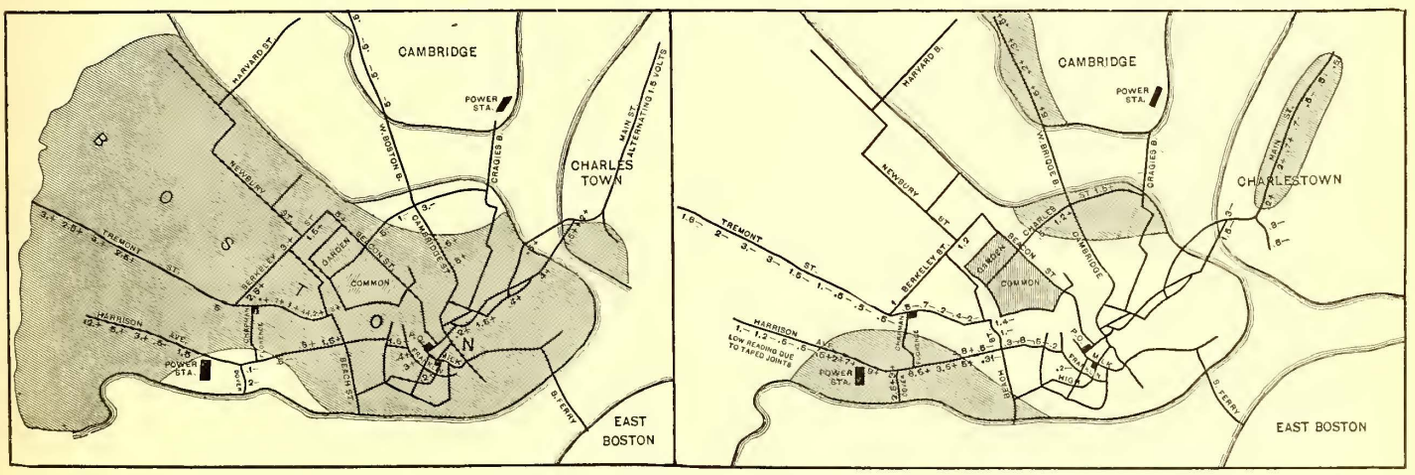


FIGS 3 AND 4.—DIAGRAMS SHOWING DIRECTION OF CURRENT DURING BOSTON EXPERIMENTS.

Fifth: Breaking the metallic continuity of the cable sheath and pipes was proposed. From the fact that severe action is frequently found in comparatively isolated spots, where cables and pipes cross each other or pass near or across the rails, it follows that any system of breaking the metallic continuity, would have to be studied with reference to the entire complicated system of pipes, cables and rails ramifying through the streets of a city. There would also be a difference of potential between the several sections of cable or pipe, severed metallically, tending to cause electrolysis at one end of each section. In case of water pipes, treated in this manner, the action might be expected on the interior as well as on the exterior.

There appears to be some evidence of such an action as this in gas and water pipes where the electrical continuity is partially broken by leaded joints. An iron service pipe taken from the Cambridge gas system showed that the action is most severe at points immediately on either side of the coupling. The reason the corrosion appears on both sides of the coupling in this case is not clear; it may be due to reversal of current on the railway system.

Sixth: It was suggested that the railway current might be so frequently alternated, as possibly to prevent serious action on the pipes and cables. The theory was, that before the oxygen gas, liberated by the current, should have time to attack the metal, the reversal of the current would disperse it. A careful experiment was conducted, extending over a period of ten days, employing a pressure of current of from three to seven volts, and alternating its direction at regular periods of one minute, by specially devised apparatus. No material change had taken place in either plate during this period of time. We then considered the practicability of reversing the railway current frequently. It seemed possible to reverse it once each twenty-four hours, at a given time in the night when the load is comparatively light. To do this in a large system involving several power stations would require either a loss of current for a few minutes in order to guard against one station reversing before some other had opened or reversed its current, or would require some electrical system connecting the several stations together and operating the reversing apparatus simultaneously. We concluded it would be very difficult, if indeed at all practicable, to reverse such heavy currents during regular traffic.



FIGS. 1 AND 2.—MAPS OF BOSTON, SHOWING POTENTIALS OF EARTH DURING EXPERIMENTS.

*Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers, New York, April 18.

We then renewed the reversing experiment, giving twenty-four hour periods between each alternation, but found at the end of two weeks, to our sorrow, that the plates subjected to the action of the current were seriously electrolyzed. It seemed useless to pursue this line of work further at that time. When alternating current motors become practicable for use on street cars, advantage may be taken of the fact that such currents appear not to cause electrolysis to the extent of injuring pipes and cables exposed to them.

Seventh: Mr. Fred S. Pearson suggested that if the positive pole be connected with the trolley, the danger of electrolysis would be removed from the greater and more scattered portion of the city, and be brought near the power stations where it possibly could be more easily dealt with. This reversal was made and the expected potential changes between cables and earth followed. Fig. 2 is a map of Boston, showing the condition after the reversal of current. The shaded or dangerous portions in this map, correspond to the white or safe districts in the map, shown in Fig. 1, the only variation being, that by the reversal, the neutral or zero line was thrown out a little further from the Albany Street power house than it was located before. It was also noted that the cables near the power house which had been from one to two volts negative to earth before the change of current, were now one to nine volts positive to earth; that is, they were raised higher above zero than they had been below zero prior to the reversal. Fig. 4 is a typical representation of the current flowing through trolley, car, rails and cables at this time. It will be readily understood that with the conditions as illustrated in this figure, the electrolytic action would be confined to the territory comparatively near the power stations where the current is leaving the cables to reach the negative or rail side of the dynamo.

Mr. Pearson next suggested the plan of running out large copper conductors from the negative side of the dynamo and extending them through the dangerous district, connecting them at frequent intervals to the cables. On the principle involved in Professor Thomson's motor generators, this low resistance conductor connected directly to the dynamo, was to pump the current from the cables and so prevent its passage into or through the moist earth. This plan has been followed with most excellent results. The shaded patch which existed in the locality of the Albany Street station is now removed, and the cables are all negative to earth. The remaining shaded patches or dangerous sections have been corrected by taking similar means of reaching the East Cambridge power house.

The facts given above, with others similar, though not enumerated, lead me to these conclusions:

1. All single trolley railways employing the rails as a portion of the circuit, cause electrolytic action and consequent corrosion of pipes in their immediate vicinity, unless special provision is made to prevent it.

2. A fraction of a volt difference of potential between pipes and the damp earth surrounding them is sufficient to induce the action.

3. Bonding of rails, or providing a metallic return conductor equal in sectional area and conductivity to the outgoing wires, is insufficient to wholly prevent damage to pipes.

4. Insulating pipes sufficiently to prevent the trouble is impracticable.

5. Breaking the metallic continuity of pipes at sufficiently frequent intervals, is impracticable.

6. It is advisable to connect the positive pole of the dynamo to the trolley lines.

7. A large conductor extending from the grounded side of the dynamo, entirely through the danger territory and connected at every few hundred feet to such pipes as are in danger, will usually ensure their protection.

8. It is better to use a separate conductor for each set of pipes to be protected.

9. Connection only at the power station, to water or gas pipes, will not ensure their safety.

10. Connection between the pipes and rail, or rail return wires, outside of the danger district, should be carefully avoided.

11. Frequent voltage measurements between pipes and earth should be obtained, and such changes in return conductors made as the measurements indicate.

A Peculiar Electric Truck.

At the works of the McGuire Manufacturing Company, of Chicago, are four electric motor trucks building for the Johnson Rail Company, of Johnstown, Pa. The peculiarity of the construction is that the gauge is adjustable, that is to say, the wheels can be readily changed to run on any track varying from three feet six inches to five feet three inches. There is a thread cut in the hub and on the wheel fit of each axle. It is a thread three to the inch, sixteen inches long, and is cut at each wheel fit of the axle, and the hub of the wheel is cut to fit it. The keys are double jointed and so arranged that they can be changed and the gauge changed in a very few minutes when desired. There are two key ways cut in the hub, and two in the axle on the quarter, so as to get a quarter turn adjustment. It is a very fine and expensive piece of work and is only intended for the purpose for which it is built.

Within the last month the McGuire Company has also built seventy steel frame trucks for the Electric Traction Company, Philadelphia; fifteen for Memphis, Tenn.; five for Davenport, Ia., and twelve for the Cicero & Proviso Electric Railway, Oak Park, Ill. The company also has orders yet unfilled from the Derby Street Railway, Derby, Conn.; Buffalo & Williamsville Street Railway, Buffalo, N. Y.; Philadelphia, Neville Island & Coraopolis Railway, Coraopolis, Pa.; Hamilton, Grimsby & Beamsville Railway, Hamilton, Ont.; Sandusky, Milan & Norwalk Street Railway, Sandusky, O.; Philadelphia & Delaware County Railway, Philadelphia, Pa., and others.

The Pier Movable Sidewalk Purchased.

Visitors to the World's Fair, Chicago, will remember the movable sidewalk on the pier, which was extremely interesting from a mechanical standpoint, and which carried large numbers of people. This sidewalk has been purchased by L. K. Hirsch, of Chicago, who deals in old railway material, iron and steel scrap, etc.

The movable sidewalk, as will be remembered, consisted of a large number of cars, 351 in all, connected together. The cars were mounted on eighteen inch wheels, with axles of about one and seven-eighths inches in diameter, and with three feet nine inch gauge. Mr. Hirsch intends to sell these cars and trucks separately, and thinks that they will meet with a large demand for mining and other work. Mr. Hirsch has also secured a great deal of timber and a large supply of eight, twelve and sixteen pound iron and steel T rails, which he has for sale at immediate delivery.

Street Railway News.

Extensions and Improvements.

Boston, Mass.—Among the plans of the West End Street Railway Co. for this spring is the extension of electric lines of cars into all of East Boston, the uncompleted part of Brookline, Mt. Auburn Street and Huron Avenue in Cambridge, Malden and Medford, and minor extensions in Somerville and other suburbs.

The new Westinghouse motors for the West End Street Railway, are being delivered daily.

Brooklyn, N. Y.—The Brooklyn, Queen's County & Suburban Railroad Company is being equipped for electrical operation.

Dayton, O.—The City Railway Company writes that it will shortly place a contract for a number of cars and trucks.

Detroit, Mich.—Work will begin at once on Woodward Avenue for the extension of the Highland Park electric road as far north as Edson Avenue formerly known as the Six Mile Road.

Milwaukee, Wis.—It is stated that the Milwaukee Street Railway Company has decided to extend the Farwell Avenue electric line up Glen Avenue to the Lakeside Park, as soon as the Common Council will grant permission. The company is also considering a proposition to extend the electric line up Glen Avenue to Menlo Park.

The Milwaukee Street Railway Company has been given permission to extend its North Avenue line to Folsom Place.

Neenah, Wis.—It is contemplated to electrically equip the Menasha & Neenah Street Railway, and extend it to Appleton and neighboring towns.

New Haven, Conn.—The J. G. Brill Company, of Philadelphia, has received an order for cars for the West Shore Railway Company, which it is expected, will be in operation by June 5. The road will connect West Haven and Milford. The type of car adopted is a combination car with cross seats.

The hearing on the application of the Centerville Horse Railroad Company for permission to extend its lines from the city line to the center of Centerville will take place before the Selectmen May 17.

Oshkosh, Wis.—The controlling interest in the Oshkosh Street Railway Company has been sold to an Indianapolis syndicate. The sale is conditioned upon the granting by the Common Council to the new company of a franchise for an electric line. The purpose is to reorganize and install electricity and make large extensions. Representatives of an Ohio syndicate are also seeking a franchise.

Philadelphia, Pa.—Contractor McCaul commenced work April 5 on the large car house for the Germantown branch of the People's Traction Company on Germantown Avenue above Church Street. It is to be constructed of local stone, and is to be done by May 1.

Roxborough, Pa.—Mayor Stuart has signed the ordinance granting trolley privileges to the Manayunk & Roxborough Incline Plane & Railway Company. It is rumored that this company will extend the road to Norristown by the way of Marble Hall.

Washington, D. C.—The Belt Railway Company has applied for rights to make a number of extensions.

The Washington, Alexandria & Mt. Vernon Electric Railway Company contemplates an extension into the city of Washington.

New Roads.

Akron, O.—On April 4 there was incorporated the Akron Street Railway Company, of Akron, with a capital stock of $700,000.

Allegheny, Pa.—The Allegheny & Butler Railway Company was incorporated April 18, with a capital stock of $300,000 for constructing and operating an electric railway in Allegheny County, Pa. Wm. I. Mustin, of Pittsburgh, Pa., is the president of the company, and others interested are Charles K. Hill, of Ross Township, Allegheny County and F. Gwinner and Wm. R. Rhodes, of Allegheny.

The Etna & Glenshaw Street Railway Company was incorporated April 18, with a capital stock of $50,000 to construct and operate an electric railway in Allegheny County, Pa. F. Gwinner, of Allegheny, Pa., is the president of the company. Others interested are F. Gwinner, Jr., Edward W. Gwinner and Wm. B. Rhodes, all of Allegheny.

Champaign, Ill.—The Champaign Rapid Transit Company has filed a certificate of consolidation with the Urbana & Champaign

Street Railway Company, under the name of the Urbana & Champaign Electric Street Railway Company. The capital stock of the consolidated company is to be $50,000.

Chester, Pa.—A new organization, to be known as the Chester Traction Company, with a capital of $500,000, has secured control of all the railways centering in this city. Samuel A. Dyer will be the active spirit in the new concern, and it is rumored that the Philadelphia Traction Company is a party in the deal.

Chestertown, Md.—An electric road from Chestertown to Rock Hall is being considered.

Chicago, Ill.—The Chicago & Morgan Park Electric Street Railway Company was incorporated lately, with a capital stock of $500,000. The incorporators are B. Frank Deacon, Charles S. McCoy, Samuel H. Hubbard, Frank Foster and Ralph F. Bogle. The company contemplates the construction of an electric railroad between Englewood, Morgan Park and Blue Island, and eventually will extend the line to West Pullman and Harvey. It is proposed to connect with the cable and suburban lines of Englewood.

Chicopee, Mass.—The Chicopee Street Railway Company will organize with $100,000 capital stock to build an electric street railroad from Holyoke to Springfield. The directors are Charles C. Abbey of Chicopee, James E. Delaney of Holyoke, Selig Manilla of Springfield and others.

Delaware Water Gap, Pa.—The Mt. Minsi Electric Railway Company was incorporated April 3, with a capital stock of $125,000. A. B. Batchelder, of Delaware Water Gap, is president. Other stockholders are S. E. Overfield, H. W. Hauser, Eugene Brodhead and F. W. Eilenburger.

Detroit, Mich.—A Denver syndicate, composed of D. H. Moffatt, president of the First National Bank, J. C. Montgomery and J. B. Thompson, of Chicago, are negotiating for the purchase of the street railway franchise of the City of Detroit. The present franchise, granted thirty years ago, expires this year.

Fort Lee, N. J.—The company which, some time ago, began to build a trolley railroad from Fort Lee to Leonia is to be reorganized for the purpose of carrying out the project, which contemplates freight as well as passenger traffic.

Geneva, O.—An electric road from Geneva to Warren is talked of. The road would be forty-four miles long, and would pass through Bloomfield, North Bristolville and Champion.

Green Bay, Wis.—E. P. Morton, a New York capitalist, has organized a company here, and will complete the electric street railway upon which the construction was stopped last summer by a failure of the parties holding the franchise. The road is to be in operation in two months.

Houston, Tex.—A new corporation is the Houston & Suburban Street Railway Company. The capital stock is $100,000. The incorporators are A. Christeson, Wm. G. Wilson, Jr., and E. W. Cave.

Houtzdale, Pa.—The Houtzdale & Suburban Electric Railway was incorporated on March 30, with a capital stock of $100,000, for the purpose of constructing and operating an electric railway in Clearfield County, Pa. The president of the company is A. Markle, of Hazelton, Pa. Others interested are J. E. Giles, E. S. Doud, of Hazelton, and Chas. A. Bragg, of Philadelphia.

Hull, Mass.—The Hull & Nantasket Street Railway Company has been formed for building a new line from Pemberton Point to the division line of Hingham and Hull. It has a capital stock of $40,000, and the incorporators are Henry Norwell, of Norwell; Joseph O. Burdette, of Hingham; Z. Taylor Harrington, of Hull, and others.

Iowa City, Ia.—The subject of a street railway is being agitated here.

Kansas City, Mo.—Articles of consolidation were filed April 11 by the Kansas City Cable Railway, the Independence Railway Company, and the Kansas City & Independence Rapid Transit Railway Company, under the name of the Kansas City Cable Railway Company; capital stock, $4,300,000. The directors are L. C. Kurthoff, Webster Withers, Geo. W. Clawson and R. W. Hocker, of Kansas City, and Frank C. Warnell of Westport.

Lancaster, Pa.—The Lancaster & Lititz Electric Railway Company, and the Lancaster & New Holland Electric Railway Company, each with a capital stock of $100,000, were chartered April 4. John S. Graybill, of Lancaster, is president of both corporations. The directors of both companies are the following. John S. Graybill, S. H. Reynolds, Dr. Henry Yeagley, H. C. Hopkins, John Shaub and Carl F. Espenshade. The Lancaster & Lititz Company proposes the building of a line seven miles long to connect these two towns by way of Neffsville. The other company intends constructing a line thirteen miles in length, with terminal points at Lancaster and New Holland.

AT a recent meeting of the directors of the Lancaster & Philadelphia Electric Railway Company, the company decided to construct a line from Downingtown to West Chester.

Lock Haven, Pa.—The Lock Haven Electric Railway Company was organized April 14, with a capital stock of $100,000 for constructing and operating an electric railway in Clinton County, Pa. Luther M. Patterson, of Lock Haven, is the president of the company. Others interested are, Jacob B. Brown & Sons, A Simons' Sons and Moore Fredericks, all of Lock Haven.

Mohnsville, Pa.—The Mohnsville & Adamstown Electric Railway has been commenced.

Orange, Mass.—Arrangements have been made for the building of the proposed electric railroad between Orange and Athol.

Paterson, N. J.—There is a movement on foot to connect Paterson and New Brunswick by an electric railway, the route to be through Orange.

Philadelphia, Pa.—The Pennsylvania Traction Company, it is announced, proposes to construct a four track electric railroad, between Philadelphia and Harrisburg, running through Lancaster, Coatesville, West Chester and other places.

Philipsburg, Pa.—The Philipsburg & Suburban Electric Railway was incorporated on March 30, with a capital stock of $100,000, for the purpose of constructing and operating an electric railway in Clearfield and Centre Counties. The president of the company is A. Markle, of Hazelton. Others interested are John A. Seely, of Brooklyn, N. Y., E. S. Doud and J. Edwin Giles, of Hazelton.

Providence, R. I.—An act to incorporate the Narragansett Electric Railway has been introduced in the legislature.

Reading, Pa.—An ordinance has been introduced in Councils, granting permission to the Birdsboro Electric Railway Company to occupy certain streets of this city. The company proposes to construct a railway, nine miles in length, from Birdsboro to Reading. At Birdsboro it will connect with an extension of the Pottstown Electric Railway.

Rhinebeck, N. Y.—The incorporators of the Rhinebeck & Rhinecliff Electric Railroad Company have commenced the construction of the road. Robert H. Hunter of Poughkeepsie, is the president of the company.

Richmond, Va.—Application has been made by the Virginia Electric & Railway Company—John C. Robertson, president—for permission to construct a double track railway on Broad Street, the road to run from the Boulevard or the Exposition Grounds to Chimborazo Park.

Sanillac Centre, Mich.—Citizens of this town and Carsonville are trying to obtain an electric road between the two towns, a distance of eight miles.

Seattle, Wash.—The Council has been asked for a franchise for a street railway and an electric plant for supplying light, heat and power, by A. H. Gamel, a well known lawyer, who is supposed to represent a syndicate.

Tiffin, O.—It is reported that Amandus Betts and Nelson W. Miller will, in a very short time, commence the construction of an electric road from Tiffin to Melmore.

Thompsonville, Conn.—The project of an electric road between Thompsonville and Springfield is being discussed, and action is soon to be taken in the matter.

Trenton, N. J.—There was filed in the office of the Secretary of State, April, 13, an article of incorporation for the Central Jersey Traction Company, whose plan to connect New York and Philadelphia and intermediate points by trolley has already been mentioned in the STREET RAILWAY JOURNAL. The incorporators are J. H. Baldwin, of Orange; John H. Tingely, of Rahway, and George G. Crosby, of New York. The capital stock is $150,000, with power to increase to $10,000,000. The organization consists of Frank Magowan, of Trenton, president; Col. E. W. Hine, of Newark, vice-president; J. H. Baldwin, of Newark, secretary; J. H. Darrah, of Trenton, treasurer; George C. Crosby, of New York; John H. Tingely, of Rahway, and John C. McNaughton, of Philadelphia, directors. This road is to be operated independently of the New Jersey Consolidated road, but not in opposition, claiming friendly relations.

Warren, N. H.—There is a project to construct an electric railroad from Warren to the summit of Mount Moosilauke.

West Chester, Pa.—The newly incorporated Suburban Railway Company, of West Chester, will construct an electric railway between Philadelphia and West Chester. It is expected that work on the road will be begun some time this summer.

Westfield, Mass.—The contract for the building of the Woronoco Street Railway has been awarded.

Winnipeg, Man.—The incorporation of a company to construct and operate a bicycle electric railway from Winnipeg to the port of Louisburg, in Cape Breton, is among the measures to come before the next session of the Dominion Parliament.

Personal.

Mr. Wm. Sutton, of the American Car Works, St. Louis, was in the East during April.

Mr. W. B. Allen, of the Brownell Car Company, St. Louis, was a visitor at our office last month.

Messrs. John A. Brill and F. C. Randall, of the J. G. Brill Company, of Philadelphia, were in New York last month.

Mr. John G. Holmes, president of the Citizens' Traction Company, of Pittsburgh, Pa., spent a considerable portion of April in New York.

Mr. J. W. Cooper, treasurer of the J. W. Fowler Car Company, of Elizabethport, has resigned, and Mr. F. L. Heidritter has been elected to the position.

Col. Wm. H. Sinclair, president and general manager of the Galveston City Street Railway, of Galveston, Tex., was in New York last month on a business trip.

Mr. Ross McKenzie has been appointed manager of the Niagara Falls Park & River Railway Company, with headquarters at Niagara Falls, *vice* Mr. W. A. Grant, resigned.

Mr. George O. Manchester, formerly of the Atchison Topeka & Sante Fe Railroad Company, has been elected vice president and treasurer of the Sargent Company, Chicago.

Mr. F. Ruel Baldwin, a well-known engineer of New York, has been appointed Eastern manager of the Bass Foundry & Machine Company, with headquarters at 41 Cortlandt Street, New York.

Mr. E. I. Robinson, of the Laclede Car Company, of St. Louis, was in New York last month and closed an order for twenty-five cars with the Consolidated Traction Company, of New Jersey.

Mr. Gardner McKnight, Eastern representative of the St. Louis Register Company, of St. Louis, has been looking after trade in the New York field. His headquarters are Girard Building, Philadelphia, Pa.

Mr. Payson K. Andrews, who has recently been the Chicago agent of the J. G. Brill Company, will hereafter represent the American Car Company, of St. Louis, in that city. Mr. Andrews has a wide reputation as a most successful business man, and is well liked and popular in the street railway field.

Mr. P. F. Leach, of the Bass Foundry & Machine Company, of Ft. Wayne, is spending some time in New York. Mr. Leach reports a very favorable business outlook, and has recently made a number of important sales of both the Bass and the Cushion car wheels, which are also manufactured by the Bass Company.

Mr. Henry C. Payne, of the Milwaukee Street Railway Company and receiver of the Northern Pacific Railway, has been elected president of the Chicago & Northern Pacific Railroad, and the Chicago & Calumet Terminal Railway Companies. The roads comprise the Chicago terminals of the Northern Pacific, and are now the property of that company.

Mr. Alex. B. Allan, of Glasgow, Scotland, who was in this country last year as a representative of George Cradock & Company, of Wakefield, England, manufacturers of cables, has severed his connection with that concern. Mr. Allan is now engaged in constructing works for the manufacture of wire cables near Glasgow, and writes us that he will soon be in a position to supply orders.

Mr. H. M. Littell, general manager of the New Orleans Traction Company, spent a considerable time in New York City last month in arranging for new equipment. Mr. Littell is very much pleased with New Orleans as a residence city, and is very enthusiastic over the possibilities of electric traction in that city. His company has arranged for an excellent and thoroughly first class equipment.

Lieut. E. J. Spencer, who had charge of the installation, maintenance and removal of the exhibit and contract material of the General Electric Company at the World's Columbian Exposition, and who had been connected with that company for a number of years, has opened an office in the Security Building, St. Louis, and will practise as a consulting and contracting electrical and mechanical engineer. Lieutenant Spencer's experience in the corps of engineers of the United States Army extended over a period of over nine years.

Mr. E. P. Shaw, Jr., general manager and secretary of the Norwich and New London Street Railway Companies, is a native of Newburyport, Mass., and the eldest son of Hon. E. P. Shaw of that city, widely known as one of the most energetic and enterprising men in New England, in the founding and operating of street railways. Although the youngest general manager of a railroad corporation in New England, being about twenty-five years of age, he has gained the good will of the patrons of both the street railways whose affairs he conducts, by his efficient and clever management.

E. P. SHAW, JR.

E. P. Shaw, Jr., obtained a good, sound business education, first, in the public schools of Newburyport, and, later, at Bryant & Stratton's Business College, at Boston. After leaving school, he entered the employ of the Thomson-Houston Electric Company in its office in Boston, and subsequently was employed at the works of the company, Lynn, Mass. In 1887, he returned to Newburyport and entered the employ of the Plum Island Street Railway Company, as clerk, a road which did a large summer business. Upon the organization, in the fall of 1887, of the Newburyport Car Manufacturing Company, of which his father is president, he became a bookkeeper for the company. While acting in this capacity he was also identified with the management of the Black Rocks & Salisbury Beach Street Railway. Upon his assuming the management of the street railway of Norwich, a marked change for the better was speedily shown. Under his management the lines of the road have been, several times, extended, electricity has superseded horse power, and rapid transit has followed slow horse car transportation.

Mr. Shaw is well versed in street railway matters, including the makeup of the cars and the working of electricity. That he has proved an efficient manager of the road in this and other cities is conceded on all sides.

Obituary.

The death, on April 14, of Gen. Henry W. Slocum, formerly president of the Brooklyn & Coney Island Railroad Company, and father of the present president of that road, will be mourned by a large circle of intimate friends, of which he had a large number in street railway circles, and by everyone who is familiar with his brilliant military achievements and his sterling qualities as a citizen and a man. His end was sudden and quite unexpected. The immediate cause was heart failure, resulting from an attack of pneumonia.

General Slocum was born in Delphi, N. Y., on September 24, 1827, and at the time of his death was in his sixty-sixth year. He was educated at Cazenovia Academy and West Point, and served in the army as a second lieutenant until 1856, when he resigned his commission to practice law in Syracuse. When the war broke out, he immediately offered his services to the Government. They were eagerly accepted, and he went to the front as colonel of the Twenty-Seventh New York Volunteers. He served with distinction all through the war, and rapidly rose to the rank of major-general of volunteers. Taking part in nearly all the great battles of the East, he became known as the "fighting general."

At the close of the war, General Slocum made his home in Brooklyn, where he resided until his death. He took an active part, as a Democrat, in national politics, served three terms in Congress, and was at one time mentioned as a possible candidate for President. As president of the Coney Island & Brooklyn Railway Company, General Slocum was the first to adopt electricity as a motive power for surface cars in Brooklyn. The success of his undertaking was most gratifying, and resulted in the electric motor supplanting the horse on nearly all the street railways of that city.

Removal of the Central Electric Company.

The Central Electric Company has moved from its old quarters 116–118 Franklin Street, Chicago, to Nos. 173–175 Adams Street, where the company now occupies one of the finest electrical supply stores in this country. On account of the great increase in its trade the company had outgrown the old store, making it necessary to find more commodious quarters, and it is doubtful whether a more suitable place could have been found in all Chicago. The company occupies three floors, the main floor, the basement and the second floor. The basement is used for storage, the main floor and second story are used as sales rooms to conduct a large and constantly growing wholesale and retail trade. The offices are on the main floor, and are conveniently arranged, partitioned off in individual offices, with highly polished oak with brass trimmings, giving a substantial, solid, business like appearance through the whole establishment.

We extend to the Central Electric Company hearty congratulations, and wish the managers every success in their new quarters.

New Publications.

Tables and Formulas for Electric Street Railway Engineers. Compiled and arranged by E. A. Merrill. Published by W. J. Johnston Company, Limited, New York. Price $1.

This work will be found very convenient and useful by an electric street railway engineer in his practical every day work, as it gives the principal tables, data, etc., required in his work. The volume is of convenient pocket size, and substantially bound. The author, Mr. Merrill, is a well known authority on electrical engineering, and is conversant with the needs of a book of this kind.

Catalogue of the Vulcanized Fibre Company.

The Vulcanized Fibre Company, with factories at Wilmington, Del., and New York office, 14 Dey Street, has recently issued a new catalogue giving price list and description of the various forms in which its well known vulcanized fibre is manufactured. A glance over this catalogue will be a surprise to many, indicating the large number of uses to which this valuable product can be applied. Vulcanized fibre is supplied in sheets, tubings, washers, gibs, rollers, ferules, staples, and special shapes. Vulcanized fibre is not only used very extensively for electrical and mechanical purposes, as our readers well know, but for trunks, sample cases, etc. The insulating saddle staple manufactured by this company is meeting with a large sale.

The Catalogue of the Genett Air Brake for Cable and Electric Street Railways. Published by the Genett Air Brake Company of Chicago and New York.

The increased weight of electric and cable cars over the old horse cars early showed the necessity for some kind of power brake which should be more effective than that operated by hand. The success and rapid adoption of the air brake for steam railways suggested the importance of a similar application to street cars, and it is through working on these lines that the Genett air brake has been evolved. The catalogue before us is extremely attractive both in regard to typographical work and engravings, and the interesting information which it contains. The encased duplex compressor, the latest type for street car air brake service, is fully illustrated, both in details and in its application to different types of cars and trucks. The same careful attention is given to the other parts of the apparatus, and one engraving is given of method of attachment for a train of electric cars, by which the trucks on the trail car, as well as on the motor car, are set by the movement of one handle on the front platform of the motor car.

The Book of the Fair. 1,000 Imperial folio pages, 12 × 16 ins.; to be issued in twenty-five parts. Price $1 a part. Published serially by the Bancroft Company, of Chicago and San Francisco.

The remarkable exhibition of the world's progressive science, art and industry, as shown at the Columbian Exposition at Chicago, in 1893, so far exceeded in completeness, interest and extent anything which had ever before been attempted in the history of the world, that a book of the Fair, presenting its most important features, and worthy of the Fair, became a necessity. The Bancroft Company has undertaken the publication of a work of this description, and the first numbers issued form excellent evidence that the work will be in every way representative of the event which is to be treated. "The Book of the Fair" is written by, and published under the direct supervision of, Hubert Howe Bancroft, whose historical works on America have a deservedly wide reputation, and are a sufficient guarantee that the many interesting features of the Chicago Fair will be suitably presented. To those who visited Jackson Park last summer, the work will recall most vividly the wonders and delights of the Exposition, and to those who were unable to make the trip, the work will supply the deficiency so far as can be done. No efforts have been spared in time and money to make the publication interesting and attractive, and it will form a most handsome and valuable addition to any library.

Equipment Notes.

The Vose Spring Company, of New York, has moved its offices from 115 Broadway to 39 Cortlandt Street.

The Worcester Construction Company, of Worcester, Mass., reports business very good, in its particular line.

I. H. Randall, of Boston, Mass., has brought suit against the West End Street Railroad, for building and using for advertising purposes the Randall advertising rack.

The Electrical & Mechanical Engineering & Trading Company, of New York, has moved its offices from the Edison Building, 44 Broad Street, to 39 Cortlandt Street, New York.

The Davis Car Shade Company, of Portland, Me., has received an order from the Buffalo Street Railroad Company for 1,500 of its automatic shades. The shades of this company are growing in popularity.

W. S. Davis & Sons, of Concord, N. H., manufacture an excellent design of tower wagons. Its main points of advantage are familiar to railroad managers. This firm has been very successful in obtaining orders.

Neftel, O'Conner & Company, of New York, have commenced construction on the 135th Street line of the Union Railway Company, of New York, the first trolley line in New York City south of the Harlem River.

Julius Meyer, consulting engineer, has given up his offices in Temple Court, New York, and has removed to 44 Broad Street, Edison Building. Mr. Meyer has secured here more commodious and comfortable quarters.

S. E. Hartman, of Worcester, Mass., has put on the market an adjustable tower, for construction work, which can be mounted on any express wagon, or is supplied with a special wagon. When not in use, the tower can be lowered out of the way.

Westinghouse, Church, Kerr & Company, as mentioned in our last issue, have moved their New York office to 26 Cortlandt Street, The Chicago office of Westinghouse, Church, Kerr & Company is now located at 171 Lasalle Street, instead of 159 Lake Street, which was the old address.

The J. G. Brill Company, of Philadelphia, Pa., has received the orders for cars for the West Shore Railway, of New Haven, Conn. This road will be constructed and in operation by June 5, and will connect West Haven and Milford. The type of car adopted is a combination car with cross seats.

The United Columbian Electric Company, of New York and Kingston, has issued a pamphlet descriptive of its electric railway system. The pamphlet contains views of the company's apparatus, also the record of a test made of a motor equipment on the Union Railway, of New York, February 21, 1894, showing high economy.

The American Manufacturing & Engineering Company, of 143 Liberty Street, New York, is the sole owner of the "positive" electric car lighting system, for which a number of advantages are claimed. The company also manufactures a storage battery, which has given excellent results in service, and other electrical supplies.

Best, Fox & Company, of Pittsburgh, Pa., brass founders, iron pipe fitters and machinists, have opened an office at Room 600, Betz Building, Philadelphia, where their present large piping and bronze business will be carried on and somewhat enlarged. The general sales agent of the company in charge of this office will be W. K. Mitchell.

The Ames Register Company, of Boston, manufacturer of the Ames combined, portable and stationary register, has closed a number of orders for this appliance recently. It is the only one on the market combining the portable and stationary register, and full particulars of its valuable features were published in a recent issue of this periodical.

The R. Woodman Manufacturing & Supply Company, of Boston, Mass., the manufacturers of R. Woodman's celebrated cast steel ticket punches, which are extensively used on electric and cable roads for the cancellation of transfer and other tickets, tell us that the demand for these punches is constantly growing. The punches are giving universal satisfaction.

Thompson & Inness, dealers in railway equipment and supplies have moved their office from No. 115 Broadway to the Havemeyer Building, No. 26 Cortlandt Street, New York. This firm is general agent of the American Wire Glass Manufacturing Company, Philadelphia, Pa., and agent for A. Whitney & Sons Car Wheel Works, Philadelphia, Pa.

The Glazier Headlight Company, of Rochester, N. Y., is the title of a new corporation organized to manufacture locomotive and motor headlights, railroad lamps and lanterns, etc. The president and general manager of this company is E. C. Glazier, after whom the company is named. Mr. Glazier is a well known authority on headlights and well posted on the subject.

The General Electric Company, of New York, has just issued a handsome souvenir in the form of a blank memorandum book. It is handsomely bound and double indexed, and will prove a most useful present to business men. The front cover is stamped in gilt "With the Compliments of the General Electric Company," and the addresses of the different offices of the company are given on the back cover.

J. H. Herrick & Company, is the title of a firm recently organized, with headquarters at 44 Broad Street, N. Y., for the transaction of a general brokerage business in investment securities, loans and commercial paper. The firm is composed of J. Hobart Herrick, formerly of the General Electric Company, and Edward B. Camp. H. M. Vickers, consulting engineer, will have charge of the electrical securities department.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., manufacturer of the Crawford wheel guard and pickup fender, writes us that F. A. Lawson & Company, of San Francisco, Cal, have been appointed that company's agents for the Pacific Coast. This action has been taken by the Crawford Company to supply the large demand which has arisen for fenders on the roads in California and neighboring states.

The United States Steam & Street Railway Advertising Company, Messrs. Carleton & Kissam, proprietors, of Boston and New York, has removed its New York office to the Postal Telegraph Building corner of Broadway and Murray Street. This company is constantly adding to the list of lines which it controls, and the advertising service which it renders is growing more popular to advertisers and street railway companies.

A. B. Laurence, New York manager of the Shultz Belting Company, of St. Louis, has secured very commodious and central offices at 113 Liberty Street. Mr. Laurence will keep here a full line of Shultz patent sable raw hide belting, genuine raw hide lacing, and can also furnish pure oak tanned leather belting as required. The high reputation which the Shultz belting has achieved in the past is well sustained, and these belts seem growing in popularity among steam users.

The Gleason & Bailey Manufacturing Company, of Seneca Falls, N. Y., has received the contract from the Fire Commissioners of New York City for two large steel trucks and three hose wagons. The time specified for completion is 120 days. The same company has also received an order for a handsome hose wagon for Danville, N. Y., and its fourth order for a hose wagon from Mt. Vernon, N. Y. The emergency wagons of this company form a desirable part of the equipment of any railway.

The Breese & Mansfield Company, of Philadelphia, Pa., which has recently been appointed representative in that city of the Walker Manufacturing Company, of Cleveland, O., as mentioned in our last issue, is located at room 1,120 Betz Building, Philadelphia, and not 120, as printed in our last issue. The president of the company is C. P. Breese. We understand that the company is entering upon its work under the best possible conditions, and the outlook for the future is extremely bright.

Wm. E. Hooper & Sons, of Baltimore, Md., manufacturers of cotton duck, yarns, twines, rope, wicks, etc., are doing a large business in the manufacture of cotton ropes for power transmission in stations. Ropes manufactured by this company are employed by the New Haven Street Railway Company, for use in its new station, and are giving excellent satisfaction. The company also manufactures a high grade of cotton duck for car curtains and other purposes. The firm has offices in New York and Philadelphia, and large mills in Baltimore.

The Manhattan Construction Company, of New York, has secured the agency for the Fleming woven wire gauze brush. W. H. Fleming, the inventor, who was associated with the International Trading & Electric Company, has severed his connection with that company, and has made arrangements with the Manhattan Construction Company to act as selling agent for the brush. All orders and inquiries relating to prices and sizes of brushes in stock ready for immediate delivery should, therefore, be addressed to the Manhattan Company.

The American District Steam Company, of Lockport, N. Y., writes us that recent results from the exhaust steam heating plant of the Springfield Electric Light & Power Company, described in our last issue, show even better returns than in the preceding years. The company during the winter just past took in about $12,000 from the heating service, this being practically all gain. During the preceding winter the income was about $8,000, and not $3,000, as the types made us say in our last issue.

Jones & Laughlins, Limited, of Pittsburgh, Pa., have supplied many thousands of axles for street railways. Their customers include such concerns as the P. H. Griffin Machine Works, of Buffalo, the Baltimore Car Wheel Company, of South Baltimore, Md., Peckham Motor Truck & Wheel Company, of Kingston, N. Y., and other manufacturing companies, as well as a large number of street railway companies in Pittsburgh and other cities. A number of their oldest customers have never broken an axle, even under most severe conditions,

The Mica Insulator Company, of New York, manufacturer of the well known insulator "Micanite" has recently greatly improved the product "Micanite cloth," which is meeting with a large demand. This cloth is a most useful insulator for general purposes and is non-absorptive, at the same time is flexible indefinitely and contains a large amount of pure India sheet mica. It can be supplied in rolls thirty-two inches wide and sixteen feet long. The use of "Micanite" prepared in a variety of forms, such as taper and band rings, cylinders, tubes, washers, linings for rheostat boxes, ready for use, is constantly growing and it has proved its efficiency on a large number of roads.

Warren-Webster & Company, of Camden, N. J., manufacturers of vacuum feed water heaters and purifiers and oil and steam separators, report that the number of orders they have received for the above named specialties during the month of March was very satisfactory, and showed a marked improvement over the few former months. They say that the reason that their specialties sell during these hard times is on account of their goods being fuel saving devices. Rapid progress is being made upon the new extension of their wrought iron department, connected with the new works, which they just built last year. They visit steam plants at their own expense, and back their guarantees by a cash indemnity.

The New Process Raw Hide Company, of Syracuse, N. Y., some time ago sold a number of its raw hide pinions to the Watertown (N. Y.) Street Railway Company, of which G. W. Adams is superintendent. The Watertown *Daily Standard*, in a recent article about the railway, said in reference to these pinions: "Two raw hide pinions, purchased of the New Process Raw Hide Company, of Syracuse, N. Y., running about eight months in car No. 10 of the street railway company, have made a mileage of about 21,000 miles. These pinions make five revolutions for every time the car wheel moves around once, or on an average of about 400 revolutions per minute. In this 21,000 miles the wheels of car No. 10 have made 13,440,000 revolutions, and the armatures and pinions have made 67,220,000. The pinions are not yet worn out, and are still in service.

The Kotine Manufacturing Company, whose factory is at Hawthorne, N. J., and whose New York office is in the Central Building, manufactures a waterproof and dustproof paint termed "Kotine," which seems to have given good satisfaction. "Kotine" is a secret preparation. Its advantage over ordinary paint is that water does not affect it, and if, while painting a car barn or cars with Kotine, a heavy shower should come on, the company claims no harm will be done, nor will the drying of the paint be interfered with. This waterproof feature is likely to be of decided interest to street railroad men. It certainly should be an advantage to have cars painted with a material which will resist the action of the elements. The company claims also that the spreading capacity of Kotine paint is from 25 to 50 per cent. greater than that of ordinary paints. From the testimonials at the company's office it is evident that Kotine products are appreciated highly by some of the largest concerns known to the trade.

The Safety Car Heating & Lighting Company, of New York, has issued a neat and attractive circular entitled "Standard Light for Railway Coaches: A Few Opinions of the Pintsch Light." The pamphlet gives editorial expressions of the value of this company's system of lighting, together with the opinions of a number of the most prominent railway engineers of the country. The list of roads upon which this system has been adopted, together with the location given of different Pintsch plants, shows that the system has had a rapid and extensive adoption throughout the country. The company states that negotiations are now being completed for a supply in every prominent railroad center in the United States. The company has just received an order from the Third Avenue Cable Company for the equipment of 175 open cable cars with the Pintsch system of lighting. Over 200 cars of this company are already equipped with the Pintsch system, which is also the standard light of the Broadway cable line, of New York, and of the North Chicago Street Railway Company.

Chas. J. Mayer, of Philadelphia, has opened an office at No. 600 Betz Building, that city, and will represent the R. D. Nuttall Company, of Allegheny, Pa., as its general sales agent throughout the Middle States. Mr. Mayer has also arranged to represent in this territory the W. T. C. McCallan Company, of Boston, Mass., manufacturers of solid sheet mica insulators, and is prepared to quote prices on all the appliances required for trolley construction of any description. The merits of the productions of these companies are now so well established as to require no comment, and Mr. Mayer has good reason to expect a full share of patronage. He is also closing negotiations for the handling of several other street railway specialties of established merit, and will be prepared shortly to supply all wants in the line of car and station fixtures. Owing to his long practical experience in the electric railway field, to which he will devote his attention exclusively, he believes that he is in a position to thoroughly understand the requirements of electric railway companies, and well fitted to recommend the best grades of material obtainable for this service.

The Reliable Detective Agency, of New York, P. J. Saloschin general manager, has been compelled within three months to more than double its force. As stated in our February issue, this agency was in charge of the Bridgeport (Conn.) Street Railway Company's interests during the recent strike in that city. All operators are engaged by Mr. Saloschin personally. All operatives are bonded, and all reports made by them must be substantiated by affidavit, if required, this being one of the conditions previous to their engagement. The Reliable Agency writes us that among those who are well acquainted with its work are John Beaver, treasurer of the Third Avenue Railroad Company, of New York; George S. Hart, president of the Second Avenue Railroad Company, of New York; M. I. Masson, secretary of the Central Crosstown Railroad Company, of New York; Col. N. H. Heft, president of the Bridgeport Traction Company, of Bridgeport, Conn.; Andrew Radel, general manager of the Newark Street Railroad Company, of Newark, N. J.; A. C. Titus, president of the Newport Street Railroad, of Newport R. I.; Jas A. Powers, general manager of the Burlington Railroad Company, Burlington, Vt., and many others.

The Berlin Iron Bridge Company, of East Berlin, Conn., has a number of contracts for the last month. The new electric light and power station for the Brush Electric Light Company, at Baltimore, Md., will be one of the finest in the Southern states. The boiler room is 83 ft. wide by 129 ft. long. The dynamo room is 130 ft. square; the floor space in the latter is entirely free from posts. The roofs are designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn., and are made entirely of iron, covered with this company's patent, anti-condensation, corrugated iron roof covering. J. F. Rogers & Company, of New York City, have also placed the order for a new industrial school building, at Havana, Cuba, with this company. The building will be fifteen metres wide and forty-eight metres long, constructed entirely of iron and cement. Another recent customer is the McNeal Pipe & Foundry Company, of Burlington, N. J., which has placed the contract for two cleaning sheds with the company. Dr. Drysdale, of Philadelphia, has placed the contract for an iron roof over the new power house for the Hospital for the Insane, at Norristown, Pa., with this company. It was desired that the roof be fireproof, and ordinary corrugated iron could not be used on account of the drip, so that the roof will be covered with the Berlin Iron Bridge Company's patent, anti-condensation, corrugated iron covering.

The John Stephenson Company, Ltd., of New York, is busy turning out 100 new open cars for the Metropolitan Traction Company, the contract for which was awarded to it as mentioned in our last issue. These cars, which a representative of this paper had the pleasure of inspecting recently, are extremely handsome and are provided with eight benches each. They have Bombay roofs with two center lamps, spring roller curtains at the sides, and all mountings, handles, etc., are of solid bronze. The cars will be mounted on the famous Stephenson super-spring running gear. Thirty of these cars are destined for the Sixth Avenue line, ten for the 42d Street line, thirty for the Belt line, ten for the Seventh Avenue line, ten for the Avenue C line and ten for the Bleecker Street line. The cars are being colored differently according to the line for which they are intended. The Stephenson Company is also manufacturing some very handsome closed cars with mahogany finish and paneled ceiling for the 42d Street and St. Nicholas Avenue lines. Other orders, which have been received recently are for a number of cars for the Consolidated Traction Company, of New Jersey, a number of open cars for the 86th Street transverse line of the Fourth Avenue Railway, of New York, and a number of electric cars for Chattanooga and Mobile. The advent of peace in Brazil was welcome to this company, which has always enjoyed a very large trade in foreign countries, and was accompanied by an order for a number of electric cars from Rio Janeiro.

The Joseph Dixon Crucible Company, of Jersey City, N. J., is putting a cycle chain graphite on the market, which for purity of graphite and usefulness is claimed to be vastly superior to anything of the kind heretofore prepared. The graphite is not only of the choicest stock, but is ground to an impalpable powder and then reground with a high grade of lubricating oil. This company is also meeting with a large sale of its graphite for lubrication purposes. This company writes us that at a meeting of the stockholders of that company, held at its offices in Jersey City, N. J., April 16, out of 7,345 shares 7,215 votes were cast for the same board of managers that has conducted the affairs of the company through its many years of prosperity. The vote was the largest ever cast, and it was a decided compliment to the members of the board, as were also the remarks of some of the largest stockholders. The board consists of E. F. C. Young, John A. Walker, Daniel T. Hoag, Richard Butler, William Murray, Joseph D. Bedle, Jerome D. Gillett. In the organization of the board E. F. C. Young was elected president, John A. Walker, vice-president and treasurer, George T. Long, secretary. The Dixon Company was founded by Joseph Dixon in 1827, and organized as a stock company in 1868. Its manufactures are graphite products of all kinds, consisting of plumbago crucibles for melting gold, silver, brass, etc., blacklead retorts, stove polish, graphite for lubricating, electrotypers' graphite, graphite lead pencils, graphite paint, and graphite prepared in hundreds of ways for as many different uses. Graphite is one of the principal forms of carbon. It is not affected by heat or cold, acids or alkalies, and is therefore one of the most useful materials known to modern industry when rightly prepared.

WESTERN NOTES.

The B. E. Tilden Company, of Chicago, which manufactures railway replacing frogs, had its shops at Chicago entirely destroyed by fire April 9. The company writes us that it still has a supply of wrecking frogs and motor replacers at other points that it can supply patrons for the immediate future, and will arrange to supply all demands as soon as possible.

H. R. Keithley, of 107 Lake Street, Chicago, Ill., manufacturer of the Chicago rail bond, tells us that the demand for this bond is constantly increasing, and its value is being shown on a large number of roads. Over 10,000 bonds were sold last month. The bonds can be furnished at any length or size from 0 to 0000. Mr. Keithley has given us a very neat paper weight representing a portion of the web of a rail with the bond in position. This gives an excellent idea of the perfect contact made between bond and rail.

The McGuire Manufacturing Company, of Chicago, has closed a large number of orders for trucks recently. The company has been especially pushing its New England buisness, and among the contracts

received in this territory during the last month are orders from the Taunton Street Railway Company, Taunton, Mass.; Norwalk Tramway Company, Norwalk, Conn.; Dartmouth & Westport Street Railway Company, New Bedford, Mass., and the Norwalk Street Railway, Norwalk, Conn. All of these are for early delivery.

C. E. Loss & Company, of Chicago, whose reputation as a substantial and reliable contracting firm is well known, have been awarded the contract to construct and furnish complete equipment for five and a half miles of extension of the Hammond, Whiting & East Chicago Electric Railway Company. This order was certainly a flattering compliment to this firm, as C. E. Loss & Company have had charge of all previous work, proving conclusively that the company was perfectly satisfied with the work done on the previous contracts.

The Hoppes Manufacturing Company, of Springfield, O., manufacturer of the well known "Hoppes" feedwater purifier, has received the contract for the purifiers to supply the boilers with pure feedwater for the city electric light plant, now being built by the Public Lighting Commission, of Detroit, Mich., the Hoppes purifiers having been selected after very strong competition. The order calls for seven 300 H. P. purifiers to carry 165 lbs. of steam working pressure. Each purifier is required to heat and purify 9,000 lbs. of boiler feedwater per hour.

The Chas. Munson Belting Company, of Chicago, reports trade very much improved the past thirty days, having received a large number of orders principally from the saw mill trade. This company received orders for the equipment of belting for seven mills in six weeks, which is a very good record. The company's street railway trade has also picked up considerably, having received orders for quite a number of large belts the past three months. This company has been working full time all during the panicky times, and was even compelled to put on additional forces to insure prompt delivery.

The Genett Air Brake Company, of Chicago and New York, has met with very flattering results in the way of orders, and has shipped equipments as far away as Australia, where the brakes will be used on the King Street railway cars, at Sydney. Among the companies in this country which have recently ordered equipments are the Buffalo Railway Company, which will use the brakes on its large cars operating on Niagara Street, the Chicago North Shore Street Railway Company, and others. The Third Avenue Railway Company, of New York, is also using this brake on its summer cars, which have just been brought out.

The Louis K. Comstock Company, is the title of a new corporation which will carry on the business in the future of Louis K. Comstock, of Chicago, and which commenced operations April 1. The Louis K. Comstock Company will practice as electrical engineers and contractors, with offices at 1437–1438 Monadnock Block, Chicago. Louis K. Comstock is president and manager, F. S. Richmond, vice president, J. R. Allen, secretary, and J. H. Stahley, superintendent, making a very strong corps of engineers and contractors. It is the company's purpose to design, build and construct any plant in the electrical field, whether it be electric lighting or street railway constructions. We wish the new company all success.

The Mason Electric Company, of Chicago, reports a growing business in electric railway supplies. This company is agent for a number of prominent Eastern houses, including Holmes, Booth & Hayden, the Fiberite Company, of Mechanicville, N. Y., the Safety Clutch Brake Company, of Philadelphia, the Garton-Daniels Electric Company, the Partridge Carbon Company and others. The general manager of the company is W. R. Mason, who is widely recognized as being one of the best posted men in the country on electric railway supplies, and fully acquainted with the needs of street railway companies in this direction. Mr. Mason has purchased the entire stock of the Railway Equipment Company, and will continue its business. The offices of the company are located in the Pullman Building, Chicago.

The Stirling Company, of Chicago, has received the text of the award made to it by Department F— Machinery, at the Chicago Fair. The award speaks of the special advantages of the Stirling boiler, its extreme simplicity, low cost of construction and economy, and especially of its singular adaptability to situations requiring the use of impure feed water. This company has sent us an report of a interesting test by George H. Barrus, the well known expert steam engineer of Boston, on a 250 H. P. Stirling boiler at Portland, Me. This shows water evaporated per pound of coal, 10.54 lbs.; equivalent evaporation per pound of coal from and at 212 degs., 11.025 lbs.; equivalent evaporation per pound of combustible from and at 212 degs., 12.061 lbs.; moisture in steam while boiler was developing 380 H. P. or 52 per cent. above its rated capacity, .19 per cent.; moisture in steam while boiler was working at its rated capacity .06 per cent.

A. L. Ide & Son, of Springfield, Ill., report the following recent sales of Ideal engines: two 11 × 12 to the W. J. Lemp Brewing Company, of St. Louis; one 12 × 12 to the Franklin Electric Light Company, of Franklin, Mo.; one 15 × 14 to the Monett Electric Light Company, of Monett, Mo.; one 12 × 20 × 14 to E. T. Sykes, Waseca, Minn.; one 14 × 14 to E. B. Hillman & Company, Peoria. Ill., (this engine is equipped with one power transmitter); one 7 × 10 to the Griesidieck Artificial Ice Company of St. Louis, Mo.; one 8 × 10 to the Western Electric Company for the Stephens Building, Chicago, Ill.; one 8 × 10 to the United States Express Company, Chicago, Ill.; one 13 × 12 to the Chicago Edison Company, prepared for direct connection to an Edison armature for the Gottfreidt Brewing Company; one 13 × 12 to E. F. Pulsifer, Chicago, Ill.; one 6 × 6 to the Great Western Manufacturing Company for Leadville, Colo.; one 13 × 20 to the Western Electric Company for Rutland, Vt.; one 12 × 12 to the Haymarket Theatre Company, Chicago, Ill.; two 8 × 10 for the new Home Bank Building, Detroit, Mich. (each of these equipped with a power transmitter); one 12 × 12 to E. B. Hillman & Company, Peoria, Ill.; one 12 × 12 to Gardiner & Worthen, of Tucson, Ariz., (all of these equipped with power transmitters). One 9 × 10 for Belle Isle Park, Detroit, Mich, equipped with one power transmitter on each side; one 7 × 10 to the Western News Company, Chicago, Ill., and two 8 × 10 to the Peninsular Electric Company, for Fort Wayne, Mich.

The International Register Company, of 197 South Canal Street, Chicago, reports the closing of a contract with the Toledo Consolidated Street Railway Company to equip the entire system of the latter company with the International Company's well known Pratt portable registers. The adoption of this register throughout such a large system is an endorsement of its merits that is seldom accorded any device. Heretofore, the railway company has been using a stationary register, and was apparently satisfied with it until about fifteen months ago, when a sufficient number of Pratt machines were purchased to equip one branch of the system. The results obtained from the comparative tests which have been in progress during the past pear have been so entirely in favor of the Pratt registers that President Lang decided to adopt them altogether, and by May 1 there will be nothing but International registers in operation on the Consolidated lines. The total number in use will be 135. Manager A. H. Englund, of the International Register Company, is particularly jubilant over this contract, as it further demonstrates the excellency of his company's registers, and the high favor in which they are held by such practical railway managers as Mr. Lang.

The Buckeye Engine Company, of Salem, O., has sent us a list of recent sales which, although considerably smaller than last year, as might be expected, shows that the company has a good share of the engine trade. The list includes the following: J. T. Williams, New York City, 150 H. P., slow speed; Cleveland Milling Company, Cleveland, O., 125 H. P., slow speed; Alfred Ricker, Hartford, Conn., 125 H. P., slow speed; D. J. Murrag Manufacturing Company, Wausau, Wis., 70 H. P., medium speed; Bloomfield-Pearson School, Tufts College, Mass., 25 H. P., high speed; Minnesota State Public School, Owatonna, Minn., 50 H. P., high speed; Ellsworth Electric Illuminating Company, Ellsworth, Me., 180 H. P., high speed; Coplay Cement Company, Coplay, Pa., 600 H. P., slow speed, cross compound; Dayton Street Railway Company, Dayton, O., three 500 H. P., tandem compounds, medium speed, arranged for direct connection to Siemens & Halske generators; King Powder Company, Kings Mills, O., 500 H. P., medium speed, tandem compound; Diamond Match Company, Barberton, O., two 125 H. P. and one 90 H. P.; C. & O. Southwestern Railroad Company, Paducah, Ky., 150 H. P., medium speed; Blish Milling Company, Seymour, Ind., 600 H. P., medium speed, cross compound; McKeesport & Wilmerding Street Railway Company, McKeesport, O., 80 H. P., medium speed; the Snell Cycle Company, Toledo, O., 125 H. P., medium speed; Edward McDonald, McDonald, Pa., 90 H. P., high speed; Bakhaus & Kuenzels, New Bremen, O., 100 H. P., slow speed; J. T. Williams, New York City, 70 H. P., slow speed; Garland Chain Company, Rankin, Pa., 100 H. P., slow speed, cross compound; American Rubber Company, E. Cambridge, Mass., 60 H. P., high speed; Richmond Light, Heat & Power Company, Richmond, Ind., two 300 H. P., medium speed, tandem compounds. This company, on April 1, moved its New York office from 18 Cortlandt Street to 39 and 41 Cortlandt Street, New York. Here Mr. Porter, the company's sales agent, and Mr. Best, engineer, have larger and more commodious offices, where they will be pleased to see their patrons and friends at all times, and give any information or estimates they may desire. In addition to the company's regular line of plain, tandem compound, cross compound and triple expansion horizontal engines, Mr. Porter tells us that the company is having great success with its new vertical compound engines, for electric light and railway service, ranging from 150 H. P. to 1,200 H. P. and over. This engine is specially adapted for direct connecting to dynamos, and is guaranteed to work as economically as any compound engine on the market, and to run with superior regulation.

List of Street Railway Patents.

U. S. STREET RAILWAY PATENTS ISSUED MARCH 27, 1894, TO APRIL 20, 1894, INCLUSIVE.

MARCH 27.

ELECTRIC RAILWAY TROLLEY—Frank S. Church, Detroit, Mich., assignor of one-half to Wm. F. H. Edwards, same place. No. 517,028.

A trolley formed of two wheels having complementary grooved, beveled faces, the inner flanges of the groove contacting below the conductor and the outer flanges approaching each other above the conductor.

RAILROAD RAIL AND CHAIR AND PROCESS OF UNITING SAME—Maximilian M. Suppes, Johnstown, Pa., assignor, by mesne assignments, to the Johnson Company, of Pennsylvania. No. 517,075.

The combination of a railroad rail and support each having a single vertical web, the web in one terminating in a pocket, or jaws, fitted to receive the web of the other and said parts, connected altogether only by the jaws, being moulded by pressure against said web.

APPARATUS FOR SUPPLYING OR REMOVING STORAGE BATTERIES—William E. Worthen, New York. No. 517,134.

The combination with a main track and railway car, supported upon wheels, of a battery truck supported upon wheels and supporting

a battery and a motor or motors, and connected detachably with the body of the car, a movable track section, and a support for the track section whereby the same with the truck can be moved to and from the body of the car.

Trolley Catcher—Levi G. Momry, Buffalo, N. Y. No. 517,166.

A trolley catcher having swinging depressor rod, a holder for retaining the depressor rod in its normal position and a trip or releasing device operating on said holder and connected with the trolley.

Car Brake—Lloyd H. Cole, Pawtucket, R. I. No. 517,212.

A brake, car wheels, a rotatable cam, brake shoes carried by a rotatable support, and a device mounted on said support and acted upon by the cam.

Electrical Railway—Benson Bidwell, Philadelphia Pa., assignor of one-half to Chas. F. Bidwell, Indianapolis, Ind. No. 517,258.

An electric railway having a line of conductors in connection with a generator located at a station along the line of way, a branch or loop in said generator circuit having telephonic instruments and resistance coils, in combination with a car having traveling circuit and a loop or branch from the motor curcuit or loop, and including a telephonic instrument and resistance coils.

Railway Track Structure—Peter Hevner, Philadelphia, Pa. No. 517,277.

The combination in a roadbed for railways, of the opposite rails, foundation blocks of artificial stone or cement, clamping devices for securing the rails to said blocks, securing bolts immovably confined to said blocks and tie bars adapted to the inner clamp bolts, and serving as a means of spacing both the foundation blocks and the rails.

A Safety Guard for Open Cars—Wm. H. Hart, Chelsea, Mass. No. 517,339.

A street car having vertically sliding gates extending along the sides thereof, flexible supports extending transversely through and connected at their opposite ends to said gates, and guides for said supports.

Ratchet for Car Brake Staffs—August D. Gerbig, St. Louis, Mo., assignor to the Laclede Car Company, same place. No. 517,405.

A ratchet for a brake staff, comprising a ratchet wheel having a sleeve connected thereto, a staff mounted in said sleeve, and a ratchet wheel rigidly connected to said staff, and engaged by pawls connected to the upper side of the first mentioned ratchet wheel.

April 3.

Induction Electric Railway—Chas. E. Roehl, St. Joseph, Mo. No. 517,531.

Consists of a roadbed provided with a magnetically continuous iron core, separate from but extending parallel to the tracks, and a series of primary coils located upon said core, in combination with a moving vehicle carrying a secondary core and coil in inductive relation to said primary core.

System of Elevated and Surface Railways—Charles H. Barrows, Willimantic, Conn. No. 517,535.

Consists of an elevated track having the broad girders and central guide rail which accommodate flangeless traction wheels and flanged central wheels of a car, and a single surface rail adapted to receive the flanged wheels of a car provided with traction wheels.

Conduit Electric Railway—Willie C. Keithly, San Francisco, Cal. No. 537,549.

Consists of underground conduit wire, flanged hanger trolley arm, spring and means for raising and lowering said trolley arm.

Motor Car Truck—Wm. A. Dutton & Jacob F. Pfetch, Cleveland, O. No. 517,665.

Consists of side bars for car trucks having journaled yokes integral therewith, the ends of said bars bent inclinatorily upward for supporting elliptic springs on a higher plane.

Car Truck—Jas. L. Hardie, Chester, Pa. No. 517,571.

A car truck frame comprising side bars composed of two sections with a space between, the cross bars connecting the side bars and supporting the brake mechanism, springs located centrally of the frame, sills located above the side bars and levers pivoted between the sections of the bars having their outer ends connected with the ends of the sills and the inner ends with the springs.

Car Brake—Henry B. Cary, Los Angeles, Cal. No. 517,601.

Consists of shoe frames adapted to unitedly engage the track and the wheels, a crankshaft having cranks near the opposite ends thereof, which directly pass through the upper parts of shoe frames, and means for operating said crankshaft.

Car Fender—Carl P. Anderson, Boston, Mass. No. 517,638.

Consists of a horizontal slideway on the car and a fender engaging said slideway capable of vertical play, and having guides to tilt its forward end downward under a rearward movement of the fender in the slideway.

Girder Joint for Railroad Rails—James M. Price, Philadelphia, Pa., assignor to the Price Railway Appliance Company, of Pennsylvania. No. 517,660.

A girder joint for meeting rails consisting of a vertical plate with a raised center, a horizontal groove forming a jaw and feet, arches connecting the inner end of the said feet, and a bench depending from said jaw, said parts being combined.

Conduit Electric Railway—Herbert A. Gorham, Decatur, Ill. No. 517,692.

Comprises a trench, a conduit along the upper portion of the trench, a central rib, or upward extension in the conduit, supporting and insulated from the trolley wire, slotted grates covering the conduit and communicating with the trench, such grates being separated to form a slot for the trolley, and valves in the lower surfaces of the conduit.

Underground Railway—Wilton P. Jenkins, Richmond, Va. No. 517,749.

Consists of a conduit, yokes passing under same, longitudinal surface rails resting upon ends of the yokes at right angles, and a downwardly drawing screw clamp connection provided with double clamps for grasping both sides of the rail base, and adapted to be applied to the yoke for fastening the yokes to the rails at any point without the use of bolts.

Car Fender and Automatic Brake—William L. Fitzhugh, Baltimore, Md. No. 517,798.

Consists of a pilot board adapted to yield when engaged by an obstruction, a lever adapted to be positively operated from an axle of the truck, a releasing and clutch mechanism actuated by the yielding of the pilot board to operatively connect the said lever with the axle, connections between the said lever and the pilot board whereby the latter is thrown outward, a brake mechanism and motive power disconnecting devices actuated from the said lever, simultaneously with the outward movement of the pilot board.

Conduit Electric Railway—Wilton F. Jenkins, Richmond, Va. No. 517,804.

With a conduit, a horizontally projecting arm consisting of a metal core having its sides and end completely covered in a non-conducting material and bent to form depressions, and conducting wires laid loosely upon said arms within the depressions.

April 10.

Rail Connection—Theodore C. Paulsen, Chicago, Ill. No. 517,884.

The combination in an electrical connection of two rails with holes therethrough, caps inserted in such holes, said caps closed at one end and provided with a groove extending only part way through the metal, and a wire having one end in each of said caps.

Electric Railway—Henry S. Pruyn, Hoosick Falls, N. Y. No. 517,886.

A conduit, a sectional electric conductor located therein, insulators positively attached to and supporting the sections of said sectional conductor, the insulators being constructed to be freely removable from their mountings, whereby one or more sections with their attached insulators, may be bodily removed from the conduit.

Fender for Street Railways—Eldridge J. Smith, Washington, D. C. No. 517,894.

A flexible apron so made as to buckle up when a fixed obstruction is encountered, a flexible edge and hinged to the sill of a car in connection with hinged fingers and connecting rods.

Electric Railway System—Chas. D. Tisdale, Boston, Mass. No. 517,940.

Consists of a truck provided with two axles, each axle being furnished with one conducting wheel and one insulated wheel, the conducting wheel of one axle is arranged diagonally opposite the conducting wheel of the other axle, a motor attached to a truck frame and conductors connected with the brushes of the motor and directly with the axles of the truck, whereby the current flows from one of the track rails through one of the conducting wheels and axle, through the motor, through the other axle and the other conducting wheel to the other rail.

Method of and Means for Speed Regulation of Electric Locomotives—Charles E. Emery, Brooklyn, N. Y. No. 517,948.

The method consists in electrically connecting a generator, at will, with motors, singly or in series, which motors severally develop different counter electro-motive forces at like speeds of the car or apparatus to which they are attached, thereby operating such car or apparatus at different speeds for the same available voltage.

Electric Locomotive—William Lawrence, New York, assignor to the Lawrence Electric Company, same place. No. 518,006.

The combination of a commutator having contacts with forked brushes adapted to be engaged by said contacts, and means for moving either of said brushes into engagement with said contacts and side brushes.

Ice Cutting Trolley—Robert W. Thompson, Cleveland, O. No. 518,015.

In a combined trolley wheel and wire stripper, the combination of a hub provided with a central disk grooved on its edge, peripheral rings secured by radial arms to the disk and hub at either side of the disk but separated therefrom by annular openings, and cutting inner edges integral with the rings.

Trolley Wire Insulator—Louis McCarthy, Boston, Mass. No. 518,071.

Comprises an outer case, or receiver, having one or more arms, by means of which the insulator may be secured to the span wire, an insulated portion fitting within said receiver, a screw bolt passing through the top of the outer case or receiver, and entering the upper part of such insulated portion for securing said insulated portion within said receiver, and a screw connection for securing said insulator to the trolley.

Car Fender—William V. McManus, Baltimore, Md. No. 518,115.

A car fender comprising the guide frame, the receiving frame suitably supported at its upper edge and having a sliding connection at

its lower front edge with the guide frame, such sliding connection including a bearing inclined to the horizontal whereby the front edge of the receiving frame may be depressed as it is pushed rearwardly.

CAR FENDER—Benjamin Tranter, Brooklyn N. Y. No. 518,126.
Consists of a movable fender carrying frame, arranged horizontally at the front of the same, swinging hangers which pivotally connect its rear end with the bottom of the car, a pitman pivoted to said hangers, and a lever pivoted vertically at the front of the car and connected with the pitman.

ELEVATED RAILWAY—Lee Anderson, Paris, Tex. No. 518,170.
A car having wheels above and below the same, and adjustable connections for varying the distance between the upper and lower wheels.

APRIL 17.

ELECTRIC MOTOR CAR—Arnold P. Brown, New York. No. 518,221.
An electric motor car and mechanism for communicating motion from the motor to the car, an electric motor having field magnets furnished with both series field coils and shunt field coils, and an additional or choking magnet adapted to be placed in connection with the series field in starting the motor or car.

ELECTRIC RAILWAY SYSTEM—Chas. D. Tisdale, Boston, Mass. No. 518,293.
Consists of a truck provided with three insulating wheels, two upon one side and one upon the other, a motor mounted upon the truck and a trolley wheel arranged upon the side of the truck having two wheels and arranged to form an electrical contact with the rail upon the side of the truck supporting the two insulating wheels.

CAR STARTER AND BRAKE—Carl H. O. Lenerkus, Cologne-on-the-Rhine, Germany. No. 518,371.
A car starter apparatus, truck frame, a vertically movable frame carrying the car body, elevating means between the truck frames, driving connections engaging the car axle for operating the elevating means, a clutch for throwing the driving connections into and out of engagement with the car axle and the transmitting devices between the driving connections and the car axle for transmitting the falling movement of the car body and frame to the said car axle to start the car.

BOND FOR ELECTRIC RAILWAYS—Julius Meyer, New York. No. 518,414.
Consists of conductors, bonds connecting the same, a container attached to said conductors and insulating material in the container.

ELECTRIC RAILWAY CONDUIT—Paul B. Banholzer, Philadelphia, Pa. No. 518,540.
A conduit having openings in its sides in addition to the slot opening, conductors arranged in the conduit, a plastic material forced into the conduit through the side openings and securing the conductors in place.

RAILWAY TRACK AND CAR—Chas. C. Burton, Chicago, Ill. No. 518,565.
A track having supporting rails and external guides or bearing rails located above the same, a car provided with supporting wheels and with guide wheels mounted on inclined axes, and bearing upwardly and outwardly against the said bearing rails.

CONTROLLER FOR ELECTRIC RAILWAY CARS—Walter H. Knight, Lynn, assignor to the General Electric Company, Boston, Mass. No. 518,254.
The combination of an electrically propelled vehicle, a controller, therefore, means adapted to actuate the controller from a source of fluid pressure carried on the car, and an indicator upon the car platform adapted to show the position of the controller.

CONTROLLER FOR ELECTRIC MOTORS—William Cooper, Minneapolis, Minn. No 518,345.
The method of operating electric motors, which consists in first arranging the motors in series in an open circuit, then inserting a total resistance and closing the circuit through the same, then gradually cutting out a part of said resistance, then breaking or opening the circuit, and while open coupling said motors in multiple arc, and afterwards reinstating the remainder of said resistance, and finally gradually cutting out the same.

CAR BRAKE—Frank E. Gilling, Toledo, O., assignor of two-thirds to Francis M. Oliver and Frederick J. Shovar, same place. No. 518,401.
In a car brake, a friction drum upon the axle, a rope or cable coiled around the same, brake actuating mechanism connected with the rope or cable by flexible connections attached to the brake mechanism upon each side of the friction drum, and normally slack, and connections with the rope or cable and each brake rod upon the car.

FENDER FOR TRAM CARS—Franklyn S. Hogg, New York. No. 518,571.
In a tram car, a rock shaft, a fender secured to the forward face of the rockshaft, extending downwardly and forwardly therefrom, a second fender extending from the opposite side of the shaft, plungers connected with the main fender, and means for limiting the movement of the plungers.

APRIL 24.

CONDUIT ELECTRIC RAILWAY.—Chris. A. Maynard, Springfield, Mass. No. 518,695.
Consists of a metal conduit provided upon its inner wall with a longitudinal shelf, a metal cover having a triple bearing upon the conduit, and comprising a brace adapted to enter the mouth of the conduit and bear upon the shelf, a flange adapted to bear upon the outer wall of the conduit, a central portion integral with the brace and flange and adapted to be seated upon the top rim of the circuit and screw bolts through flange and the wall of the conduit.

ELECTRIC MECHANISM FOR VEHICLES.—Louis E. Freedley, Boston, Mass. No. 518,781.
Consists of a vehicle body, running gear therefor, a driving electric motor connected with said running gear, a brake mechanism comprising a brake shoe for operating against a wheel of said running gear, a supplemental motor connected with said brake mechanism, electric conductors connected with said motors, mechanism for switching the current alternately into the driving and supplemental motors, mechanism operative from the vehicle body for moving the switch mechanism, and automatic mechanism for breaking the current when the brake becomes set.

SAFETY CAR FENDER—August W. Stiefel, Baltimore, Md. No. 518,796.
Consists of a number of spring metal arms, each having at its upper end a forward, down-turned pendent which forms a spring buffer, below said spring buffer is a vertical part, the lower end of which has a rearward semicircular curve which terminates in a horizontal, forward pointing end, in combination with a cross bar, to which each spring metal arm is secured by its said vertical part.

DISTRIBUTIVE SYSTEM FOR ELECTRIC RAILWAYS—James E. Goodhand, Baltimore, Md. No. 518,782.
Consists of the feeder and working conduits; branch conduits arranged transversely to and connecting the feeder and working conduits; feeder wires in the feeder conduits, electrical conductors arranged in sections in the working conduits; a connecting block at the intersection of the branch and feeder conduits, and branch wires connecting the feeder wire with the working conductor.

CAR FENDER—Chas. F. Thomas, Buckeyestown, Md. No. 518,904.
Comprises a main fender frame adapted to be connected to the truck frame and held rigid therewith, brace bars pivoted at their lower ends to the said main frame, and having their upper ends formed for a detachable and sliding connection with the car dash.

FENDER FOR STREET CARS—Henry F. Roony, Randolph, Mass. No. 518,926.
A car fender comprising a stationary vertical portion supported by the car body in front of the dashboard, a pivoted portion or fender proper, having a hinged connection with the car body and provided with a rearward extension and a catch secured to the car under the control of the driver, which holds said arm normally in a horizontal position.

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.

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., April 19.

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

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	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., April 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.....	85	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	.....	16½	17

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort	1892	500,000	.....	5	.....	108½	109
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	105½	106
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	101	101½
" " "	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. April 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	75	76
West End Com'n	50	9,085,000	J. & J.	3	1890–1892	46	48¼

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

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. Kaufman Charleston, S. C., April 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., April 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	322	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	.....	246½	247½
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	152½	153

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	106	.....
" "	.....	1,850,000	M. & N.	4½	1927	98	100
North Chicago Street 1st mort	.....	2,850,000	J. & J.	5	1906	102	103
West Chicago Street	.....	4,100,000	M. & N.	5	.....	102½	102¾
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, April 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	.....	106	106½
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	107½	108
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	60	65
" " " Pref.	100	100,000	.....	6	.....	96¾	98
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	.	.....	19	19½

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	.....	98	99½
" " extended	.....	150,000	J. & J.	5	.....	100½	101½
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	110½	111½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104¾	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	106½	108
" " "	.....	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	113	115

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co.	100	12,000,000	.....	....	1893	48½	49½
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	102½
" " City " "	1893	2,349,000	.....			95	96

DETROIT STOCKS.—Corrected by CAMERON CURRIE & Co., Bankers and Brokers, 82 Griswold Street, Detroit, April 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. April 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	.....	...	.....	125	150

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

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	84	85
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	39	40

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	99	99½
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	114	115
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	114	115
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. April 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	.....	55	57½
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., April 20. 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	126½	130
Crescent City R. Co.....	100	1,150,000	"	3	1866	74	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	115
Orleans R. R. Co.....	50	185,000	"	2	1868	45	55
St. Charles Street R. R. Co..	50	600,000	"	2½	1863	55	59

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	113½	117
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	95	.....
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, April 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	143¼	144½
" " (new stock)	50	2,000,000	.....	...	May, '94.	134½	135

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, April 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	25	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	184	187
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	145	.....
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	140	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	120	124
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4	.....	295	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	40	48
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	.....	132	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	190	200
Third Avenue.....	100	5,000,000	Q.—M.	4	.....	176	177
23d St.....	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	132	.....
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	111
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	103	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	104	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	100	.....
Broadway Consolidated.....	.....	8,500,000	J. & J.	5	 1943	104¾	105
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	112	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	117	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	105	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	99	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	50	57
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	103	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	114½	115¼
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING, 143 South Fourth st. (Bullitt Building), Philadelphia, April 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	127	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	331	335
Germantown.....	50	1,500,000	Q.—J.	2¾	1858	110	112
Green & Coates...	50	500,000	Q.—J.	3	1858	123	125
Hestonville...	50	2,050,000	.....	...	1859	38	39½
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	155	160
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	80	85
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	114¾	115
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	230	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	207	210
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	230	240
Union.....	50	1,250,000	J.—J.	9½	1864	199	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	200	210
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	120	121
Baltimore Traction.....	25	5,000,000	.....	1	1889	16¼	16½
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	107¾	108¾
" " Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
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	103½	.....
" " "	.....	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., April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't 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., April 20. 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	.....	...	.....	20¼	20¾
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	61¼	62
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	13¾	13½
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	...	.....
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	21¼	22
Pittsburgh, Allegheny & Man	50	3,000,000	.....	1¼	.....	42½	43
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	.....	...	.....	28¼	22½
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	107¼	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	105	110
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	96	96¾
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	102¾	103¼
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	100¾	.....
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	.....	.....
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	.....
Suburban Rapid Transit	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Inc'e PlaneCo. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Inc'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS, Bankers, Providence, April 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	98	100
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, April 19.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	34	38
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	60	62
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	13	20
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	39	40
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	60	80
do do Common.	100	4,000,000	.....	...	1892	15	18
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	68	80
do do Common.	100	3,000,000	.....	...	1892	15	20
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	37	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	93	95
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	99	99½
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	94	96
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	90	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	87	90

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., April 10.

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 & Occan R. R. Co	100	1,000,000	.....	1	.....	.....	110
Market Street Cable Co.	.....	17,892,000	.....	...	.....	37½	38
Metropolitan Electric	.....	.....	.....	...	.....	25½	.....
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	18
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	.....	.....	104
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	105	.....
Geary St., Park & Ocean	.....	.....	.....	...	.....	101	101½
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	119½	.....
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	.....	114
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	114	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	103	.....
Powell Street R. R.	.....	700,000	M. & S.	6	1912	107½	111
Sutter St. Cable Co.	.....	.....	.....	..	..	103	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., April 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	74½	76
Missouri.	100	2,000,000	Q.—J.	2	1891	190	210
People's.	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis	100	2,000,000	J. & J.	3½	1890	157	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, Prd.	.....	800,000	.....	...	.....	15	25
" Com.	.....	700,000	.....	...	.....	15	25
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	104
Fourth St. & Arsenal	1888	50,000	J. & J.	6	1898-1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895-1910	100	102
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., April 21. 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	295	315
Metropolitan R. R.	50	750,000	Q. J.	2	1864	85	91
Columbia R. R.	50	400,000	Q. M.	1	1870	60	65
Belt R.R.	50	500,000	Q. J.	...	1875	2.	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	25	.....
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'tn & Geo'tn conv't. 1st.	'83-'99	3,000,000	J. & J.	6	1899-1929	135	139
" " " 2d.	.....	500,000	J. & J.	6	1903-1943	.....	.....
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	90	.....
Belt	1921	240,000	J. & J.	6	1921	84	94
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	102	108
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	80	.....

Financial.

THE New England Street Railway Company on April 16 paid a quarterly dividend of 1 per cent.

$ $ $

THE Sioux City Street Railway, of Sioux City, Ia., will be sold on May 3. The receiver is J. C. French.

$ $ $

THE receiver of the Tampa (Fla.) Street Railway & Power Company, T. C. Taliaferro, has applied to Judge Phillips for an order of sale for the entire plant, including the electric railway.

THE directors of the Winooski (Vt.) & Burlington Street Railway Company have voted to increase the capital stock of the company to $200,000. The line of the road will be extended this spring.

$ $ $

THE United Electric Railway, of Nashville, Tenn., was sold April 18, pursuant to a decree of the United States Court, to Nathaniel Baxter, Jr. It is understood that the road has been bought for the bondholders.

$ $ $

THE mortgage of the Nassau Electric Railroad Company, of Brooklyn, N. Y., for $6,000,000, was filed April 19, in the office of the Clerk of Kings County. The Hamilton Trust Company, of Brooklyn, is trustee of the mortgage.

$ $ $

JAMES H. MAURY has been elected president of the New Orleans Traction Company, *vice* James W. Henning, resigned, and the board of directors is somewhat changed. Among the firms principally interested in the company now are H. B. Hollins & Company, Manuel Lehmann and J. &. W. Seligman.

$ $ $

THE Columbus (O.) Street Railway Co. reports as follows the result of its operations for March: Gross earnings, 1894, $42,965.65; 1893, $42,305.07; increase, $660.58. Operating expenses, 1894, $21,232.13; 1893, $28,017.18; decrease, $6,785.05. Net earnings, $21,733.52; 1893, $14,287.89; increase, $7,445.63.

$ $ $

THE Pittsburgh (Pa.) & Birmingham Traction Company gives the following statement of its operations for February: Gross earnings, 1894, $20,650.74; 1893, $26,307.64; decrease, $5,656.90. Operating expenses, 1894, $10,635.72; 1893, $13,353.66; decrease, $2,717.94. Net earnings, 1894, $10,015.02; 1893, $12,953.98; decrease, $2,938.96.

$ $ $

THE directors of the Fairhaven & Westville Horse Railroad Company, of New Haven, Conn., have decided to increase the capital stock of the company by the addition of 8,000 shares at $25 a share. Stockholders of record May 15, 1894, will be allowed to subscribe for the new stock at par, at the rate of one share of new stock for each two shares of old stock held.

$ $ $

THE electric railway and lighting plant of the Consolidated Electric Company, of St. John, N. B., were sold at auction under an order of the equity court. The bidding was done by E. C. Jones, local manager of the bank of Montreal; C. E. Fawcett, a wealthy land owner of Sackville, N. B., and Mr. Donovan. At $92,000, Mr. Jones secured the property. Mr. Jones is thought to represent a Montreal syndicate, which will put the road in first rate shape immediately.

$ $ $

THE Buffalo (N. Y.) Railway Company reports the following as its operations for March:

	1894.	1893.	Inc. or Dec.
Gross earnings	$120,009.02	$112,374.84	Inc. $7,634.18
Operating expenses	71,721.73	76,119.92	Dec. 4,398.19
Net earnings	$ 48,287.29	$ 36,254.92	Inc. $12,032.37

THE Scranton (Pa.) Traction Company reports the following as its operations for March:

	1894.	1893.	Inc. or Dec.
Gross earnings	$19,252.72	$15,687.61	Inc. $3,565.11
Operating expenses	11,436.59	10,227.08	Inc. 1,209.51
Net earnings	$ 7,816.13	$ 5,460.53	Inc. $2,355.60

$ $ $

THE North Shore Traction Company, of Lynn and Boston, Mass., submits the following comparative statement of its operations for February:

	1894.	1893.	Inc. or Dec. 1894.
Gross earnings	$67,147.62	$63,267.50	Inc. $ 3,880.12
Operating expenses	63,632.36	78,739.13	Dec. 15,106.77
Net earnings	$3,515.26	Loss 15,471.63	Inc. $18,986.89

$ $ $

WE have received the following statement of the operations of the Brooklyn Traction Company for the months of January and February. January: Gross earnings, 1894, $69,291.70; 1893, $53,456.60; increase, $15,835.10. Operating expenses, 1894, $48,637.10. Earnings from operation, 1894, $20,654.60. Miscellaneous earnings, 1894, $5,635.07. Net earnings, 1894, $26,289.67. February: Gross earnings, 1894, $61,445.22; 1893, $49,562.75; increase, $11,882 47. Operating expenses,

1894, $45,433,36. Earnings from operation, 1894, $16,011.86. Miscellaneous earnings, 1894, $4,820.62. Net earnings, 1894, $20,832.48. We have no data showing the operating expenses and net earnings for the corresponding months of 1893.

$ $ $

THE last installment of $5 per share on the new stock of the City Passenger Railway Company, of Baltimore, Md., will be payable May 1. This will complete the payment for the $1,000,000 of new stock, and the company will deliver the certificates to the holders of receipts given for the several partial payments. The Board of Directors has also determined to declare and pay May 1, a stock dividend of 50 per cent. to the holders of the original $1,000,000 capital stock and authorized by the Legislature two years ago. This distribution represents accumulated earnings spent on real estate, new roads and other improvements. It is expected that the City Passenger Company will commence the payment of dividends on its entire capital stock in July, and that the earnings of the company will at first enable the payment of 6 per cent. per annum. If the new stock sells at 44 (par 25) which is at about the prices it is figured, the new stock will correspond to the old stock at present prices of the latter, the stock will be selling on about a 3⅜ per cent. basis.

Map of the United States.

A large handsome Map of the United States, mounted and suitable for office or home use, is issued by the Burlington Route. Copies will be mailed to any address on receipt of fifteen cents in postage by P. S. EUSTIS, General Passenger Agent, C., B. & Q. R. R., Chicago, Ill. ***

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. ***